Government of Jammu & Kashmir,

Project Management Unit
Jhelum &Tawi Flood Recovery Project (World Bank Funded)

BID [TENDER] NO: PMU/JTFRP/MISSINGLINKS/02

Construction of Drainage Network for Missing Link Zone - II

NATIONAL COMPETITIVE BIDDING
(Single Stage, Single Envelope Bidding Process without e-Procurement)

NAME OF WORK : **Construction of Drainage Network for Missing Link Zone - II**

PERIOD OF SALE OF BIDDING DOCUMENT	:	FROM 18 – 10 – 2019 TO 29– 11 – 2019.
TIME AND DATE OF PRE-BID MEETING[1]	:	DATE 24 – 10 – 2019; TIME 1130 HOURS
LAST DATE AND TIME FOR RECEIPT OF BIDS	:	DATE 29 – 11– 2019; TIME 1600 HOURS
* TIME AND DATE OF OPENING: OF BIDS		DATE 29– 11 – 2019 TIME 1630 HOURS

PLACE OF OPENING OF BIDS : ERA Commercial Complex, Rambagh Srinagar.

OFFICER INVITING BIDS : Director Technical

INVITATION FOR BIDS

(IFB)

Government of Jammu & Kashmir,

Project Management Unit
Jhelum &Tawi Flood Recovery Project (World Bank Funded)

INVITATIONS FOR BIDS (IFB)

NATIONAL COMPETITIVE BIDDING

Date: 15 – 10 – 2019.
Bid No.: PMU/JTFRP/MISSINGLINKS/02

1. The Government of India has received credit for financing from the World Bank towards the cost of Jhelum & Tawi Flood Recovery Project and intends to apply a part of the funds to cover eligible payments under the contracts for construction of works as detailed below.
2. Bidding will be conducted through National Competitive Bidding procedures agreed with the World Bank. Bidding is open to all eligible bidders as defined in the World Bank's Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers, January 2011 revised July 2014.
3. Bidders from India should, however, be registered with the Government of J&K or other State Governments/Government of India, or State/Central Government Undertakings. Bidders from India, who are not registered as above, on the date of bidding, can also participate provided they get themselves registered by the time of contract signing, if they become successful bidders. **Bidders are advised to note the clauses on eligibility (Section I Clause 4) and minimum qualification criteria (Section III – Evaluation and Qualification Criteria), to qualify for the award of the contract.** In addition, please refer to paragraphs 1.6 and 1.7 of the World Bank's Guidelines setting forth the World Bank's policy on conflict of interest.
4. The Director Technical, PMU JTFRP invites sealed bids for the construction of works detailed below in the table. The bidders may submit bids for any or all of the works indicated therein. Interested bidders may obtain further information and inspect the bidding documents at the address given below during office hours.

    - PMU JTFRP office, ERA Commercial Complex, Rambagh Srinagar, J&K.
    - 2nd Floor, JKPCC Building Railhead Complex Jammu, J&K.

5. Bidding documents may be purchased from the above mentioned addresses office - from **18-10-2019 to 29-11-2019** for a non-refundable fee as indicated in the table below, in the form of Demand Draft (DD) on any Scheduled/Nationalized bank payable in favour of Chief Accounts Officer PMU JTFRP ***.The bidding documents and addenda if any can also be downloaded from the website www.jtfrp.in. The cost of bid document in shape of DD should accompany the bid submission failing which the bid will be treated non responsive .***

6. All Bids must be accompanied by a bid security of the amount specified for the work in the table below, drawn in favour of Chief Accounts Officer, PMU JTFRP. Bid security will have to be in any one of the forms as specified in the bidding document and shall have to be valid for 45 days beyond the validity of the bid.
7. Bids must be delivered to the following address :

PMU JTFRP office, ERA Commercial Complex, Rambagh Srinagar, J&K.

on or before 1600 hours on 29 – 11 – 2019 and will be publicly opened on 29-11-2019 1630 hours , in the presence of the bidders designated representatives who wish to attend. If the office happens to be closed on the date of receipt of the bids as specified, the bids will be received and opened on the next working day at the same time and venue. Late Bids will be rejected.

8. A pre-bid meeting will be held on 24 – 10 – 2019 at 1130 hours at the office of Director Technical, PMU JTFRP, ERA Complex, Rambagh Srinagar to clarify the issues and to answer questions on any matter that may be raised at that stage as stated in ITB Clause 7.4 of 'Instructions to Bidders' of the bidding document. Bidders are advised to obtain the bidding document prior to the pre-bid meeting in order for bidders to have a good understanding of the scope of work under this contract for discussion and clarification at the pre-bid meeting.
9. Other details can be seen in the bidding documents.
10. The address for communication is as under:

- Name & Designation of Officer : Iftikhar Ahmed Kakroo.
- Official Address :
  - (a) PMU JTFRP office, ERA Commercial Complex, Rambagh Srinagar, J&K.
  - (b) 2nd Floor, JKPCC Building Railhead Complex Jammu, J&K (Contact Person : Narinder Kalay).
- Email : dirpmujk@gmail.com/dirpnc@gmail.com
- Telephone 0194-2437320, 9419153731, 7006966231, 9419194825, 9419016749

Package No	Name of Work	Bid Security (Rs.)	Cost of Document (Rs.)	Period of Completion
1	2	3	4	5
1	**Construction of Drainage Network for Missing Link Zone - II**	INR 65.00 Lacs	INR 10,000/=	18 months.

Sd/-
Director Technical, JTFRP.

PART 1 – Bidding Procedures

Section I. Instructions to Bidders

These Instructions to Bidders shall not be part of the Contract Agreement and shall cease to have effect once the Contract is signed.

Section 1 - Instructions to Bidders

Table of Clauses

Section I - Instructions to Bidders

A. General

1. Scope of Bid

1.1 The Employer, as **indicated in the BDS**, issues this Bidding Document for the procurement of the Works as specified in Section VII (Works' Requirements) & Invitation for Bids (IFB). The name, identification, and number of contracts of this bidding are **specified in the BDS**.

1.2 Throughout this Bidding Document:

(a) the term "in writing" means communicated in written form and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) "day" means calendar day; and

(d) "ESHS" means environmental, social (including sexual exploitation and abuse (SEA) and gender based violence (GBV)), health and safety.

2. Source of Funds

2.1 The Borrower or the Recipient (hereinafter called "Borrower") **specified in the BDS** has received/applied for financing (hereinafter called "funds") from the International Bank for Reconstruction and Development or the International Development Association (hereinafter called "the Bank") in an amount **specified in the BDS**, towards the cost of the project **specified in the BDS**. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.

2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank, and will be subject, in all respects, to the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the Loan (or other financing) account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Corrupt and Fraudulent Practices

3.1 The Bank requires compliance with its policy in regard to corrupt and fraudulent practices as set forth in Section VI.

3.2 In further pursuance of this policy, Bidders shall permit and shall cause their agents (whether declared or not), sub-contractors, sub-consultants, service providers, or suppliers and any personnel thereof, to permit the Bank to inspect all accounts, records and other documents relating to any prequalification process, bid submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, a state-owned entity or institution subject to ITB 4.5, or any combination of such entities in the form of a Joint Venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent, unless otherwise **specified in the BDS**. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. This authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all members. Unless **specified in the BDS**, there is no limit on the number of members in a JV. The joint venture agreement shall be registered in the place **specified in BDS** so as to be legally valid and binding on members.

4.2 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this bidding process, if the Bidder:

(a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or

(b) receives or has received any direct or indirect subsidy from another Bidder; or

(c) has the same legal representative as another Bidder; or

(d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or

(e) participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in

the disqualification of all Bids in which such Bidder is involved. However, this does not limit the inclusion of the same subcontractor in more than one bid; or

(f) any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the bid; or

(g) any of its affiliates has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager (Engineer) for the Contract implementation; or

(h) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(i) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding documents or specifications of the contract, and/or the bid evaluation process of such contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the procurement process and execution of the contract.

4.3 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.7. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed sub-contractors or sub-consultants for any part of the Contract including related Services.

4.4 A Bidder that has been sanctioned by the Bank in accordance with the above ITB 3.1, including in accordance with the Bank's Guidelines on Preventing and Combating Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants ("Anti-Corruption Guidelines"), shall be ineligible to be prequalified for, bid for, or be awarded a Bank-financed contract or benefit

from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address **specified in the BDS**.

4.5 Bidders that are Government-owned enterprises or institutions in the Employer's Country may participate only if they can establish that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not dependent agencies of the Employer. To be eligible, a government-owned enterprise or institution shall establish to the Bank's satisfaction, through all relevant documents, including its Charter and other information the Bank may request, that it: (i) is a legal entity separate from the government (ii) does not currently receive substantial subsidies or budget support; (iii) operates like any commercial enterprise, and, inter alia, is not obliged to pass on its surplus to the government, can acquire rights and liabilities, borrow funds and be liable for repayment of its debts, and can be declared bankrupt; and (iv) is not bidding for a contract to be awarded by the department or agency of the government which under their applicable laws or regulations is the reporting or supervisory authority of the enterprise or has the ability to exercise influence or control over the enterprise or institution.

4.6 Not used.

4.7 Firms and individuals may be ineligible if so indicated in Section V and (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country.

4.8 Bidder shall provide such evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment and services to be supplied under the Contract and financed by the Bank may have their origin in any country subject to the restrictions specified in Section V, Eligible Countries, and all expenditures under the Contract will not contravene such restrictions. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The Bidding Document consist of Parts 1, 2, and 3, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures
Section I - Instructions to Bidders (ITB)
Section II - Bid Data Sheet (BDS)
Section III - Evaluation and Qualification Criteria
Section IV - Bidding Forms
Section V - Eligible Countries
Section VI - Bank Policy-Corrupt and Fraudulent Practices

PART 2 Work's Requirements
Section VII – Works' Requirements

PART 3 Conditions of Contract and Contract Forms
Section VIII - General Conditions of Contract (GCC)
Section IX - Particular Conditions of Contract (PCC)
Section X - Contract Forms

6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.

6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the Bidding Documents, responses to requests for clarification, the minutes of the pre-Bid meeting (if any), or Addenda to the Bidding Documents in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Documents and to furnish with its bid all information and documentation as required by the Bidding Documents.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Bidder requiring any clarification on the Bidding Document shall contact the Employer in writing at the Employer's address **indicated in the BDS** or raise his inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of bids, within a period **specified in the BDS**. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so **specified in the BDS**, the Employer shall also promptly publish its response at the web page identified in the BDS. ***(where electronic downloading of bid document is permitted, the Employer will upload the addenda on the website and it will be the responsibility of the bidders [who downloaded the bidding documents] to search the website for any addenda).*** Should the clarification result in changes to the essential elements of the Bidding Documents, the Employer shall amend the Bidding Documents following the procedure under ITB 8 and ITB 22.2.

7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 If so **specified in the BDS**, the Bidder's designated representative is invited to attend a pre-bid meeting and/or a Site of Works visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested, to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the

responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Documents in accordance with ITB 6.3. Any modification to the Bidding Documents that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.

7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Documents by issuing addenda.

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 22.2

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in English. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise the following:

(a) Letter of Bid;

(b) completed Schedules including priced bill of quantities, in accordance with ITB 12 and 14, as **specified in BDS**;

(c) Bid Security, in accordance with ITB 19;

(d) alternative bids, if permissible, in accordance with ITB 13;

(e) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;

(f) documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the contract, if its Bid is accepted;

(g) Technical Proposal in accordance with ITB 16;

(h) Construction methodology proposed as detailed in Para 1.1 of Section III Evaluation Criteria;

(i) Contractor Registration certificate (as per IFB); and

(j) Any other document **required in the BDS**.

11.2 In addition to the requirements under ITB 11.1, bids submitted by a JV (where permitted) shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all members and submitted with the bid, together with a copy of the proposed Agreement.

11.3 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.

12. Letter of Bid and Schedules

12.1 The Letter of Bid, Schedules including the Bill of Quantities, and all documents listed under Clause 11, shall be prepared using the relevant forms in Section IV (Bidding Forms), if so provided. The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Bidders shall submit offers that comply with the requirements of the bidding documents, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered.

14. Bid Prices and Discounts

l4.1 The prices and discounts (including any price reduction) quoted by the Bidder in the Letter of Bid and in the Schedules shall conform to the requirements specified below.

14.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works (both in figures and words), as identified in Section IV, Bidding Forms alongwith the total bid price (both in figures

and words). The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. **Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.** Corrections if any in the bid shall be made by crossing out, initialling, dating and rewriting.

14.3 The price to be quoted in the Letter of Bid in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered.

14.4 Discounts, if any, and the methodology for their application shall be quoted in the Letter of Bid, in accordance with ITB 12.1.

14.5 Unless otherwise **specified in the BDS** and the Conditions of Contract, the rates and prices quoted by the Bidder shall be fixed

14.6 If so indicated in ITB 1.1, bids are invited for individual lots (contracts) or for any combination of lots/contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 14.4, provided the bids for all lots/contracts are opened at the same time.

14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as applicable on the deadline for submission of Bids, shall be included in the rates and prices and the total bid price submitted by the Bidder.

14.8 Bidders may like to ascertain availability of tax/duty exemption benefits available in India. They are solely responsible for obtaining such benefits which they have considered in their bid and in case of failure to receive such benefits for reasons whatsoever, the Employer will not compensate the bidder (Contractor). The bidder shall furnish alongwith his bid a declaration to this effect in the Declaration Format provided in Section IV of the bidding documents.

Where the bidder has quoted taking into account such benefits, it must give all information required for issue of certificates in terms of the Government of India's relevant Notifications as per the declaration format. In case the bidder has not provided the required information or has indicated to be furnished later on in the Declaration Format, the same shall be construed that the goods/construction equipment for which certificate is required is

Nil.

To the extent the Employer determines the quantities indicated therein are reasonable keeping in view the quantities in bill of quantities, construction program and methodology, the certificates will be issued within 60 days of signing of the contract and no subsequent changes will be permitted. In case of materials pertaining to Variation items and quantities, the certificate shall be issued only on request from the Contractor when in need and duly certified by the Project Manager.

No certificate will be issued for items where no quantity/capacity of equipment is indicated in the statement.

If the bidder has considered the tax/duty exemption for materials/construction equipment to be bought for the work, the bidder shall confirm and certify that the Employer will not be required to undertake any responsibilities of the Government of India Scheme or the said exemptions being available during the contract execution, except issuing the required certificate. The bids which do not conform to the above provisions or any condition by the bidder which makes the bid subject to availability of tax/duty exemption for materials/construction equipment or compensation on withdrawal of any variations to the said exemptions will be treated as non-responsive and rejected.

Any delay in procurement of the construction equipment/machinery/goods as a result of the above shall not be a cause for granting any extension of time.

15. Currencies of Bid and Payment

15.1 The unit rates and prices shall be quoted by the Bidder and shall be paid for, entirely in Indian Rupees.

16. Documents Comprising the Technical Proposal

16.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as per details stipulated in Section IV (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.

17. Documents Establishing the Qualifications of the Bidder

17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, included in Section IV, Bidding Forms.

17.2 To establish its qualifications to perform the Contract in accordance with Section III, Evaluation and Qualification Criteria, the Bidder shall provide the complete information as requested in the corresponding information sheets included in

Section IV (Bidding Forms).

18. Period of Validity of Bids

18.1 Bids shall remain valid for 90 days or for a period **specified in the BDS** after the bid submission deadline date prescribed by the Employer in accordance with ITB 22.1. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.

18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 19, it shall also be extended for forty five (45) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its bid.

18.3 If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the Contract price shall be determined as follows*:*

(a) In the case of fixed price contracts, the Contract price shall be the bid price adjusted by the factor **specified in the BDS**.

(b) In the case of adjustable price contracts, no adjustment shall be made.

(c) In any case, bid evaluation shall be based on the bid price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

19.1 Unless otherwise **specified in the BDS**, the Bidder shall furnish as part of its bid, in original form, a bid security for the amount **shown in BDS,** for this particular work.

19.2 The bid security shall be a demand guarantee, at the Bidder's option, in any of the following forms:

(a) an unconditional bank guarantee, issued by a Nationalized/ Scheduled bank located in India;

(b) an irrevocable letter of credit issued by a Nationalized or Scheduled bank located in India;

(c) a cashier's or certified check; or demand draft from a Nationalized or Scheduled Bank located in India;

(d) another security **indicated in the BDS.**

In case of a bank guarantee, the bid security shall be

submitted using the Bid Security form included in the Section IV (Bidding Forms). The form must include the complete name of the Bidder. The bid security shall be valid for forty five (45) days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.

19.3 If a Bid Security is specified pursuant to ITB 19.1, any bid not accompanied by a substantially responsive Bid Security shall be rejected by the Employer as non-responsive.

19.4 If a bid security is specified pursuant to ITB 19.1, the bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the contract and furnishing of the performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security pursuant to ITB 42.

19.5 If a bid security is specified pursuant to ITB 19.1, the bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security.

19.6 The bid security may be forfeited:

(a) if a Bidder withdraws/modifies/substitutes its bid during the period of bid validity specified by the Bidder on the Letter of Bid, or any extension thereto provided by the Bidder in accordance with ITB 18.2 or

(b) if the Bidder does not accept the correction of its Bid Price pursuant to ITB 31 or

(c) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 41; or

(ii) furnish a performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security in accordance with ITB 42.

19.7 The Bid Security of a JV shall be in the name of the JV that submits the bid. If the JV has not been constituted into a legally-enforceable JV, at the time of bidding, the Bid Security shall be in the names of all future members as named in the letter of intent mentioned in ITB 4.1 and ITB 11.2.

20. Format and

20.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it

Signing of Bid

"ORIGINAL". Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked "Alternative" In addition, the Bidder shall submit copies of the bid in the number **specified in the BDS,** and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as **specified in the BDS** and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid where entries or amendments have been made shall be signed or initialed by the person signing the bid.

20.3 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives

20.4 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

21.1 Bidders may always submit their bids by mail or by hand. When so **specified in the BDS**, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows:

(a) Bidders submitting bids by mail or by hand shall enclose the original and each copy of the Bid including alternatives if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL", "ALTERNATIVE" and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with ITB sub-Clauses 21.2 and 21.3.

(b) Bidders submitting bids electronically shall follow the electronic bid submission procedures **specified in the BDS**.

21.2 The inner and outer envelopes shall:

(a) bear the name and address of the Bidder;

(b) be addressed to the Employer as provided in the BDS pursuant to ITB 22.1;

(c) bear the specific identification of this bidding process indicated in accordance with ITB 1.1; and

(d) bear a warning not to open before the time and date for bid opening.

21.3 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

21.4 E-mail, Telex, Cable or Facsimile bids will be rejected as non-responsive.

22. Deadline for Submission of Bids

22.1 Bids must be received by the Employer at the address and no later than the date and time **indicated in the BDS**. Bidders submitting bids electronically (when permitted) shall follow the electronic bid submission procedures **specified in the BDS.**

In the event of the specified date for the submission of Bids being declared a holiday for the Employer, the Bids will be received upto the appointed time on the next working day.

22.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Bids

23.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, Substitution, and Modification of Bids

24.1 A Bidder may withdraw, substitute, or modify its bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," "MODIFICATION;" and

(b) received by the Employer prior to the deadline prescribed for submission of bids, in accordance with ITB 22.

24.2 Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.

24.3 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof. This will result in the forfeiture of the Bid Security pursuant to ITB 19.6.

25. Bid Opening

25.1 Except in the cases specified in ITB 23 and 24, the Employer shall publicly open and read out in accordance with ITB 25.3 all bids received by the deadline, at the date, time and place **specified in the BDS** in the presence of Bidders' designated representatives and anyone who chooses to attend. Any specific electronic bid opening procedures required, if electronic bidding is permitted in accordance with ITB 21.1, shall be as **specified in the BDS**.

In the event of the specified date of bid opening being declared a holiday for the Employer, the bids will be opened at the appointed time and location on the next working day.

25.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening. Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding bid being substituted, and the substituted bid shall not be opened, but returned to the Bidder. No bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at bid opening. Envelopes marked "MODIFICATION" shall be opened and read out with the corresponding bid. No bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at bid opening. Only envelopes that are opened and read out at bid opening shall be considered further.

25.3 All other envelopes shall be opened one at a time, reading out: the name of the Bidder and whether there is a modification, the total Bid Price, per lot (contract) if applicable, including any discounts and alternative bids, the presence or absence of a bid security; and any other details as the Employer may

consider appropriate. Only discounts and alternatives and modifications read out at bid opening shall be considered for evaluation. The Letter of Bid and the Bill of Quantities are to be initialed by representatives of the Employer attending bid opening in the manner **specified in the BDS.** The Employer shall neither discuss the merits of any bid nor reject any bid at bid opening (except for late bids, in accordance with ITB 23.1).

25.4 The Employer shall prepare a record of the bid opening that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; the Bid Price, per contract if applicable, including any discounts and alternative bids; and the presence or absence of a bid security, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the examination, evaluation, comparison, and post-qualification of bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders in accordance with ITB 40.

26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.

26.3 Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it shall do so in writing.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, and comparison of the bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its bid, giving a reasonable time for response. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease in the prices or substance of the bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids, in

accordance with ITB 31.

27.2 If a Bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the Bidding Document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

29. Determination of Responsiveness

29.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.

29.2 A substantially responsive bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.

29.3 The Employer shall examine the technical aspects of the bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section VII (Works' Requirements) have been met without any material deviation, reservations or omissions.

29.4 If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation or omission.

30. Nonconformities, Errors, and

30.1 Provided that a bid is substantially responsive, the Employer may waive any non-conformities in the bid which do not

Omissions

constitute a material deviation, reservation or omission.

30.2 Provided that a bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price or substance of the bid. Failure of the Bidder to comply with the request may result in the rejection of its bid.

30.3 Provided that a bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner **specified in the BDS**.

31. Correction of Arithmetical Errors

31.1 Provided that the bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis:

(a) only for unit price contracts, 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;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

31.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 31.1, shall result in the rejection of the Bid and the Bid Security may be forfeited in accordance with ITB Sub-Clause 19.6.

32. Conversion to Single Currency

32.1 Not used.

33. Margin of Preference

33.1 Not used.

34. Sub-contractors

34.1 Unless otherwise **stated in the BDS**, the Employer does not intend to execute any specific elements of the Works by sub-contractors selected in advance by the Employer.

34.2 The Employer may permit subcontracting for certain specialized works as indicated in Section III. When subcontracting is permitted by the Employer, the specialized sub-contractor's experience shall be considered for evaluation. Section III describes the qualification criteria for sub-contractors.

34.3 Bidders may propose subcontracting upto the percentage of total value of contracts or the volume of works as **specified in the BDS.** Subcontractors proposed by the Bidder shall be fully qualified for their parts of the Works.

35. Evaluation of Bids

35.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

35.2 To evaluate a bid, the Employer shall consider the following:

(a) the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 31.1;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) Not Used,

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 30.3;

(f) the additional evaluation factors as specified in Section III, Evaluation and Qualification Criteria;

35.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

35.4 If this Bidding Document allows Bidders to quote separate prices for different lots (contracts), and to award multiple contracts to a single Bidder, the methodology to determine the lowest evaluated price of the contract combinations, including any discounts offered in the Letter of Bid, is specified in Section III, Evaluation and Qualification Criteria.

35.5 If the bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced, front loaded or substantially below updated estimates in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses (with breakdown of unit rates) for any or all items of

the Bill of Quantities, to demonstrate the internal consistency and justification of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

36. Comparison of Bids

36.1 The Employer shall compare the evaluated prices of all substantially responsive bids established in accordance with ITB 35.2 to determine the lowest evaluated bid.

37. Qualification of the Bidder

37.1 The Employer shall determine to its satisfaction whether the Bidder that is selected as having submitted the lowest evaluated and substantially responsive bid meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

37.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17.1. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the bidding document), or any other firm(s) different from the Bidder.

37.3 An affirmative determination of qualification shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the bid, in which event the Employer shall proceed to the next lowest evaluated bid to make a similar determination of that Bidder's qualifications to perform satisfactorily.

38. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

38.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

39. Award Criteria

39.1 Subject to ITB 37.1, the Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to

be qualified to perform the Contract satisfactorily.

40. Notification of Award

40.1 Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, via the Letter of Acceptance included in the Contract Forms, that its bid has been accepted. The Letter of Acceptance shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

40.2 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

41. Signing of Contract, Publication of award and Recourse to unsuccessful Bidders

41.1 The Contract Agreement shall incorporate all agreements between the Employer and the successful Bidder. It shall be kept ready in the office of the Employer for the signature of the Employer and the successful Bidder, within 21 days following the date of Letter of acceptance. Within 21 days of receipt of Letter of acceptance, the successful Bidder shall sign the Agreement and furnish the performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security in accordance with ITB Clause 42 and revised construction methodology. If the successful bidder is a JV, it shall also furnish the JV agreement duly signed by all the members, if it had submitted only a letter of intent to execute the JV agreement alongwith the bid.

41.2 The Employer within 3 weeks of issue of notification of award shall publish in a national website (http://tenders.gov.in or GoI Central Public Procurement Portal https://eprocure.gov.in/cppp/) or on the Employer's website with free access, the results identifying the bid and lot numbers and the following information: (i) name of each bidder who submitted the bid; (ii) bid prices as read out at bid opening; (iii) name and evaluated prices of each bid that was evaluated; (iv) name of bidders whose bids were rejected and the reasons for their rejection; and (v) name of the winning bidder, and the price it offered, as well as the duration and summary scope of the contract awarded.

41.3 The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, requests the Employer in writing to explain on which grounds its bid was not selected.

42. Performance Security

42.1 Within twenty-one (21) days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security in accordance with the conditions of contract, subject to ITB 35.5, using for that purpose the Performance Security and ESHS Performance Security Forms included in Section X (Contract Forms). The performance security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security of a Joint Venture shall be in the name of the Joint Venture specifying the names of all members.

42.2 Failure of the successful Bidder to submit the above-mentioned Performance Security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security, or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

42.3 Upon the successful Bidder's signing the Agreement and furnishing of the Performance Security and if required in the BDS, the Environmental, Social, Health and Safety (ESHS) Performance Security, pursuant to ITB Clause 42.1, the Employer shall promptly notify the name of the winning bidder to each unsuccessful bidder and shall discharge the Bid Securities of the bidders pursuant to ITB Clause 19.4 and 19.5.

43. Adjudicator

43.1 The Employer proposes the person **named in the BDS** to be appointed as Adjudicator under the Contract, at the daily rate **specified in the BDS**, plus reimbursable expenses (actual boarding, lodging, travel and other incidental expenses). If the Bidder disagrees with this proposal, the Bidder should so state in Letter of Bid. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator proposed by the Bidder, the Employer will request the Appointing Authority designated in the Particular Conditions of Contract (PCC) pursuant to Clause 23.1 of the General Conditions of Contract (GCC), to appoint the Adjudicator.

Section II - Bid Data Sheet (BDS)

The following specific data for the Works to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

[Instructions for completing the Bid Data Sheet are provided, as needed, in the notes in italics mentioned for the relevant ITB.]

A. Introduction

ITB 1.1	The Employer is: The Employer is: Chief Executive Officer J&K ERA/JTFRP ERA Complex Rambagh Srinagar **AND** JKPCC Building, 2nd Floor, Rail Head Complex, Jammu-180012
ITB 1.1	The name of the work is: **Construction of Drainage Network for Missing Link Zone - II** The identification number of the work is: ***PMU/JTFRP/MISSINGLINKS/02***
ITB 2.1	The Borrower is Government of India. The Sub-Borrower is Government of J&K The Employer is: **Chief Executive Officer, J&K *ERA Complex, Rambagh Srinagar, J&K.* /JKPCC Building, 2nd Floor, Rail Head Complex, Jammu-180012 (J&K)**
ITB 2.1	The name of the Project is: ***Jhelum and Tawi Flood Recovery Project.*** Loan or Financing Agreement amount: ***USD 250 Million.***
ITB 4.1	Bids from Joint ventures are acceptable.
	Maximum number of members in the JV shall be***: One lead member plus two other members***
	Place where the agreement to form JV to be registered is: anywhere in India

ITB 4.4	A list of debarred firms and individuals is available at the Bank's external website www.worldbank.org/debarr.

B. Contents of Bidding Documents

ITB 7.1	For **clarification purposes** only, the Employer's address is: Attention: ***Director Technical*** ***ERA Commercial Complex, Rambagh Srinagar, J&K.*** **JKPCC Building, 2nd Floor, Rail Head Complex, Jammu-180012 (J&K)**
ITB 7.1	www.jtfrp.in
ITB 7.4	A Pre-Bid meeting ***shall*** take place. If a Pre-Bid meeting will take place, it will be at the following date, time and place: Date: 24 – 10 – 2019, Time: 1130 hours **Place: Office of the Director Technical, PMU, *ERA Commercial Complex, Rambagh Srinagar, J&K.***

C. Preparation of Bids

ITB 11.1 (b)	The following schedules shall be submitted with the bid: (a) original bid security in approved form; (b) Bid Processing Fee towards the cost of the document in approved form (c) Original affidavit regarding correctness of information furnished online along with their Technical bid. d) JV agreement in case of bid is submitted as a JV. e) Legally valid Power of Attorney to demonstrate the authority of the signatory to sign the Bid. In the case of Bids submitted by an existing or intended JV, the authorization shall be evidenced by a Power of Attorney signed by legally authorized signatories of all the members.
ITB 11.1 (j)	*NA*
ITB 13.1	Alternative bids ***shall not be*** permitted.

ITB 14.5	The prices quoted by the Bidder ***shall*** not be ***subject*** to adjustment during the performance of the Contract.
ITB 18.1	The bid validity period shall be: 120 days.
ITB 19.1	The Bidder shall furnish a bid security for an amount of INR 65.00 Lacs**.**
ITB 19.2 (d)	Other types of acceptable securities are: Fixed Deposit/Time Deposit certificate issued by a Nationalized or Scheduled Bank located in India for equivalent or higher values are acceptable as bid security provided it is pledged in favour of *Chief Accounts Officer, PMU JTFRP,* and such pledging has been noted and suitably endorsed by the bank issuing the certificate.
ITB 20.1	In addition to the original of the bid, the number of copies is: ***two***
ITB 20.2	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: *(a) Legally valid Power of Attorney is required to demonstrate the authority of the signatory to sign the Bid; and* *(b) In the case of Bids submitted by an existing or intended JV, if permitted as per ITB 4.1, the authorization shall be evidenced by a Power of Attorney signed by legally authorized signatories of all the members*

D. Submission and Opening of Bids

ITB 21.1 & 22.1	Electronic bidding is not permitted; bidders **shall not have** the option of submitting their bids electronically.
ITB 22.1	For **bid submission purposes** only, the Employer's address is Attention: Director Technical • PMU JTFRP office, ERA Commercial Complex, Rambagh Srinagar, J&K. Country: INDIA

	The deadline for bid submission is: Date: 29– 11 – 2019. Time: 1600 hours. **Electronic bidding is not permitted.**
ITB 25.1	The bid opening shall take place at: PMU JTFRP office, ERA Commercial Complex, Rambagh Srinagar, J&K.
ITB 25.1	Electronic bidding is not permitted, bids **shall not be opened** electronically.

E. Evaluation and Comparison of Bids

ITB 25.3	The Letter of Bid and Priced Bill of Quantities shall be initialled by representatives of the Employer conducting Bid opening: *Each Bid shall be numbered, any modification to the unit or total price shall be initialed by the Representative of the Employer.*
ITB 30.3	The adjustment shall be based on the highest price of the item or component as quoted in other substantially responsive Bids, subject to a maximum of the estimated price of the item. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate.
ITB 34.1	At this time the Employer does not intend to execute certain specific parts of the Works by sub-contractors selected in advance.
ITB 34.3	(A) After award of the Contract, the subcontracting of any part of the work, except for those subcontractors and sub consultants nominated in the Bid, shall require the prior written consent of the Owner. Notwithstanding such consent, the Bidder shall remain responsible for the acts, defaults, and neglects of all subcontractors and sub consultants during Contract implementation. (B) Contractor's proposed subcontracting: Maximum percentage of subcontracting permitted is: 30*% of the total contract amount* (C) Bidders planning to subcontract more than 10% of total volume of work shall specify, in the Bid Submission Form, the activity (ies) or parts of the works to be subcontracted along with complete details of the sub-contractors and their qualification and experience. The qualification and experience of the sub-contractors must meet the minimum criteria for the relevant work to be sub-contracted failing which such sub-contractors will not be permitted to participate. (D) Sub-contractors' qualification and experience will not be considered for evaluation of the Bidder. The Bidder on its own (without taking into account

	the qualification and experience of the sub-contractor) should meet the qualification criteria.
ITB 35.4	Not Applicable
ITB 42.1 and 42.2	The successful Bidder shall also be required to submit performance security equal to 05% of accepted contract amount and an Environmental, Social, Health and Safety (ESHS) Performance Security equal to 1% of accepted contract amount. .
ITB 43.1	The Adjudicator/Dispute Review Expert proposed by the Employer ***shall be decided at the time of signing the Contract agreement***. The daily fee for this proposed Adjudicator/Dispute Review Expert shall be: INR 5000**.**

Section III - Evaluation and Qualification Criteria

1. Evaluation

In addition to the criteria listed in ITB 35.2 (a) – (e) the following criteria shall apply:

1.1 Adequacy of Technical Proposal

Evaluation of the Bidder's Technical Proposal will include:

(i) an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, material sourcing and Quality Control/Assurance in sufficient detail and fully in accordance with the requirements stipulated in Section VII (Works' Requirements).

For this purpose, the Bidder should also submit:

a detailed note outlining its proposed methodology and program of construction including compliance with the Environmental, Social, Health and Safety (ESHS) obligations under this contract, backed with equipment planning and deployment, materials and manpower planning and deployment, duly supported with broad calculations and quality control system/assurance procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

(ii) an assessment of the details of subcontracting elements of works amounting to more than 10% of the bid price; for each element proposed to be sub contracted furnish details whether the identified Sub-contractor possesses the required qualifications and experiences to execute that element satisfactorily. [***Work should not be split into small parts and sub-contracted***].

1.2 Multiple Contracts if permitted under ITB 35.4, will be evaluated as under.

If works are grouped in multiple contracts pursuant to Sub-Clause 35.4 of the Instructions to Bidders, the Employer will evaluate and compare Bids on the basis of a contract, or a combination of contracts, or as a total of contracts in order to arrive at the least cost combination for the Employer by taking into account discounts offered by Bidders in case of award of multiple contracts. If a bidder submits several successful (lowest evaluated substantially responsive) bids, the evaluation will also include an assessment of the Bidder's capacity to meet the aggregated requirements regarding:

- Experience
- Financial situation
- Current contract commitments,
- Cash flow capacity,
- Equipment to be allocated, and

- Personnel to be fielded.
- Bid Capacity

1.3 Specialised Subcontractors

If permitted under ITB 34, only the specific experience of sub-contractors for specialized works permitted by the Employer will be considered. The general experience and financial resources of the specialized sub-contractors shall not be added to those of the Bidder for purposes of qualification of the Bidder.

The specialized sub-contractors proposed shall be fully qualified for their work proposed, and meet the following criteria:

Qualification

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture where permitted			Submission Requirements
				All Parties Combined	Each Partner	One Partner	
2.1 Eligibility							
2.1.1	**Nationality**	Nationality in accordance with ITB Sub-Clause 4.3.	Must meet requirement	Existing or intended JV must meet requirement	Must meet requirement	N / A	Forms ELI –1.1 and ELI-1.2 With attachments
2.1.2	**Conflict of Interest**	No conflicts of interest in ITB Sub-Clause 4.2.	Must meet requirement	Existing or intended JV must meet requirement	Must meet requirement	N / A	Letter of Bid
2.1.3	**Bank eligibility**	Not having been declared ineligible by the Bank, as described in ITB Sub-Clause 4.4.& 4.7.	Must meet requirement	Existing JV must meet requirement	Must meet requirement	N / A	Letter of Bid
2.1.4	**Government Owned Entity**	Applicant required to meet conditions of ITB-A Sub-Clause 4.5. The entity should not be a dependent agency of the borrower or sub-borrower or Employer.	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Forms ELI -1.1 and 1.2 with attachments
2.1.5	**United Nations resolution or Borrower's country law**	Not having been excluded as a result of prohibition in the Borrower's country laws or official regulations against commercial relations with the Bidder's country, or by an act of compliance with UN Security Council resolution, both in accordance with ITB 4.7 and Section V.	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Forms ELI -1.1 and 1.2 with attachments

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture where permitted			Submission Requirements
				All Parties Combined	Each Partner	One Partner	
Historical Contract Non-Performance							
2.2.1	**History of Non-Performing Contracts**	Non-performance of a contract[2] did not occur as a result of contractor default since 1st January 2014 .	Must meet requirement by itself or as partner to past or existing JV	N / A	Must meet requirement by itself or as partner to past or existing JV	N / A	Form CON – 2
2.2.2	**Suspension due to withdrawal of the Bid within Bid validity**	Not under suspension due to withdrawal of the Bid pursuant ITB 19.6.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.2.3	**Pending Litigation**	Bidder's financial position and prospective long term profitability sound according to criteria established in 2.3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement by itself or as partner to past or existing JV	N / A	Must meet requirement by itself or as partner to past or existing JV	N / A	Form CON – 2

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture where permitted			Submission Requirements
				All Parties Combined	Each Partner	One Partner	
2.2.4	**Litigation History**	No consistent history of court/arbitral award decisions against the Bidder[3] since 1st January *2014*	Must meet requirement by itself or as partner to past or existing JV	Must meet requirement	Must meet requirement by itself or as partner to past or existing JV	N/A	Form CON – 2
2.3	**Declaration: Environmental, Social, Health, and Safety (ESHS) past performance**	Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social, or health or safety requirements or regulations in the past five years[4].	Must make the declaration. Where there are Specialized Sub-contractor/s, the Specialized Sub-contractor/s must also make the declaration.	N/A	Each must make the declaration. Where there are Specialized Sub-contractor/s, the Specialized Sub-contractor/s must also make the declaration.	N/A	Form CON-3 ESHS Performance Declaration

[3]The Bidder shall provide accurate information on the letter of Bid about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the last five years. A consistent history of court/arbitral awards against the Bidder or any member of a joint venture may result in disqualifying the Bidder.

Qualification Criteria			Compliance Requirements				Documentation
No.	**Subject**	**Requirement**	**Single Entity**	**Joint Venture where permitted**			**Submission Requirements**
				All Parties Combined	**Each Member**	**One Member**	

2.3 Financial Situation and Performance

2.3.1	**Financial Capabilities**	(a) The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as **INR 12.00 Crores for** the subject contract(s) net of the Bidders other commitments (b) The Bidders shall also demonstrate, to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract	(a) Must meet requirement (b)) Must meet requirement	(a) Must meet the requirement (b)) Must meet requirement	(a) Must meet at least 25% of the requirement as a minimum N/A	(a) Must meet at least 50% of the requirement as a minimum N/A	Form FIN - 3.1 with attachments

Qualification Criteria			Compliance Requirements				Documentation
No.	**Subject**	**Requirement**	**Single Entity**	**Joint Venture where permitted**			**Submission Requirements**
				All Parties Combined	**Each Member**	**One Member**	
		commitments (c) The audited balance sheets or, if not required by the laws of the Bidder's country, other financial statements acceptable to the Employer, for the last *five* years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability.	(c) Must meet requirement	N/A	(c) Must meet requirement	N/A	
2.3.2	**Annual Construction Turnover**	Achieved in at least two financial years (in the last five years) a minimum annual financial turnover[5] in civil engineering construction work of **INR 50 Crores *[Fifty Crore Rupees]*** calculated as total certified payments received for contracts in progress or completed.	Must meet requirement	Must meet requirement	Must meet twenty five percent (25%) of the requirement	Must meet fifty percent (50%) of the requirement	Form FIN - 3.2

[5] At.price level. Financial turnover of previous years shall be given weightage @5% per year based on rupees value to bring them to the price level of the financial year in which bids are received.

Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture where permitted			Submission Requirements
				All Parties Combined	Each Member	One Member	

2.4 Experience

2.4.1	**General Construction Experience**	Experience under construction contracts for similar works such as those pertaining to construction of Drainage/ Sewerage works including sump well, screen chamber, pump house, Supply, installation, testing & successful commissioning of (electromechanical works) in the role of contractor, JV member, subcontractor, or management contractor for at least the last seven [7] years prior to the bid submission deadline.	Must meet requirement	N/A	Must meet requirement of having executed works of similar nature	N/A	Form EXP – 4.1

Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture where permitted			Submission Requirements
				All Parties Combined	Each Member	One Member	
2.4.2 (a)	**Specific Construction Experience**	Bidder should have successfully completed as a prime contractor, JV member, management contractor or subcontractor, One contract with a value not less than **INR 34.00 Crores** substantially for the last seven (7) years (FY 2012-13.to FY 2018-19), which is similar to the proposed works of construction of drainage / sewerage works and pump house works with all electro mechanical equipments	Must meet requirement	Must meet requirement	Must meet requirement for one contract of 25% value	Must meet requirement for one contract of 50% in value	Form EXP 4.2(a). The contractor should have borne responsibility for execution of works to the extent he claims experience. A contractor should not claim experience for the works he has never executed.
In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated							

Qualification Criteria			Compliance Requirements				Documentation
No.	**Subject**	**Requirement**	**Single Entity**	**Joint Venture where permitted**			**Submission Requirements**
				All Parties Combined	**Each Member**	**One Member**	
2.4.2 (b)	**Specific Experience**	For the above or other contracts executed during the period stipulated in 2.4.2(a) above, a minimum construction experience in the following key activities: a) Construction of drainage/ sewerage network by way of laying of RCC/ PCC Cast in situ or RCC/ DI /other pipe material at least 2000 mts. b) Sump wells/ screen chambers and pump house works. c) Supply ,installation & commissioning of Pumping units with allied accessories like control valves, pipeline, Servo voltage stabilizer, electrical distribution panels, EOT crane , Electric sub-station with allied accessories	Must meet requirements	Must meet requirement	Should meet the criteria in full, at least for one of key activities listed in column 3.	N/A	Form EXP-4.2(b)

2.4.2 (c) For a bidder (either individually as a single entity or as a JV partner) to qualify for a group of lots (contracts), he must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for all the contracts in question.

2.4.2 (d)	Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity for construction work is equal to or more than the total bid value of the work. The available bid capacity will be calculated as under: Assessed Available bid capacity = (A*N*2 – B) Where, A = Maximum value of civil engineering works executed in any one year during the last five years (updated to the price level of the financial year ….. at the rate of 5% per year), taking into account the completed as well as works in progress). N = Number of years prescribed for completion of the works for which bids are invited (period upto 6 months to be taken as half-year and more than 6 months as one year). B = Value, at the current price level, of existing commitments on on-going works to be completed during the period of completion of the works for which bids are invited. Note: *the statements in Section IV showing the value of existing commitments of on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.*
2.4.2 (e)	Even though the bidders may meet the above qualifying criteria, they are subject to be disqualified if they have: - - made misleading or false representations in the forms, statements, affidavits, and attachments submitted in proof of the qualification requirement; - Record of poor performance such as abandoning the works, not properly completion or financial failures etc. - Consistent history of litigation or arbitration awards against the bidder or any partner or the joint venture. - Participated in the previous bidding (if this is a re-bidding) for the same work and had quoted unreasonably high bid price and could not furnish any rational justification for the same to the employer.

2.5 Personnel

The Bidder must demonstrate that it will have the personnel for the key positions that meet the following requirements. The Contractor shall require the Employer's consent to substitute or replace the Key Personnel (reference the Particular Conditions of Contract 9.1).

S. No	Designation of Personnel (Position)	No.	Minimum Qualification	Minimum years of experience	Minimum experience in similar works.
1.	Project Manager (Civil)	01	B.E (Civil)	25 Years	10 Years
2.	Construction Manager.	01	B.E (Civil)	15 years	5 Years
3.	Mechanical Engineer	01	B.E (Mechanical)/ Diploma (Mech.)	8 / 10 years	5 / 7 years
4.	Civil Engineer	02	B.E (Civil)/ Diploma (Civil)	8 / 10 years	5 / 7 years
5.	Electrical Engineer	01	B.E (Electrical)/Diploma (Elec.)	8 / 10 years	5 / 7 years
6.	Surveyor	01	Diploma (civil)	7 years	5 years
7.	Safety officer	01	Diploma in Construction safety/Occupational safety with skill & experience in handling the Health, Environmental, safety issues in handling the linear infrastructure projects.	5 Years	3 Years

The Bidder must not have in his employment:

[i] A near relations (defined as first blood relations, and their spouses, of the bidder or the bidder's spouse) of persons of Jhelum Tawi Flood Recovery Project / JKERA.

[ii] Without Government permission, any person who retired as gazetted officer within the last one year.

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Forms included in Section IV, Bidding Forms.

2.6 Equipment

The Bidder must demonstrate that it will have access to the key Contractor's equipment listed hereafter:

S.No.	Equipment Type and Characteristics	Capacity	Minimum Number required
1	Excavator cum loader	--	03 No's
2	Tipper	--	06 No's
3	Hydra/Crane	10 - 15 Ton	02No's
4	Carrier Vehicle	3 Ton	04 No's
5	Hydraulic Vibrator Road Roller	8-10 Ton	01 No's
6	D.G sets (Potable)	10-255 KVA.	2 No's
7	Concrete Mixer with Hooper capacity not less than 1 Cum.(Mini Batching Plant)	Min.1cum	02 No's
8	Welding Sets .		2 No's
9	Storage tanker	10KL	02 No's
10	Needle vibrator with needle set of all sizes	--	04 sets
11	Water Tanker	10 KL	01No's
12	Diesel Engine dewatering pumps ,mud pumps	1-5 Cusec	06 No's
13	Total Station Survey Equipment & Auto level	--	1no & 03 No's

The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section IV.

Section IV - Bidding Forms

Letter of Bid

The Bidder must prepare the Letter of Bid on stationery with its letterhead clearly showing the Bidder's complete name and address.

Note: All italicized text is for use in preparing these forms and shall be deleted from the final products.

Date: _____

Invitation for Bid No.: _____

To: ***(Insert name of the Employer)***

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB 8);

(b) We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) We offer to execute in conformity with the Bidding Documents the following Works: _____;

(d) The total price of our Bid, excluding any discounts offered in item (e) below is:

-In case of only one lot, total price of the Bid ***[insert the total price of the bid in words and figures];***
-In case of multiple lots, total price of each *lot* ***[insert the total price of each lot in words and figures];***
-In case of multiple lots, total price of all lots (sum of all lots) ***[insert the total price of all lots in words and figures]***;

(e) The discounts offered and the methodology for their application are:

(i) The discounts offered are: ***[Specify in detail each discount offered.]***
(ii) The exact method of calculations to determine the net price after application of discounts is shown below*: [**Specify in detail the method that shall be used to apply the discounts**]* _____;

(f) Our bid shall be valid for a period of _____ ***[insert validity period as specified in ITB 18.1**.]* days from the date fixed for the bid submission deadline in accordance

with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(g) We accept the appointment of ***[insert name proposed in Bid Data Sheet]*** as the Adjudicator

[or]

We do not accept the appoint of ***[insert name proposed in Bid Data Sheet]*** as the Adjudicator, and propose instead that ***[insert name]*** be appointed[6] as Adjudicator, whose daily fees and biographical data are attached;

(h) If our bid is accepted, we commit to obtain a performance security [*and an Environmental, Social, Health and Safety (ESHS) Performance Security*, ***Delete if not applicable***] in accordance with the Bidding Document;

(i) We are not participating, as a Bidder, in more than one bid in this bidding process in accordance with ITB 4.2,

(j) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by the Bank, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council (ITB 4.7);

(k) We are not a government owned entity / We are a government owned entity but meet the requirements of ITB 4.5[7];

(l) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:[8] [*insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount of each such commission or gratuity*]

Name of Recipient	Address	Reason	Amount

(m) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud and corruption.

(n) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;

[6] In case appointment of Adjudicator was proposed from the list provided by an Institution in ITB 43, the replacement should also be proposed from the list of same institution.

[7] ***Use one of the two options as appropriate.***

[8] ***If none has been paid or is to be paid, indicate "none".***

(o) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive; and

(p) If awarded the contract, the person named below shall act as Contractor's Representative: _____

Name of the Bidder***** ***[insert complete name of person signing the Bid]***

Name of the person duly authorized to sign the Bid on behalf of the Bidder****** ***[insert complete name of person duly authorized to sign the Bid]***

Title of the person signing the Bid ***[insert complete title of the person signing the Bid]***

Signature of the person named above ***[insert signature of person whose name and capacity are shown above]***

Date signed ***[insert date of signing]*** day of ***[insert month]***, ***[insert year]***

*****: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

**: Person signing the Bid shall have the power of attorney given by the Bidder to be attached with the Bid Schedules.

Bill of Quantities

PREAMBLE TO THE BILL OF QUANTITIES

1.0 General

1.1 The bill of quantities shall be read in conjunction with the Instruction to Bidder, General and Conditions of Contract, Specifications and Drawings.

1.2 The Contractor shall be deemed to have visited the site and read and examined the Tender Documents before completing the Bill of Quantities and filling the rates. The Drawings, Specifications, Schedules etc. are to be considered as explanatory of each other and no advantage shall be taken of any omission in tender documents.

1.3 The Contractor shall be deemed to be fully conversant with and to have made full allowance in his Tender for the site conditions, the nature and complexity of the work to be undertaken, the other extensive development and construction work currently being or which may be executed on and around the Site and all changes in the nature and condition of the Site from that existing at the time of Tender.

1.4 General directions and descriptions of scope of work and materials given in the Specification or shown in the Drawings are not necessarily repeated in the Bill of Quantities and reference is to be made to the Specification and the Drawings for this information.

1.5 The Bill of Quantities is an estimate of the quantities of work involved and is to be used as a basis for pricing of the Tender and for valuation of the work executed, in conjunction with instructions to Bidders, General and Condition of contract, Technical specifications and Drawings

1.6 The quantities shown in the Bill of Quantities are approximate only and may be subject to variation. The quantities shown should not be considered as limiting or defining the extent of work to be done and material to be supplied by the Contractor. The contractor shall ascertain the actual quantities of materials required before placing orders.

1.7 Quantities given in the Bill of quantities for the various items are approximate only and are given to provide a common basis for tendering. The basis of payment will be the actual quantities of work carried out, as measured by the Engineer and valued at the rates of prices quoted in the Bills of Quantities where applicable, and otherwise at such rates for prices as may be fixed within the terms of the contract. Variations in the quantities of work in the Schedule shall not vitiate the contract.

1.8 Extra items of work shall not vitiate the Contract. The Contractor shall be bound to execute extra items of work as directed by the Engineer. The rates for extra items of works will be as per rates decided under Contract Conditions.

1.9 The rates quoted in the schedule shall be all inclusive value for the work described and be deemed to include for all the Contractor's liabilities and obligations and all risks set forth or implied in the document and all matters and things necessary for the proper construction, of the Works including surveying, setting out, plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes and duties together with all general risks liabilities and obligations set out or implied in the Contract.

1.10 It is to be expressly understood that the measured work is to be taken net (not withstanding any system or practice to the contrary) according to the actual quantities wherein finished according to the Drawings or as may be ordered from time to time by the Engineer and the cost calculated at the respective prices, without any additional charges for any necessary or contingent works connected therewith. The rates quoted are for works in-situ and complete in every respect. Unless the Bill of Quantities specially indicates to the contrary, the constructional plant and temporary works will not be measured.

1.11 Unless otherwise stated, all items are measured net and no allowance will be made for wastage, working space, bulking or shrinkage, overlaps and the like. For supply or transportation of sand etc., deduction for bulk age/voids will be done as per provisions in IS codes /CPWD specifications.

1.12. The unit rate should be entered against each item in the Bill of Quantities and shall be written in figures. Any item left un-priced will be deemed to be included for elsewhere in the Bill of Quantities or the Schedule and hence the rate for that item will be taken as NIL.

1.13. In case any discrepancy is found between the quoted rates and the amounts, the unit rates will be taken as correct.

1.14. Provisional sums included and designated in the BOQ shall be expended in whole or in part at the discretion and direction of the Engineer in accordance with the conditions of contract. It shall include shifting of utility services, electrical works on HT Side, and electrical energy charges during O&M period with additional 2 months, etc."The amount for provisional sum shall be Rs 300 Lacs. The bidders , however, shall not have to quote this amount in the BOQ & the same shall be added to the lowest evaluated bidder at the time of award. The expenditure out of the provisional sum shall be carried out only after prior approval of the employer and shall be paid as per the actual work done, supported by the relevant documents

2.0 Earthworks

2.1 The unit of measurement for earthworks where measured separately shall be Cubic Meters for all types of soils including hard rock.

2.2 The rates for excavation shall include for all plant, materials and labour required for excavation irrespective of depth in any material and in any location and shall also include for all temporary diversions, support and protection of any existing services and utilities, temporary support and maintenance of the excavation, dewatering, any additional excavation necessary to provide working space, refilling to any over excavation with materials as required by the specification or shown on the drawings, multiple handling and stack piling materials required for filling anywhere on the site, backfilling with materials as required by the specification or shown on the drawing(excluding the cost of outside material) compaction. Disposal of surplus earth is included in excavation item.

3.0 Dewatering

3.1 The rates for all items in Bill of Quantities shall be deemed to include all charges on account of dewatering, diversions, ring bund, protection bunds of any kind etc and all such hidden arrangements/items that are not listed and are necessary for execution of all BOQ items, to entire satisfaction of engineer in charge.

3.2 Nothing extra shall be paid on account of dewatering of any kind which the contractor has to carry out during the execution of works, the rate of dewatering of all kinds such as but not limited to, rainfall, snowfall, springs, wells, underground, sub-surface or surface water, water from broken PHE Lines, drainage pipe lines, drains or any other utility, stagnant water of any kind , flood water, is deemed to be included

4.0 Approach to Work Site

Provision for access and approach to all construction sites is the responsibility of contractor and no payment will be made on this account.

5.0 Safety

The contract rates for such items in BOQ shall include all costs of compliance with safety requirements (barricading of roads ,night lamps for lighting ,watch and ward caution boards, safety ribbons sign boards & etc) & Specifications. The rates for such items given in BOQ shall be deemed to include all costs on account of traffic diversions and all such hidden assessment/items, which are not listed but have to be complied to entire satisfaction of Engineers In charge.

Note:

Following points shall be kept in view while filling up the BOQ in financial bid.

1. *Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities*
2. *Unit rates and prices shall be quoted by the bidder in Indian Rupees*
3. *Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern as explained in*

Where there is a discrepancy between the rate in figures and words, the rates in words will govern.

Bill of Quantities (BOQ) :

Bill of Quantities (BOQ)						
Pipe drain				**Rate (INR)**		
S. No.	**Description**	**Qty.**	**Unit**	**In Figures**	**In Words**	**Amount**
1.1	Earth work in excavation in trenches for laying of pipes ,construction of RCC drains for all depths, in all types of soil including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	58950.0	Cum			
1.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.(complete job)	3000.00	Cum			
1.3	Providing and laying in position cement concrete of 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size) excluding the cost of centering and shuttering including dewatering job.	1984.00	Cum			
1.4	Close timbering/ steel shorring for depths exceeding1.5 meter in trenches including strutting, shoring and packing cavities,	66572.00	Sqm			

	wherever required,complete job (Measurements to be taken of the face area timbered).					
1.5	Supply and filling of Local Sand / Stone Crushed Dust including watering, ramming, dressing , dewatering, carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking. (complete job)	7820.00	Cum			
1.6	Providing & Laying of stone aggregate of 40 mm size and below on horizontal level including ramming, all leads and lifts, cost and carriage of material, dewatering etc. (complete job).	6268.00	Cum			
1.7	Providing & laying nallah muck (GSB) in trenches in layers not exceeding 20 cm in depth consolidating each layer by ramming / watering and compacting including all carriages upto site of work (complete job).	35100.00	Cum			
1.8	Supply, laying & jointing of rubber ring jointed non-pressure NP-3 class socket & spigot R.C.C. pipes of specified internal dia & thickness with jointing materials as per BIS with Stiff mixture of cement mortar in the proportion of 1:2 (1 cement: 2 fine sand) including dewatering,loading ,unloading, freight,stacking & transportation at site & testing of joints etc. complete job as per drawing specifications & as directed by Engineer Incharge.					
(a)	300 mm dia	10524.00	M			
(b)	350 mm dia	2494.00	M			
(c)	400 mm dia	1441.00	M			
(d)	450 mm dia	1828.00	M			
(e)	500 mm dia	847.00	M			
(f)	600 mm dia	930.00	M			
(g)	700 mm dia	450.00	M			

(h)	800 mm dia	417.00	M			
(i)	1000 mm dia	645.00	M			
1.9	Providing and laying in position ready mixed M-30 grade. for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant, transported to site of work in transit mixer for all leads & lifts , having continuous agitated mixer, including pumping of R.M.C. from transit mixer to site of laying , cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge for all works up to floor five level. including cost of stone soling ,PCC & RCC raft in foundation work, supplying and fixing 560 mm dia. SFRC manhole frame and cover, supply and fixing of cast iron footsteps staggered at 30cms apart as directed, watering, curing, including earth work in excavation , shoring strutting, shuttering & reinforcement (hysd) in RCC slabs in construction of RCC manholes & providing and laying of nallah muck (GSB) in filling around the manholes as per the specifications & details of approved drawings with all leads and lifts for all depths. Contractor to Quote Rate Including dewatering .Nothing extra will be paid on account of dewatering.(complete job)					
(a)	900 mm dia	525.00	Nos.			
(b)	1200 mm dia	210.00	Nos.			
(c)	1500 mm dia	290.00	Nos.			
(d)	1800 mm dia	16.00	Nos.			

(e)	2000 mm dia	24	Nos.			
	Description	**Qty.**	**Unit**	**Rate in Figures**	**Rate in Words**	**Total Amount**
	2. C.C drain					
2.1	Earth work in excavation by manual or mechanical means in trenches for foundations, drains, pipes, cables etc. (not exceeding 1.5m in width) and for shafts, wells, cesspits and the like not excedding 10 sqm on plan, depth upto 1.5 mtr including disposed of excavated earth upto 1 m from cutting edge, disposed earth is to be levelled and neatly dreassed in, including dewatering of kinds.(complete job)	300	cum			
2.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.(complete job)	35	cum			
2.3	Providing and laying in position cement concrete of 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size). specified grade excluding the cost of centering and shuttering .	35	cum			
2.4	Providing and laying in position cement concrete of 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 40 mm nominal size). specified grade excluding the cost of centering and shuttering .(compelte job)	126	cum			
2.5	Filling available excavated earth (excluding rock in trenches, plinth, sides of foundation etc. Layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering lead upto 50m and lift upto 1.5m.	50	Cum			

2.6	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge	460	Sqm			
2.7	Strctural steel work welded in built up sections, trusses and framed work, including supply cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete job.	14500	kgs			
	3. R.C.C covered drain					
3.1	Earth work in excavation in trenches for laying of pipes ,construction of RCC drains for all depths, in all types of soil including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	1000	Cum			
3.2	Supplying and filling of Local Sand / Stone Crushed Dust including watering, ramming, dressing , dewatering, carriage of materials from nearest source to site of work by mechanical transport including	300	Cum			

	loading, unloading and stacking. (complete job)					
3.3	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.Complete job)	60	Cum			
3.4	Providing and laying in position cement concrete of 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) excluding the cost of centering and shuttering including dewatering .(complete job)	51	Cum			
3.5	Providing and laying in position RCC /PCC for all types of works etc. any thickness in Cement concrete 1:2:4 using 20mm and down grade crushed stone aggregate including cost and carriage of all materials equipments and dewatering et. complete as directed by the Engineer in charge. (excluding cost of reinforcement, centering and shuttering)	173	Cum			
3.6	Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work in Slabs using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended	131	Cum			

	proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. M- 25 grade reinforced cement concrete. all works upto floor five level. (complete job)					
3.7	Reinforcement steel for R.C.C work including Supply straightening, cutting, bending, placing in position and binding . Thermo-Mechanically Treated bars.(Fe 500 D) (complete job)	9150	Kg			
3.8	Providing and fixing ,centering and steel shuttering works for drain abutments and bottom haunch in semi circular shape including strutting, propping etc to give an even and smooth surface for all depth and heights complete and removal of the same for all types of works etc .Including cost and carriage of material ,equiment ,dewatering,diversion and construction of ring bunds etc.Complete job as per drawing, specifications and as directed bu the engineer incharge	1100	Sqm			
	4. Sump well at Palpora					
4.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused	375	Cum			

	by any means to any extent, construction of diverssion and ring bunds etc & disposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)					
4.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.) (complete job)	114	Cum			
4.3	Reinforcement steel for R.C.C work including supply ,straightening, cutting, bending, placing in position in cutting edges and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D)(complete job)	9000	Kg.			
4.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply,cutting, hoisting, fixing in position and applying a priming coat	2500	Kg.			

	of approved steel primer.(complete job).					
4.5	Strctural steel work welded in built up sections, trusses and framed work, including, supply, cutting, hoisting, fixing in position in cat ledder and applying a priming coat of approved steel primer all complete.ISMC 250 x 100mm (complete job)	1800	Kg.			
4.6	Providing and laying in position cement concrete of 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 20mm nominal size) specified grade excluding the cost of centring and shuttering- All work upto plinth level.(complete job)	20	Cum			
4.7	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	375	Sqm			
4.`8	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete as per drawing and directed the Engineer.	450	Kg			
4.9	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329.	6	M			

	1000mm dia					
4.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	7.8	M			
	5. Gate Valve Chamber at Palpora					
5.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as	50	Cum			

	directed by the engineer I/C as per site condition (compelete job)					
5.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	18	Cum			
5.3	Reinforcement steel for R.C.C work including supply straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D) (Complete job)	1500	Kg.			
5.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cuttng edges and applying a priming coat of approved steel primer.	1100	Kg.			

	(complete Job)					
5.5	Providing and laying in position cement oncrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) specified grade excluding the cost of centering and shuttering - All work up to plinth level :(including carriage of cement.)	3	Cum			
5.6	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	90	Sqm			
5.7	Providing orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910, on 12 mm dia steel bar conforming to IS: 1786, having minimum cross section as 23 mmx25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing, including fixing in manholes with 30x20x15 cm cement concrete block.1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	16	No.			

	complete as per design.					
5.8	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. completejob as per drawing and directed the Engineer.	250	Kg			
5.9	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 1000mm dia (Complete job)	6	M			
5.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of	5	M			

	filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge					
	6. Silt Chamber at palpora					
6.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	250	Cum			

6.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	71	Cum			
6.3	Reinforcement steel for R.C.C work including supply, straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D) complete job.	5600	Kg.			
6.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer all complete. (complete job)	2000	Kg.			
6.5	Providing and laying in position cement oncrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)specified grade excluding the cost of centering and shuttering - All work up to plinth level :(including carriage of cement.)	10	Cum			

6.6	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	250	Sqm			
6.7	Structural steel work welded in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cat ladder and applying a priming coat of approved steel primer all complete.	150	Kg			
6.8	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 1000mm (compelte job)	6	M			
6.9	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete as per drawing and directed the Engineer.	300	Kg			

6.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	6.3	M			
	7. Screen Chamber at palpora					
7.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	250	Cum			

7.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	114	Cum			
7.3	Reinforcement steel for R.C.C work including supply, straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D) (complete job)	8700	Kg.			
7.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer.(complete job)	2100	Kg.			
7.5	Brick work with common burnt common burnt clay F.P.S. (non-modualar) bricks of class designation 75 in foundation and plinth in cement mortar 1:4 (1cement : 4 coarse sand).	1	Cum			
7.6	Providing and laying in position cement oncrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)specified grade excluding the	13	Cum			

	cost of centering and shuttering - All work up to plinth level :(including carriage of cement.)					
7.7	Providing and laying in position cement concrete of 1:4:8 (1 cement : 4 fine sand : 8 graded stone aggregate 40 mm nominal size) specified grade excluding the cost of centring and shuttering. All work upto plinth level.	1	Cum			
7.8	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	310	Sqm			
7.9	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge	180	Sqm			
7.10	Structural steel work welded in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cutting cat ladder and applying a priming coat of approved steel primer.(complete job)	200	Kg			
7.11	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329.	6	M			

	800mm dia					
7.12	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete as per drawing and directed the Engineer.	350	Kg			
7.13	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	5	M			
7.14	Providing and fixing precast FRC (Ferous Rainforced Concrete) perforated slab as per direction of engineer- in- charge.	20	Sqm			
	8. Screen Chamber at sampora					

8.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	275	Cum			
8.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	156	Cum			

8.3	Reinforcement steel for R.C.C work including supply, straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D)	12000	Kg.			
8.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply,cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer.(complete job)	2300	Kg.			
8.5	Brick work with common burnt common burnt clay F.P.S. (non-modualar) bricks of class designation 75 in foundation and plinth in cement mortar 1:4 (1cement : 4 coarse sand).	1	cum			
8.6	Providing and laying in position cement concrete of 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 20mm nominal size) specified grade excluding the cost of centring and shuttering- All work upto plinth level.	14	Cum			
8.7	Providing and laying in position cement concrete of 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size) excluding the cost of centering and shuttering including dewatering job - All work up to plinth level.	1	Cum			
88.	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	390	Sqm			

8.9	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge	35	Sqm			
8.10	Strctural steel work welded in built up sections, trusses and framed work, including supply ,cutting, hoisting, fixing in position and applying a priming coat of approved steel primer. (complete job)	300	Kg.			
8.11	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 800mm dia	6	M			
8.12	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete as per drawing and directed the Engineer.	350	Kg			
8.13	Providing and fixing precast FRC (Ferous Rainforced Concrete) perforated slab as per direction of engineer- in- charge.	20	Sqm			

8.14	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	6.5	M			
9	**Sump Well at sampora**					
9.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc. and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	450	Cum			

9.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)complete job	174	Cum			
9.3	Reinforcement steel for R.C.C work including supply,straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D) complete job.	13500	Kg.			
9.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer. Complete job	2600	Kg.			
9.5	Structural steel work welded in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cat ladder and applying a priming coat of approved steel primer.M.S Grating & ISMB 250X100 MM complete job.	5800	Kg.			

9.6	Providing and laying in position cement oncrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)specified grade excluding the cost of centering and shuttering - All work up to plinth level :(including carriage of cement.) complete job.	20	Cum			
9.7	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	440	Sqm			
9.8	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 700mm dia	6	M			
9.9	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete as per drawing and directed the Engineer.	600	Kg			

9.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	9.3	M			
10	**Silt Chamber At sampora**					
10.1	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc. and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	225	Cum			

10.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	97	Cum			
10.3	Reinforcement steel for R.C.C work including supply,straightening, cutting, bending, placing in position and binding . Thermo-Mechanically Treated bars.(Fe 500 D) complete job.	7800	Kg.			
10.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply,cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer.complete job.	2000	Kg.			
10.5	Providing and laying in position cement concrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)specified grade excluding the cost of centering and shuttering - All work up to plinth level :(including carriage of cement.) complete job.	11	Cum			

10.6	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	280	Sqm			
10.7	Structural steel work welded in built up sections, trusses and framed work, including supply cutting, hoisting, fixing in position in cat ladder and applying a priming coat of approved steel primer. Complete job.	200	No.			
10.8	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc. complete job as per drawing and directed the Engineer.	300	Kg			
10.9	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 700mm dia	6	M			

10.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	7.3	M			
11	**Gate Valve Chamber at sampora**					
11.0	Earth work in excavation in trenches for laying of pipes ,construction of sump well/slit chamber/valve chamber/screen chamber, in al lsorts of soi/rocks l including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc. and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	50.00	Cum			

11.2	Providing and laying in position ready mixed M-30 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. (In Wall, Shoe, Base, Slab, Foundation of Pump etc.)	22.00	Cum			
11.3	Reinforcement steel for R.C.C work including supply,straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D)	1700.00	Kg.			
11.4	Strctural steel work riveted or bolted in built up sections, trusses and framed work, including supply, cutting, hoisting, fixing in position in cutting edges and applying a priming coat of approved steel primer. Complete job.	1350.00	Kg.			
11.5	Providing and laying in position cement concrete of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) specified grade excluding the cost of centering and shuttering - All work up to plinth level :(including carriage of cement.) complete job	2.00	Cum			

11.6	Providing anf fixing ,centering and shuttering (M.S) for circular /conical works including strutting, proper etcs to give an even and smooth surface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,construction of diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the Engineer incharge	115.00	Sqm			
11.7	Providing orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910, on 12 mm dia steel bar conforming to IS: 1786, having minimum cross section as 23 mmx25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing, including fixing in manholes with 30x20x15 cm cement concrete block1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete as per design.	21.00	No.			
11.8	Providing, fabricating and fixing hand railing consisting of 40 mm N.B. G.I..Pipe in 2 rows with 65x65x6 mm M.S. angle 900 mm ht above concrete at 1200 c/c including embedding angles 200mm in concrete, painting M.S. angles 200mm in concrete, painting M.S.angles and pipes with red oxide primer and two coats of oil paint of approved make and colour etc.	150.00	Kg			

	complete job as per drawing and directed the Engineer.					
11.9	Providing and laying S&S Centrifugaly Cast (Spun)/ Ductile Iron Pipes conforming to IS:8329. 800mm dia . Complete job.	12.00	M			
11.10	Well sinking to required level of sump well/ silt chamber/screen chamber and valve chamber of required diameters and specification including all skilled and unskilled labour,supply and filling of empty cement bags with sand and placing in position, making of plat form ,scaffolding etc. after every casting of the steining and removal of the same, carriage of all material what so ever involved ,the job includes providing and fixing of .063 mm x 300 mm plain G.I sheet at every casting joint ,including positioning of steel edge to level on ground surface after preparation of leveled ground surface by way of filling/leveling including dewatering caused by any means ,construction of diversion and ring bunds etc .complete job as per the approved drawing ,specifications and as approved by the Engineer Incharge	6.30	M			
12	**Iron Gate at palpora & sampora Stations**					
12.1	Earth work in excavation by manual means in trenches for foundations, drains, pipes, cables etc. (not exceeding 1.5m in width) and for shafts, wells, cesspits and the like not excedding 10 sqm on plan, depth upto 1.5 mtr including disposed of excavated earth upto 1 m from cutting edge, disposed earth is to be levelled and neatly dreassed in, including dewatering of	4	Cum			

	kinds.complete job					
12.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.complete job	1	Cum			
12.3	Providing and laying in position cement concrete of 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size). specified grade excluding the cost of centering and shuttering - All work up to plinth level.	1	Cum			
12.4	Providing and laying in position RCC /PCC for all types of works etc. any thickness in Cement concrete 1:1:2 using 20mm and down grade crushed stone aggregate including cost and carriage of all materials equipments and dewatering et. complete as directed by the Engineer in charge. (excluding cost of reinforcement, centering and shuttering). Compelte job.	6	Cum			
12.5	Reinforcement steel for R.C.C work including straightening, cutting, bending, placing in position and binding all complete. Thermo-Mechanically Treated bars.(Fe 500 D). Complete job.	500	kgs			
12.6	Structural steel work welded in built up sections, trusses and framed work, including supply,cutting, hoisting, fixing in position and applying a priming coat of approved steel primer.complete job.	2000	kgs			

12.7	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge. Complete job)	50	Sqm			
13	**Collection Chamber at Palpora & sampora**					
13.1	Earth work in excavation in trenches for laying of pipes ,construction of RCC drains for all depths, in all types of soil including boulders,picking of metalled roads with bitumen or tar macadam road surfaces cuttings,tiles floors,devri stones etc. (by manual or mechanical means)with all leads lifts dressing of sides, ramming of bottom including dewatering caused by any means to any extent, construction of diverssion and ring bunds etc..Complete job and didposal of surplus excavated earth within a lead of 10 kms by mechanical transporet,disposal of surplus excavated earth to be levelled and neatly dressed or as directed by the engineer I/C as per site condition (compelete job)	1910	Cum			
13.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.Complete job.	150	Cum			

13.3	Providing and laying in position cement concrete of 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size).specified grade excluding the cost of centering and shuttering - All work up to plinth level (complete job)	130	Cum			
13.4	Providing and laying in position cement concrete of 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 40 mm nominal size).specified grade excluding the cost of centering and shuttering - All work up to plinth level Complete job)	345	Cum			
13.5	Filling available excavated earth (excluding rock in trenches, plinth, sides of foundation etc. Layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering lead upto 50m and lift upto 1.5m. Complete job.	500	Cum			
13.6	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge.(compelet job)	3615	Sqm			
13.7	Strctural steel work welded in built up sections, trusses and framed work, including supply cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.ISA 35x35x6mm Angle & 30x5mm flat bars. Complete job.	26500	Kg			
13.8	Supplying and filling in plinth with fine sand under floors including,	500	Cum			

	watering, ramming consolidating and dressing complete.Around the 150mm RCC NP-3 pipe.complete job.					
13.9	Supplying, Delivering, Placing in position and fixing of 150 mm dia RCC Pipes grade confirming to NP3 including jointing of pipe with gully trap in rich cement mortar as directed by the Engineer incharge including all carriage upto site of work inclluding testing if any (150 mm dia).Complete job.	2130	M			
14	**Compound Walling Around Premises at Palpora & Sampora.**					
14.1	Earth work in excavation by manual means in trenches for foundations, drains, pipes, cables etc. (not exceeding 1.5m in width) and for shafts, wells, cesspits and the like not exceeding 10 sqm on plan, depth upto 1.5 mtr including disposed of excavated earth upto 1 m from cutting edge, disposed earth is to be levelled and neatly dressed in, including dewatering of kinds.(complete job)	100	cum			
14.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.(complete job)	20	cum			
14.3	Providing and laying in position cement concrete of 1:4:8 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).in coping specified grade excluding the cost of centering and shuttering - All work upto plinth level.(complete job)	15	cum			
14.4	Providing and laying in position specified grade of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size derived from natural sources)	3	cum			

	reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level.(complete job)					
14.5	Providing and laying in position RCC /PCC for all types of works etc. any thickness in Cement concrete 1:1.5:3 using 20mm and down grade crushed stone aggregate including cost and carriage of all materials equipments and dewatering et. complete as directed by the Engineer in charge. (excluding cost of reinforcement, centering and shuttering)(complete job)	120	cum			
14.6	Reinforcement steel for R.C.C work including supply,straightening, cutting, bending, placing in position and binding. Thermo-Mechanically Treated bars.(Fe 500 D)(complete job)	2000	kgs			
14.7	Brick work with F.P.S bricks of class designation 75 in superstructure above plinth level up to floor V level in all shapes and sizes in: (including carriage of cement.)Cement mortar 1:6 (1 cement : 6 coarse sand)1 2 mm cement plaster of mix: (including carriage of cement.(complete job)	90	cum			
14.8	Cement plaster 12 mm of mix 1 : 6 (1cement : 6 coarse sand).(complete job)	1000	sqm			
14.9	Finishing walls with water proofing cement paint of required shade:New work (Two or more coats applied @ 3.84kg / 10 sqm)(complete job)	1000	sqm			
15	**Road Restoration at palpora & sampora**					
15.1	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with 3 wheeled steel/ vibratory roller 8-10 tonnes in					

	stages to proper grade and camber, applying and brooming requisite type of screening/ binding Materials to fill up the interstices of coarse aggregate, watering and compacting to the required density.(complete job)					
A	Grade - I as per Technical specification Morth 404.	2850	Cum			
b.	Grade - II as per Technical specification Morth 404.	2850	Cum			
15.2	Providing and laying bituminous macadam with 100-120 TPH hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading premixed with bituminous binder, transported to site, laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled as per clauses 501.6 and 501.7 to achieve the desired compaction (50mm)(complete job)	1900	Cum			
15.3	Providing and laying semi dense bituminous concrete with 100-120 TPH batch type HMP producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.5 to 5 per cent of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 508 complete in all respects (25 mm)(complete job)	1050	Cum			
15.4	Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.60	40000	Sqm			

	kg/sqm using mechanical means.(complete job)					
15.5	Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor at the rate of 0.25 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom.(complete job)	42000	Sqm			
15.6	Providing/Laying of Seal coat sealing the wides in Bituminous Surface laid to specified levels, grade & cross fall using type B seal coat.(complete job)	42000	Sqm			
	16.Miscellaneous Civil Works at Sempora					
16.1	Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully automatic batching plant and transported to site of work in transit mixer for all leads, having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work, including pumping of R.M.C. from transit mixer to site of laying , excluding the cost of centering, shuttering finishing and reinforcement, including cost of admixtures in recommended proportions as per IS : 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. M- 25 grade reinforced cement concrete by using 330 kg of cement per cum of concrete. all works upto floo five level.(complete job.)	171	Cum			
16.2	Reinforcement steel for R.C.C. work including supply straightening, cutting, bending, placing in position and binding all complete.(complete	500	Kgs			

	job.)					
16.3	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.(complete job.)	231	cum			
16.4	Providing and laying in position cement concrete of 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size). specified grade excluding the cost of centering and shuttering - All work upto plinth level.(complete job.)	116	cum			
16.5	Dismantling existing structures like culverts, bridges,brick work structures, retaining walls and other structure comprising of P.C.C / R.C.C including T&P and scaffolding wherever necessary, sorting the dismantled materials, disposal of unserviceable materials and stacking the serviceable materials including all leads & lifts.(complete job.)	30	cum			
16.6	Filling available excavated earth (excluding rock in trenches, plinth, sides of foundation etc. Layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering lead upto 50m and lift upto 1.5m.(complete job.)	850	cum			
	17.Outfall Arrangement at sampora					
17.1	Earth work in excavation by manual means in trenches for foundations, drains, pipes, cables etc. (not exceeding 1.5m in width) and for shafts, wells, cesspits and the like not excedding 10 sqm on plan, depth upto 1.5 mtr including disposed of excavated earth upto 1 m from cutting edge, disposed earth is to be levelled and neatly dreassed in, including dewatering of	130	Cum			

	kinds.(complete job.)					
17.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.(complete job.)	6	Cum			
17.3	Providing and laying in position cement concrete of 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).specified grade excluding the cost of centering and shuttering.(complete job.)	27	Cum			
17.4	Providing and laying in position machine· batched, machine mixed and machine vibrated -design mix cement concrete of specified grade for reinforced cement concrete structural elements, excluding the cost of centring, shuttering, finishing and reinforcement, including Admixtures in recommended proportions, (as per IS 91 03) to accelerate, retard setting of concrete improve workability without impairing strength and durability as per direction of Engineer-in-chargecharge- M-25 grade reinforced cement concrete. (complete job.)	116	Cum			
17.5	Reinforcement steel for R.C.C. work including supply,straightening, cutting, bending, placing in position and binding all complete job.	11600	Kg			

17.6	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge (complete job.)	170	Sqm			
17.7	Providing and laying in position cement concrete of 1:2:4 (1cement:2coarse sand:4graded stone aggregate 20mm nominal size)specified grade excluding the cost of centring and shuttering.(complete job.)	9	Cum			
17.8	Preparing and dressing side slopes of canals for lining. In ordinary soils.(complete job.)	70	Sqm			
17.9	Dry stone pitching 22.5cm thick laid in courses required profile with hammer dressed stone having no side less than 15cm, with minimum depth of 20cm including preparing the bedding surface etc. all complete (Payment for stone to be made separately).	193	Sqm			
17.10	Supplying and stacking of hard stone (for stone pitching) 22.5cm thick at site.(complete job.)	56	cum			
17.11	Strctural steel work welded in built up sections, trusses and framed work, including supply,cutting, hoisting, fixing in position and applying a priming coat of approved steel primer.(complete job.)	600	Kg			
17.12	Making knitted wire crates of approved mesh-size; including weaving, binding sides and partitions, and binding top after filling; excluding cost of filling, stones and weaving materials.(complete job.)	115	Sqm			

17.13	Supply Stone boulder (quarry) nominal size 255mm (Stack measurements reduced by 15%)(complete job.)	26	cum			
17.14	Filling of stone in to wire crates.(complete job.)	26	cum			
17.15	Tipping stone-filled wire crates in position; including equipment charges.(complete job.)	26	cum			
17.16	Supply of B.A wire at site.(complete job.)	300	kgs			
	18. Outfall Arrangement at palpora					
18.1	Earth work in excavation by manual means in trenches for foundations, drains, pipes, cables etc. (not exceeding 1.5m in width) and for shafts, wells, cesspits and the like not excedding 10 sqm on plan, depth upto 1.5 mtr including disposed of excavated earth upto 1 m from cutting edge, disposed earth is to be levelled and neatly dreassed in, including dewatering of kinds.	95	Cum			
18.2	Providing & laying stone soling above 75 mm size including dewatering job complete including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.	6	Cum			
18.3	Providing and laying in position cement concrete of 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).specified grade excluding the cost of centering and shuttering.	3	Cum			
18.4	Providing and laying in position machine· batched, machine mixed and machine vibrated -design mix cement concrete of specified grade for reinforced cement concrete structural elements, excluding the cost of centring, shuttering, finishing and reinforcement, including Admixtures in recommended proportions, (as per IS 91 03) to accelerate, retard setting of concrete improve workability	23	Cum			

	without impairing strength and durability as per direction of Engineer-in-chargecharge- M-25 grade reinforced cement concrete.					
18.5	Reinforcement steel for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete.	2300	Kg			
18.6	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge.Complete job.	90	Sqm			
18.7	Providing and laying in position cement concrete of 1:2:4 (1cement:2coarse sand:4graded stone aggregate 20mm nominal size)specified grade excluding the cost of centring and shuttering.Complete job	3	Cum			
18.8	Dry stone pitching 22.5cm thick laid in courses required profile with hammer dressed stone having no side less than 15cm, with minimum depth of 20cm including preparing the bedding surface etc. all complete (Payment for stone to be made separately).	25	Sqm			
18.9	Supplying and stacking of hard stone (for stone pitching) 22.5cm thick at site.	5	cum			
18.10	Strctural steel work welded in built up sections, trusses and framed work, including cutting, hoisting,	600	Kg			

	fixing in position and applying a priming coat of approved steel primer all complete.					
18.11	Making knitted wire crates of approved mesh-size; including weaving, binding sides and partitions, and binding top after filling; excluding cost of filling, stones and weaving materials.Complete job	90	Sqm			
18.12	Supply Stone boulder (quarry) nominal size 255mm (Stack measurements reduced by 15%).Complete job	19	cum			
18.13	Filling of stone in to wire crates.Complete job	19	cum			
18.14	Tipping stone-filled wire crates in position; including equipment charges.Complete job	19	cum			
15.15	Supply of B.A wire at site.Complete job	200	kgs			
	19. Annexe Buildings sampora & palpora					
19.1	Earth work in excavation by manual means in trenches for foundation, drains, pipes, cables etc. (not exceeding 1.5 m in width) and for shafts, wells, cesspits and the like not exceeding 10 sqm on plan, depth upto upto 1.5 m, including disposal of excavated earth up to 1.0 m from cuttind edge, dispoed earth is to be levelled and neatly dressed in . All kinds of soil. complete job.	340	cum			
19.2	Close timbering in trenches including strutting, shoring and packing cavities (wherever required) complete, (Measurements to be taken of the face area timbered).complete job.	170	sqm			
19.3	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. Layer not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50m and lift up to 1.5m.complete	100	cum			

	job.					
19.4	Providing and laying in position cement concrete of 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size) specified grade excluding the cost of centering and shuttering - All work up to plinth level .complete job.	12	cum			
19.5	Providing and laying in position cement concrete of 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) specified grade excluding the cost of centering and shuttering - All work up to plinth level :Flooring (100 mm thick in prop 1:3:6).complete job.	14	cum			
19.6	Providing and laying damp proof course 40 mm thick with cement concrete in prop 1:2:4 (1 cement : 2 coarse sand : 4 gradedstone aggregate 12.5 mm nominal size). complete job.	14	Sqm			
19.7	Providing and laying in position specified grade of 1:1:2 (1 cement: 1 coarse sand: 2 graded stone aggregate 20mm nominal size) M-25 reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level .complete job.	110	cum			
19.8	Reinforced cement concrete 1 1:2 (1 cement: 1 coarse sand : 2 graded crushed stone aggregate 20mm nominal size) M-25 work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts ans sturts, etc. upto floor five level excluding cost of centering, shuttering, finishing and reinforcement.complete job.	70	cum			

19.9	Providing anf fixing ,centering and shuttering works for Foundations, footings, bases of columns, etc.includng strutting, proper etc to give an even and smooth serface for all depth and heights cmplete and removal of frame work for all types of works etc.Including cost and carriage of material ,equiment ,dewatering,diversion and ring bunds etc.Complete job as per drawing, specifications and as directed by the engineer incharge	1100	Sqm			
19.10	Providing & laying stone soling above 75 mm size including dewatering including carriage of materials from nearest source to site of work by mechanical transport including loading, unloading and stacking.complete job.	30	cum			
19.11	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level. Cement mortar 1:4 (1 cement :4 coarse sand)complete job.	80	Sqm			
19.12	Extra for providing and placing in position 2 Nos 6mm dia. M.S. bars at every third course of half brick masonry.complete job.	80	sqm			
19.13	Cement Concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate) finished with a floating coat of neat cement including cement slurry, but excluding the cost of nosing of steps etc. complete. 25 mm thick with 12.5 mm nominal size stone aggregate. complete job.	250	sqm			
19.14	Providing and laying/ fixing Ceramic glazed floor tiles of 300x300 mm (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 13755, of NITCO, ORIENT, KAJARIA, SOMANY or equivalent make in colour shades except white, lovory, Grey, Fume	122	sqm			

	Red, Brown laid on 20 mm thick bed of Cement Mortar 1:4 (1 Cement : 4 Coarse sand), including pointing the joints with white cement and matching pigments etc., complete job.					
19.15	Cement plaster 15 mm thick on the rough side of single or half brick wall of mix: 1:4 (1 Cement : 4 Coarse Sand) complete job.	350	sqm			
19.16	Cement Plaster 6 mm thick to ceiling of mix 1:3 (1 Cement : 3 Fine Sand). complete job.	350	sqm			
19.17	Providing wood work in frame (chowkaths) of doors, windows, clerestory windows and other similar works wrought, framed and fixed in position with hold fast lugs or with dash fasteners of required dia and length (hold fast lugs or with dash fasteners shall be paid ofr separately) Deodar. complete job.	0.5	cum			
19.18	Providing and fixing panelled or panelled and glazed shutters for doors, windows and clerestory windows, including ISI marked M.S. pressed butt hinges bright finished of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge.With 1st class deodar wood,35 mm thick.complete job.	14	sqm			
19.19	Applying priming coat: with ready mixed pink or grey primer of approved brand and manufacture on wood work (hard and soft wood) complete job.	14	sqm			
19.20	Painting with ready mixed synthetic enamel paint of approved brand and manufacture in all shades to give an even shade.complete job.	14	sqm			

19.21	Providing and fixing double glazed hermetically sealed glazing in aluminium windows, ventilators and partition etc. with 6 mm thick clear float glass both side, having 12 mm air gap, including providing EPDM gasket, perforated aluminium spacers, desiccants, sealant (Both primary and secondary sealant) etc. as per specifications, drawings and direction of Engineer-in-charge complete.3 Track sliding window,6mm clear glass.complete job.	10	sqm			
19.22	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete job.	680	sqm			
19.23	Wall painting with acrylic emulsion paint, having VOC (Volatile Organic compound) content less than 50 grams/litres, of approved brand and manufacture, including applying additional coat wherever required, to achieve even shade and colour.Two or more coats on new work.complete job.	680	sqm			
19.24	Finishing walls with water proofing cement paint of required shade : New work (Two or more coats applied @ 3.84 kg/10 sqm) complete job.	330	sqm			
19.25	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.complete job.	18000	kgs			
19.26	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. At 17.25 kgs per sqm of roof area.complete job.	4000	kgs			

19.27	Providing ridges or hips of width 60 cm overall width plain G.S. sheet fixed with polymer coated J. or L hooks, bolts and nuts 8 mm dia G.I. limpet and bitumen washers complete. 0.80 mm thick with zinc coating not less than 275 gm/m².complete job.	30	RM			
19.28	Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works, including applying priming coat of approved steel primer.M.S. Tube.complete job.	520	kgs			
19.29	Structural steel work welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	9000	kgs			
19.30	Providing and fixing G.I. pipes complete with G.I. fittings and clamps, i/c cutting and making good the walls etc. Internal work - Exposed on wall. 15 mm Dia.complete job.	60	Rm			
19.31	Providing and fixing brass bib cock of approved quality.	8	No's			
19.32	Providing and fixing G.I. pipes complete with G.I. fittings including trenching and refilling etc. (external work) 15 mm.complete job.	100	Rm			
19.33	Providing and fixing water closet squatting pan (Indian type W.C. pan) with 100 mm sand cast Iron P or S trap, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required:White Vitreous china Orissa pattern W.C. pan of size 580x440 mm with integral type foot rests.complete job.	2	No			

19.34	Providing and fixing P.V.C. low level flushing cistern with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete.10 litre capacity - White.complete job.	2	No			
19.35	Providing and fixing plained eaves boarding.2nd class kail wood 300x40 mm (nominal size)complete job.	70	M			
19.36	Providing and fixing 20mm thick wooden planks ceiling (frame work for base to be paid for separately) with M.S. Screws (1st class kail wood)complete job.	44	sqm			
19.37	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia and length (hold fast lugs or with dashfasteners shall be paid for separately). Second class kail wood complete job.	2	cum			
19.38	Making soak pit 2.5 m diameter 3.0 metre deep with 45 x 45 cm dry brick honey comb shaft with bricks and S.W. drain pipe 100 mm diameter, 1.8 m long complete as per standard design. complete job.	2	Each			
19.39	Providing c;1nd fixing wash basin with C. I./M.S. brackets, 15mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls White Vitreous China Wash basin size: 630x450 mm with a single 15 mm C.P. brass pillar tapswherever required.complete job.	2	each			
19.40	Providing and fixing kitchen sink with C.I. brackets, C.P. brass chain with rubber plug, 40mm C.P. brass waste complete, including painting the fittings and brackets, cutting and making good the walls wherever required.complete job.	2	each			
19.41	White glazed fire clay kitchen sink of size 600x450x250mm .complete job.	2	each			

19.42	Providing and Fixing of H.I Rib profiled SMP coated sheets of coloured comprising 0.63 mm thick class - 3 sheets fixed to the supporting structure with 8 mm dia G.I J/L hooks. G.I limpet and bituminous felt washers including SMP quoted plain ridges, valleys etc. all included but excluding cost of supporting structure. As per direction engineer in charge complete job..	230	sqm			
19.43	P/F of Geyser point with PVC insulated copper with complete fittings including 50 liters capacity Geyser of approved brand ISI mark. complete job.	2	No			
19.44	P/F of fan point with PVC insulated copper with complete with heavy conduit PVC channels and fittings including 1200 mm ceiling fan of approved brand ISI mark. complete job.	2	No			
19.45	Pre fabricated Septic Tank polyethylene water terracotta (1.0 m dia,2.5m long &10 mm thick) complete job.	4	LS			
19.46	Providing & Fixing of Tower bolts, handles, hooks for doors & Windows. complete job.	4	LS			
19.47	Supply & Installation of Polyethylene water storage tank 1000 liters capacity with cover & all fittings, suitable locking arrangement. complete job.	4	LS			

	20. E&M Works at Palpora					
20.1	Pump motor unit and accessories: Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation testing and commissioning with all charges for non clog submersible pump set coupled with 3 phase induction motor IP68 complete with MOC (Casing: CI with 2%Ni, Impeller: CF8M SS, Shaft: AISI 410, Chain : Galvanised, Each Pump Set Coupled with Motor =1 No., Power/ Control Cable = 30mtr, Autorail Coupling = 1 Set, SS Guide Rail Pipe= 24mtr, Chain = 12mtrs., SS Guide Rail Pipe Holder = 1 No., Lifting Chain Bow Schacle = 1 Set, Lifting Chain Ring = 1 No., Duck foot bend = 1 No.) for each pump as per the specification given at of following duties.					
a)	7 cusecs @ 14m head	1	Nos.			
b)	5 cusecs @ 14m head	2	Nos.			
c)	2 cusecs @ 14 m head	1	Nos.			
20.2	supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) of Non clog submersible pumping uint of capacity 7 cusec head 14 meter of reputed & approved make including power & control cables of 30 meter length & lifting chain with ring & shackles of 12 M (standby on shelf).	1	Nos.			
20.3	supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) of Non clog submersible pumping uint of capacity 2 cusec head 14 meter of reputed & approved make including power & control cables of 30 meter length & lifting chain with ring & shackles of 12 M (standby on shelf)	1	Nos.			

20.4	Supply , installation,testing & commissioning of 1000 NB DI D/F K9 Tail Piece at Inlet Valve of reputed and approved Make 1 M Length including HSS nuts, bolts & Gaskets	2	Nos.			
20.5	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 1000 mm Dia Motorized Butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications	1	Nos.			
20.6	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F Dismantling Joint 1000 mm Dia of 10 Bar Rating at Inlet Valve as per technical specifications	1	Nos.			
20.7	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of 350 mm DI D/F K9 pipe of reputed and approved Make including HSS nuts, bolts & Gaskets as per technical specifications for individual delivery of 7 cusecs pump.	15	M			
20.8	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of 300 mm DI D/F K9 pipe of reputed and approved Makeincluding HSS nuts, bolts & Gaskets as per technical specifications for individual delivery of 5 cusec pumps.	30	M			
20.9	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of 200 mm DI D/F K9 pipe of reputed and	50	M			

	approved Make including HSS nuts, bolts & Gaskets as per technical specifications for delivery & rising mains of 2 cusec pumps.					
20.10	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of 500 mm DI D/F K9 pipe of reputed and approved including HSS nuts, bolts & Gaskets as per technical specifications for common header of 7 & 5 cusecs pumps.	30	M			
20.11	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 350 mm Dia Motorized butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 7 cusec.	1	No.			
20.12	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 350 mm Dia NRV of Relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 7 cusec.	1	No.			
20.13	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 300 mm Dia Motorized butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 5 cusec.	2	No.			

20.14	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 300 mm Dia NRV of Relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 5 cusec.	2	No.			
20.15	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 200 mm Dia Motorized butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 2 cusec.	1	No.			
20.16	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI D/F 200 mm Dia NRV of Relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 2 cusec.	1	No.			
20.17	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI Dismantling Joints of 10 Bar Rating including HSS nuts, bolts and washers as per technical specifications					
a	350 mm Dia	1	No.			
c	300 mm Dia	2	No.			
d	200 mm Dia	1	No.			
20.18	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI standard Double Air valve with inbuilt isolating valve of 10 Bar rating along with all required					

	fittings/accessories for installation on respective DI delivery pipes (Complete job)					
a)	80 mm Dia (to be installed on 350 mm dia.DI pipe)	1	No.			
b)	80 mm Dia (to be installed on 300 mm dia.DI pipes)	2				
c)	50 mm Dia (to be installed on 200 mm dia.DI pipe)	1	No.			
20.19	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Erection, Testing & Commissioning of Electrically Operated Jib Crane of 3 Ton Capacity of reputed and approved Make with required length of SS Chain including DSL and all other accessories (Span - 6 m, Lift - 16 mtrs) as per technical specifications	1	No.			
20.20	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Erection, Testing & Commissioning of 1 Ton Motorised Chain Pulley Block with hook & chain of reputed and approved Make including monorail to be installed on suitable sized vertical and horizontal (span 4.0 M) I-section beams for Lifting of equipments etc from outside the pump house ground floor to DG Set Floor (Lift - 8 mtrs) as per technical specifications	1	No.			
20.21	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Erection, Testing & Commissioning of 1 Ton Motorised chain pulley block with hook & chain of reputed and approved Make including monorail to be installed on the suitably sized vertical and horrizontal (span 5.0 M)	2	No.			

	I-section beams for Lifting of screen from the screen chamber to plinth level (Lift - 6 mtrs) as per technical specifications					
20.22	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 cass DI D/F 90 Deg Bend 350 mm Dia for Individual Delivery as per technical specifications for 7 cusec.	3	Nos.			
20.23	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 Class DI D/F 90 Deg Bend 300 mm Dia for common Delivery as per technical specifications for 5 cusecs pumps.	6	Nos.			
20.24	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 ClassDI D/F 90 Deg Bend 200 mm Dia for common Delivery as per technical specifications for 2 cusecs pumps.	8	Nos.			
20.25	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 Class DI D/F 90 Deg Bend 500 mm Dia for common Delivery as per technical specifications for common header	6	Nos.			
20.26	Supply, Installation, testing and commissioning of K12 Class DI A/F 90 Deg Tee 300x500 mm Dia for common Delivery as per technical specifications for 5 cusecs pumps	2	Nos.			

20.27	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 Class DI A/F 90 Deg Tee 350x500 mm Dia for common Delivery as per technical specifications for 7 cusecs pumps.	1	Nos.			
20.28	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of K12 Class DI A/F 90 Deg Equal Tee 200x200x200 mm Dia for common Delivery as per technical specifications for 2 cusecs pumps.	1	Nos.			
20.29	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of Actuator Operated Thimble Mounted Conventional / Flush Bottom Closing C.I Sluice Gates with headstock as per IS 13349 of 1200 mm X 1200 mm Size at Screen Channel Inlet	2	Nos.			
20.30	Supply , Installation, testing and commissioning of 500 mm DI S/S K9 pipe of reputed and approved Make 7.5 M Length as per technical specifications for interceptor.	7.5	M			
20.31	Supply,Fabrication, installation, testing and commissioning of Manually Operated MS Coarse Bar Screen with Spaing b/w bars - 60 mm and Bar size of 10x50 mm (Width of Channel - 1.20 m, Platform Level 2.6m above Channel Invert Level, Liquid Depth in Channel - 0.61 m, Screen Inclined Length - 2.50 m, Angle of Inclination - 60 degrees, (1 Working + 1 Standby)	2	Job			

20.32	Supply,Fabrication, installation, testing and commissioning of Manually Operated MS Fine Bar Screen with Spacing b/w bars - 40 mm and Bar size 10x5 mm (Width of Channel - 1.2 m, Platform Level 2.6m above FGL, Liquid Depth in Channel - 0.61 m, Screen Inclined Length - 2.90 m, Angle of Inclination - 60 degrees, (1 Working + 1 Standby)	2	Job			
20.33	Supply, delivery , fixing , testing & commissioning of 11 Kv tapping point on H Frame complete. i) 2 Nos. Steel Tubular poles, 13m long. ii) 11 Kv GOS 1 set of 3 pieces iii) DO fuset set complete vi) 11 Kv lighteneing arrestor 1 set of 3 pieces. v) Steel channel, bolts, ACSR 0.05mm painting anti corrosive, grouting M-20 grade CC. as per site condition.	1	Job			
20.34	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 11 KV, Metering Panel complete with Isolator, CT, PT & Trivactor Meter for Metering by Electricity Authority	1	Set			

20.35	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of LT Switchgear panel with 2 Incomers from 2 no. Servo Voltage Stablizers connected to a 4 pole, 630A, electrically operated changeover switch with output connected to one no. motorised electrically operated 630A ACB. The panel should incorporate one 630 Amp motorised electrically operated ACB for D.G. set with interlocking arrangement, interlocked in such a way that only one ACB shall remain ON at a time. Pannel must incorporate alumiunium bus bar 1500 AMP, 2 Nos. 80 Amp MCCB/MPCB and 3no's 200 Amp. MCCB with Electronic Soft Starter with provision for installation of Pump monitoring unit and Auxiliary & Spare feeders for mis. Load detailed as required for the power control of EOT crane, all motorized valves and electric lighting etc including 32A, 16A and 4A spare MCCB on each circuit.The pannel should comprise of proctective devices for over current, single phase protection ,winding temperature ,bearing temp.,reverse running. The Panel shall be designed as per the circuit diagram and technical specification given	1	Set			
20.36	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of APFC contactor based CRCA sheet enclosed ,self supporting vertical floor mounted automatic power factor controller pannel ,design in such a manner so as to raise the power factor delevered to 0.98. The APFC pannel shall be fitted with	1	Set			

	power factor meter on the input & out put i.e. before & after correction is done.The pannel is to be designed for heavy duty operations with erativ power supply /fluctuations& shall be suatiable for working in motor range 10KW to 210 KW & correct the power in entire range ..... 145 KVAR					
20.37	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 11/0.415 KV, 400 KVA, Copper wound, Outdoor type, Concrete bed mounted Transformer, DYn11, ONAN, OLTC, and Energy Efficient as per latest IS -1180 as per technical specifications clause no. 2.2.3.1	1	No.			
20.38	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioningig of Auto Voltage Correction Servo Stablizer 400 KVA, Copper wound with Voltage correction range from 170 V to 480 V (P-P) to give an output of 415 V as per technical specifications given at 2.1.2.5. The protection in the form of a suitable capacity MCCB placed in a CRCA enclosed panel be provided on the input side of each servo stablizer.	2	Nos.			
20.39	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 320 KVA Silent Diesel Generator of producing required BHP under normal T & P conditions at site, 415 V +1 -1% , 50 Hz AC supply at 0.80 PF. Suitable Size Fuel tanking for continous running of DG set for 12	1	No.			

	hours, Batteries and inbuilt Battery Charger etc. Complete in all respect Complete in all respect as per relevent technical clause					
20.40	Supply, Laying, testing and commissioning of 3 Core X 70 Sq. mm, 11 KV Aluminium XLPE armoured Cable, from Incoming Two pole Structure to lighting Arrestor and From LA to metering panal to GOS to fuse set to Transformer Complete in all respect as per relevent technical clause	150	m			
20.41	Supply, Laying & Termination of Aluminium XLPE armoured Cable from Transformer to Servo to Panel and From DG Panel to LT Panel Complete in all respect as per relevent technical clause					
(i)	3.5C X 400 Sq. mm AYFY Cable	500	M			
20.42	Supply, Laying & Termination of other power, control & instrument cables Complete in all respect as per relevent technical clause					
A	6C X 1.5 Sq. mm YWY Cable (control cable of panel)	160	M			
c	6C X 1.5 Sq. mm YWY Cable (for actuater of sluice valve & sluice gate)	160	M			
d	4C X 2.5 Sq. mm YWY Cable (power cable for Mono rails/ EOT cranes/ chain pully block)	250	M			
e	4C X 1.5 Sq. mm YWY Cable (controle cable for Mono rails/ EOT cranes/ chain pully block)	150	M			
20.43	Supply & fixing of Cable Trays and Cable accessories i.e. Cable Lugs,Cables kits, Glands etc as per the requirement of the project with re Complete in all respect as per relevent technical clause	1	LS			

20.44	Supply & Installation of Indoor & Outdoor Lighting System (including cables power/control),conduit,other accessories Complete in all respect as per relevent technical clause	1	LS			
20.45	Supply, installation, Testing & Commissioning of Junction Boxes for Submersible Pumps	5	Nos			
20.46	Supply & Fixing of ISI Marked (IS:13849) portable Fire Extinguisher finished externally with red enameled paint complete in all respect including initial fill and wall suspension of Capacity 5 KG	5	Nos			
20.47	Supply,instalation,testing and commissioning of 11 KV Insulation Chequered Rubber Matting at Panel Floor Area and other safety items as per the requirement confirming to relevant IS Code & Complete in all respect as per relevent technical clause	5	Nos			
20.48	supply,instalation,testing & commissiong of chemical earthing mat copper to copper,including grid for 400kva transformer,D.G set and other accessories with connecters/risers,Earthing strips from electrodes to all the electrical gadgets(L.T panel,motors etc) Complete in all respect as per relevent technical clause Complete in all respect as per relevent technical clause	12	nos			
20.49	Supply & installation of Local Push Button Stations for Submersible pumps Having IP-68 Protection and other specifications Complete in all respect as per relevent technical clause	5	Sets			
20.50	MS Pipes Specials: Supply, fitting, laying, testing and commissioning of epoxy coated MS pipes specials including bends, Tees, flanges, nuts & bolts and gaskets of different sizes as required at site	1500	Kgs			
20.51	Cost of Spares for Electrical & Mechanical Items as specified	1	LS			

	Complete in all respect as per relevent technical clause					
20.52	Operation and Maintenance of Pump house (including Valve chamber, Screen chamber, Silt chamber and the pumping equipments including its accessories) as per the details given	6	months			
	21. E&M Works at Sampora					
21.1	Pump motor unit and accessories: Supply(including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation testing and commissioning with all charges for non clog submersible pump set coupled with 3 phase induction motor IP68 complete with MOC (Casing: CI with 2%Ni, Impeller: CF8M SS, Shaft: AISI 410, Chain : Galvanised, Each Pump Set Coupled with Motor =1 No., Power/ Control Cable = 30mtr, Autorail Coupling = 1 Set, SS Guide Rail Pipe= 24mtr, Chain = 12mtrs., SS Guide Rail Pipe Holder = 1 No., Lifting Chain Bow Schacle = 1 Set, Lifting Chain Ring = 1 No., Duck foot bend = 1 No.) for each pump as per the specification given at of following duties.					
a)	5 cusecs @ 16m head (1 W + 1SB)	2	Nos.			
b)	10 cusecs @ 16m head (2 W + 1SB)	3	Nos.			
21.2	Supply ,installation ,testing & commissioning of 1000 NB DI D/F K9 Tail Piece at Inlet Valve of reputed and approved Make 1 M Length including HSS nuts, bolts & Gaskets	2	Nos.			
21.3	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F Dismantling Joint 1000 mm Dia of 10 Bar Rating at Inlet Valve as per technical specifications	1	Nos.			

21.4	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 300 mm DI D/F K9 pipe of reputed and approved Make including HSS nuts, bolts & Gaskets as per technical specifications for individual delivery of 5 cusecs pumps.	30	M			
21.5	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 400 mm DI D/F K9 pipe of reputed and approved Make including HSS nuts, bolts & Gaskets as per technical specifications for individual delivery of 10 cusec & common header of 5 cusec pumps.	100	M			
21.6	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 600 mm DI D/F K9 pipe of reputed and approved Make including HSS nuts, bolts & Gaskets as per technical specifications for common header of 10 cusec pumps.	50	M			
21.7	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F 300 mm Dia Motorized butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 5 cusec.	2	No.			
21.8	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F 400 mm Dia Motorized butterfly Valve of relevent IS Code of reputed	3	No.			

	and approved Make of 10 Bar Rating as per technical specifications for 10 cusec.					
21.9	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F 1000 mm Dia Motorized Butterfly Valve of relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications	1	Nos.			
21.10	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F 300 mm Dia NRV of Relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 5 cusec.	2	No.			
21.11	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI D/F 400 mm Dia NRV of Relevent IS Code of reputed and approved Make of 10 Bar Rating as per technical specifications for 10 cusec.	3	No.			
21.12	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of DI Dismantling Joints of 10 Bar Rating including HSS nuts, bolts and washers as per technical specifications					
A	300 mm Dia	2	No.			
C	400 mm Dia	3	No.			

21.13	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works, Installation, testing and commissioning of K12 Class DI D/F 90 Deg Bend 300 mm Dia for Individual Delivery as per technical specifications for 5 cusec.	4	Nos.			
21.14	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works, Installation, testing and commissioning of K12 Class DI D/F 90 Deg Bend 400 mm Dia for common Delivery as per technical specifications	14	Nos.			
21.15	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of K12 Class DI D/F 90 Deg Bend 600 mm Dia for common Delivery as per technical specifications	7	Nos.			
21.16	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of K12 Class DI A/F 90 Deg Tee 300x400 mm Dia for common Delivery as per technical specifications	2	Nos.			
21.17	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works, Installation, testing and commissioning of K12 Class DI A/F 90 Deg Tee 400x600 mm Dia for common Delivery as per technical specifications	3	Nos.			
21.18	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of DI standard Double Air valve with inbuilt isolating valve of 10 Bar rating along with all required					

	fittings/accessories for installation on respective DI delivery pipes (Complete job)					
a)	80 mm Dia (to be installed on 300 mm dia.DI pipes)	2	No.			
b)	80 mm Dia (to be installed on 400 mm dia.DI pipes)	3	No.			
21.19	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works, Erection, Testing & Commissioning of Electrically Operated Jib Crane of 3 Ton Capacity of reputed and approved Make with required length of SS Chain including DSL and all other accessories (Span - 6 m, Lift - 16 mtrs) as per technical specifications	1	No.			
21.20	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Erection, Testing & Commissioning of 1 Ton Motorised Chain Pulley Block with hook & chain of reputed and approved Make including monorail to be installed on suitable sized vertical and horizontal (span 8.0 M) I-section beams for Lifting of equipments etc from outside the pump house ground floor to DG Set Floor (Lift - 8 mtrs) as per technical specifications	1	No.			
21.21	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Erection, Testing & Commissioning of 1 Ton Motorised chain pulley block with hook & chain of reputed and approved Make including monorail to be installed on the suitably sized vertical and horrizontal (span 5.0 M) I-section beams for Lifting of screen from the screen chamber to plinth	2	No.			

	level (Lift - 6 mtrs) as per technical specifications					
21.22	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works) , Installation, testing and commissioning of Actuator Operated Thimble Mounted Conventional / Flush Bottom Closing C.I Sluice Gates with headstock as per IS 13349 of 1000 mm X 1000 mm Size at Screen Channel Inlet	2	Nos.			
21.23	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of Actuator Operated Thimble Mounted Conventional / Flush Bottom Closing C.I Sluice Gates with headstock as per IS 13349 of 1000 mm X 1200 mm Size at gravity channel diversion	1	No.			
21.24	Supply, Installation, testing and commissioning of 1000 mm DI S/S K9 pipe of reputed and approved Make 7.0 M Length as per technical specifications for interceptor.	7	M			
21.25	Supply,Fabrication, installation, testing and commissioning of Manually Operated MS Coarse Bar Screen with Spaing b/w bars - 60 mm and Bar size of 10x50 mm (Width of Channel - 1.50 m, Platform Level 3.19 m above Channel Invert Level, Liquid Depth in Channel - 0.60 m, Screen Inclined Length - 3.50 m, Angle of Inclination - 75 degrees, (1 Working + 1 Standby)	2	Job			

21.26	Supply,Fabrication, installation, testing and commissioning of Manually Operated MS Fine bar Screen with Spaing b/w bars - 40 mm and Bar size of 10x50 mm (Width of Channel - 1.50 m, Platform Level 3.19 m above Channel Invert Level, Liquid Depth in Channel - 0.60 m, Screen Inclined Length - 3.50 m, Angle of Inclination - 75 degrees, (1 Working + 1 Standby)	2	Job			
21.27	Supply, delivery , fixing , testing & commissioning of 11 Kv tapping point on H Frame complete. i) 2 Nos. Steel Tubular poles, 13m long. ii) 11 Kv GOS 1 set of 3 pieces iii) DO fuset set complete vi) 11 Kv lighteneing arrestor 1 set of 3 pieces. v) Steel channel, bolts, ACSR 0.05mm painting anti corrosive, grouting M-20 grade CC. as per site condition.	1	Job			
21.28	Supply, Erection, Testing & Commissioning of 11 KV, Metering Panel complete with Isolator, CT, PT & Trivactor Meter for Metering by Electricity Authority	1	Set			
21.29	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of Switchgear panel with 2 Incomers from 2 no. Servo Voltage Stablizers connected to a 4 pole, 630A, electrically operated changeover switch with output connected to one no. motorised electrically operated 630A ACB. The panel should incorporate one 630 A motorised electrically operated ACB for D.G. set with interlocking arrangement, interlocked in such a way that only one ACB shall remain ON at a time. Pannel must incorporatealumiunium bus bar	1	Set			

	1500 AMP, 3 Nos. 320 Amp MCCB/MPCB and 2 nos. 200 Amp. MCCB with Electronic Soft Starter with provision for installation of Pump monitoring unit and Auxiliary & Spare feeders for mis. Load detailed as required for the power control of EOT crane, all motorized valves and electric lighting etc including 32A, 16A and 4A spare MCCB on each circuit. The pannel should comprise of proctective devices for over current, single phase protection ,winding temperature ,bearing temp.,reverse running. The Panel shall be designed as per the circuit diagram and technical specification given					
21.30	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of APFC contactor based CRCA sheet enclosed ,self supporting vertical floor mounted automatic power factor controller pannel ,design in such a manner so as to raise the power factor delevered range to 0.98. The APFC pannel shall fitted with power factor meter on the input & output i.e. before & after correction is done.The pannel is to be designed for heavy duty operations with erativ power supply /fluctuations& shall be suatiable for working in motor range 10KW to 240 KW & correct the poer in entire range ..... 192 KVAR	1	Set			
21.31	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 11/0.415 KV, 400 KVA, Copper wound, Outdoor type, Concrete bed mounted Transformer, DYn11, ONAN, OLTC, and Energy Efficient as	1	No.			

	per latest IS -1180 Complete in all respect as per relevent technical clause					
21.32	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of Auto Voltage Correction Servo Stablizer 400 KVA, Copper wound with Voltage correction range from 170 V to 480 V (P-P) to give an output of 415 V as per technical specifications given at 2.1.2.5. The protection in the form of a suitable capacity MCCB placed in a CRCA enclosed panel be provided on the input side of each servo stablizer.	2	Nos.			
21.33	Supply (including Packaging, Handling, Transportation, Insurance, Storage, Inspection & Testing at the manufacturer's works), Installation, testing and commissioning of 320 KVA Silent Diesel Generator of producing required BHP under normal T & P conditions at site, 415 V +1 -1% , 50 Hz AC supply at 0.80 PF. Suitable Size Fuel tanking for continous running of DG set for 12 hours, Batteries and inbuilt Battery Charger etc. Complete in all respect as per relevent technical clause	1	No.			
21.34	Supply, Laying, testing and commissioning of 3 Core X 70 Sq. mm, 11 KV Aluminium XLPE armoured Cable, from Incoming Two pole Structure to lighting Arrestor and From LA to metering panal to GOS to fuse set to Transformer Complete in all respect as per relevent technical clause	150	m			
21.35	Supply, Laying & Termination of Aluminium XLPE armoured Cable from Transformer to Servo to Panel and From DG Panel to LT Panel					

	Complete in all respect as per relevent technical clause					
(i)	3.5C X 400 Sq. mm AYFY Cable	500	M			
21.36	Supply, Laying & Termination of other power, control & instrument cables as per the requirement of the project & technical s Complete in all respect as per relevent technical clause					
A	6C X 1.5 Sq. mm YWY Cable (control cable of panel)	160	M			
C	6C X 1.5 Sq. mm YWY Cable (for actuater of sluice valve & sluice gate)	160	M			
D	4C X 2.5 Sq. mm YWY Cable (power cable for Mono rails/ Jib cranes/ chain pully block)	250	M			
e	4C X 1.5 Sq. mm YWY Cable (controle cable for Mono rails/ Jib cranes/ chain pully block)	150	M			
21.37	Supply & fixing of Cable Trays and Cable accessories i.e. Cable Lugs,Cables kits, Glands etc as per the requirement of the project with reference to the technical specification Complete in all respect as per relevent technical clause	1	LS			
21.38	Supply & Installation of Indoor & Outdoor Lighting System (including cables power/control)conduit,other accessories with reference to the technical specification Complete in all respect as per relevent technical clause	1	LS			
21.39	Supply, instalation, Testing & Commissioning of Junction Boxes for Submersible Pumps	5	Nos			
21.40	Supply & Fixing of ISI Marked (IS:13849) portable Fire Extinguisher finished externally with red enameled paint complete in all respect including initial fill and wall suspension of Capacity 5 KG	5	Nos			

21.41	Supply & Laying of 11 KV Insulation Chequered Rubber Matting at Panel Floor Area and other safety items as per the requirement confirming to relevant IS Code & Complete in all respect as per relevent technical clause	5	Nos			
21.42	supply,instalation,testing & commissioning of chemical earthing mat copper to copper,including grid for 400kva transformer,D.G set and other accessories with connecters/risers,Earthing strips from electrodes to all the electrical gadgets(L.T panel,motors etc) Complete in all respect as per relevent technical clause	12	nos			
21.43	Supply & installation of Local Push Button Stations for Submersible pumps Having IP-68 Protection and other specifications Complete in all respect as per relevent technical clause	5	Sets			
21.44	MS Pipes Specials: Supply, fitting, laying, testing and commissioning of epoxy coated MS pipes specials including bends, Tees, flanges, nuts & bolts and gaskets of different sizes as required at site	1500	Kgs			
21.45	Cost of Spares for Electrical & Mechanical Items as specified in Complete in all respect as per relevent technical clause	1	LS			
21.46	Operation and Maintenance of Pump house (including Valve chamber, Screen chamber, Silt chamber and the pumping equipments including its accessories) as per the details given	6	months			
	22. Environmental Management and Safety Plan					

22.1	Design and providing of Project Information Board (one during construction and another after completion of work) in sheet steel (4mm thick) and all supports of 2 nos MS angle 50 x 50 x 6 mm of height 1.5 mtrs, including fixing in M 15 Concrete blocks of size 0.30 x 0.30 x 0.60 m and maintenance during the entire project. Minimum of board size 2 meters X 1.5 meters, with necessary information in English and Urdu written in White paint with blue backgorund on the board. The board details and the required information will be furnished by the Engineer. The complete design and information should be approved by the Engineer in Charge.	6	No			
22.2	Providing, fabrication, installation and maintenance of barricades of 2.0m height, including cost of materials and fabrication charges, all materials/equipment required for fabrication, transportion to site, shifting of barricades from one place to another with all incidental charges, leads, lifts and all taxes and duties as applicable from time to time as specified by Engineer-in-charge (considering 15 operational areas at any given point of time & 50 m length of barricade per operational area)	400	m			
22.3	Design and providing of Project Information Details on Flex with frame including fixing and maintenance during O&M. Minimum of flex size 2.5 meters X 2 meters, with necessary information in English written in Black/ blue /multi colour with white backgorund on the flex. The flex details and the required information will be furnished by the Engineer. The complete design and information should be approved by the Engineer	2	No			

	in Charge.					
22.4	Cost towards environmental compliance. The contractor should carefully read the Environment management plan and assess the items and scope of work. The following items shall be the responsibility of the contractor during execution of this project. These items are related to environment management plan for the project.	18	Month			
22.5	Provision of LED strip lighting to barricades as a safety measure during night hours, including cost of LED strips and other materials/equipment required for fixing and illumination of LED strips, shifting of LED strips from one place to another with all incidental charges, leads lifts and all taxes and duties as applicable from time to time as specified by Engineer-in-charge (considering 15 operational areas at any given point of time & 50m length of barricade)	200	Rmt.			
22.6	Provision, installation and maintenance of cautionary/warning signage, including diversion boards as per IRC specifications (SP:55, 2014) near operational areas, including cost of boards and other materials required for fixing, shifting charges from one place to another with all incidental charges leads, lifts and all taxes as applicable from time to time and as specified by Engineer-in-charge.	16	No			

22.7	Providing agile watch and ward in operational areas wearing orange vest and helmet for guiding/managing the traffic and for safety at 15 locations; 1 person for each operational area per 8 hours shift for 100 days including cost of labour, all incidental charges and all taxes as applicable from time to time and as specified by Engineer-in-charge	250	Day			
22.8	Wet type portable toilet (MS fabricated) 2 seats (1 for men and 1 for women with separate entrances), fitted with 2000 liters capacity overhead tank and 500 liters capacity bottom tank, fitted with Indian type of pot with other facilities such as tap, lighting and ventilation; and sludge tank of capacity 1000L, and stationed at a suitable place in or within 100 metres from work front. Includes cost of water, cost for emptying of bottom tank through mobile suction machine, shifting cost of mobile toilet from one operational area to another, attendent cost for looking after cleaning and operation of the toilets, all materials and labour charges, all incidental charges, leads, lifts and all taxes as applicable from time to time and as specified by Engineer-in-charge.	3	No			
22.9	Providing of mobile drinking water counter/kiosk, fabricated from stainless steel with 300 liters capacity, with two taps and with bottom tank (300 litre holding capacity) to collect waste water and stationed at a suitable place within 100 metres from operational area, with one common attendant for both mobile toilet and drinking water kiosk. Cost includes charges for emptying bottom tank through suction machine, shifting cost of the kiosk from one operational area to	5	No			

	another area, attendent cost for looking after cleaning and operation, all materials and all labour charges, all incidental charges, leads, lifts and all taxes as applicable from time to time and as specified by Engineer-in-charge					
22.10	Information dissemination about type and schedule of civil works, planned diversions and/or partial closures, utility shifting/damage/emergency repairs, complaint handling and all such issues that affect public/road users/residents close to work zones. Dissemination modes to include display of banners/notices, advertisements through local electronic and print media, distribution of handbills, organization of public meetings and other appropriate means at least once in 15 days for the entire project duration.	36	Fortnightly			
22.11	Cost towards first aid and emergency response arrangements in the camp, plants and worksites (including fire and electrical safety provisions)	18	Month			
22.12	Cost towards periodic health check-ups once in three months for all construction workers	6	Month			
22.13	Cost of environmental monitoring during entire construction period in line with parameters and frequency specified in the EMP (6 monthly intervals)	3.00	Month			

Note:

1. *Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 14.2 and GCC Clause 41.3)*

2. *Unit rates and prices shall be quoted by the bidder in Indian Rupees (refer: ITB Clause 14.1 and ITB Clause 15.1)*

3. *A Provisional Sum of **INR 1.5 Crore** is reserved for the miscellaneous works not included in the BOQ. The bidder shall not quote for the Provisional Sum in BOQ. Any expense out of the Provisional Sum shall be subject to prior approval of the project manager both in terms of quantity and scope of work.*

4. *Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern (refer: ITB Clause 31).*

4. *Where there is a discrepancy between the rate in figures and words, the rates in words will govern (refer: ITB Clause 31)*

Form of Bid Security - Bank Guarantee

[Guarantor letterhead or SWIFT identifier code]

Bid Guarantee No…….*[insert guarantee reference number]*
Date…….*[insert date of issue of the guarantee]*

WHEREAS, _____ *[name of Bidder]*[9] (hereinafter called "the Bidder") has submitted his Bid dated _____ *[date]* or will submit his Bid for the construction of _____ *[name of Contract]* (hereinafter called "the Bid") under Invitations for Bids No…….*[insert number]* (hereinafter called "the IFB")

KNOW ALL PEOPLE by these presents that We _____ *[name of bank]* of _____ *[name of country]* having our registered office at _____ (hereinafter called "the Bank") are bound unto _____*[name of Employer]* (hereinafter called "the Employer") in the sum of _____[10] for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____ 20____.

THE CONDITIONS of this obligation are:

(1) If after Bid opening the Bidder (a) withdraws his bid during the period of Bid validity specified in the Letter of Bid; or (b) does not accept the correction of the Bid Price pursuant to ITB 31;

or

(2) If the Bidder having been notified of the acceptance of his bid by the Employer during the period of Bid validity:
   (a) fails or refuses to execute the Contract Agreement in accordance with the Instructions to Bidders, if required; or
   (b) fails or refuses to furnish the Performance Security, and if required, the Environmental, Social, Health and Safety (ESHS) Performance Security, in accordance with the Instruction to Bidders.

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[9] *Insert name of the Bidder, which in the case of a joint venture shall be (a) the name of the joint venture that submits the bid if the JV has been constituted into a legally enforceable JV, or (b) the names of all future members of the JV as named in the letter of intent to execute the JV Agreement submitted by the bidder alongwith its bid.*

[10] *The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 19.1 of the Instructions to Bidders.*

we undertake to pay to the Employer upto the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the four conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force upto and including the date _____[11] days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE OF THE BANK _____

WITNESS _____ SEAL _____

_____
[signature, name, and address]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[11] *45 days after the end of the validity period of the Bid.*

Technical Proposal

Technical Proposal Forms

- **Site Organization**
- **Method Statement**
- **Mobilization Schedule**
- **Construction Schedule**
- **Environmental, Social, Health, and Safety Management (ESHS) Strategies and Implementation Plans**
- **Code of Conduct (ESHS)**
- **Equipment**
- **Personnel**
- **Sub-contracting elements or works which in aggregate adds to more than 10% of Bid price (*for each the qualifications and experiences on the identified subcontractor in the relevant field should be given*.**
- ***Note: Work should not be split into small parts and sub-contracted; but sub-contracting specialized elements of works is acceptable*.**
- **Others**

Technical Proposal – Site Organization

[Insert Site Organization information]

Technical Proposal – Method Statement

[insert method Statement – A detailed note should be submitted outlining bidders proposed methodology and program of construction including Environmental, Social, Health and Safety Management Strategies and Implementation Plans (ESHS-MSIP), backed with equipment, materials and manpower planning and deployment, duly supported with broad calculations and quality control system/assurance procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated review of completion as per mile stones]

Technical Proposal – Mobilization Schedule

[Insert Mobilization Schedule]

Technical Proposal – Construction Schedule

[Insert Construction Schedule]

Technical Proposal – Sub Contracting

[Insert proposal of sub-contracting elements of works amounting to more than 10% of the bid price for each element and indicate the name of the sub-contractor, its qualifications and experiences to execute that element satisfactorily]

ESHS Management Strategies and Implementation Plans

(ESHS-MSIP)

The Bidder shall submit comprehensive and concise Environmental, Social, Health and Safety Management Strategies and Implementation Plans (ESHS-MSIP) as required by ITB 11.1 (j) of the Bid Data Sheet. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

In developing these strategies and plans, the Bidder shall have regard to the ESHS provisions of the contract including those as may be more fully described in the Works Requirements described in Section VII.

Code of Conduct: Environmental, Social, Health and Safety (ESHS)

The Bidder shall submit the Code of Conduct that will apply to the Contractor's employees and subcontractors as required by ITB 11.1 (j) of the Bid Data Sheet. The Code of Conduct shall ensure compliance with the ESHS provisions of the contract, including those as may be more fully described in the Works Requirements described in Section VII.

In addition, the Bidder shall submit an outline of how this Code of Conduct will be implemented. This will include: how it will be introduced into conditions of employment/engagement, what training will be provided, how it will be monitored and how the Contractor proposes to deal with any breaches.

Forms for Personnel

Form PER – 1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements for each of the positions listed in Section III (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

S. No.	Position	Name	Qualification	Years of Experience	Years of Experience in proposed position			
					Building* works	E&M* works	Others*	Total

(Modify this as appropriate to suit the works for which bids are invited,*
 # As listed in Section III)

Form PER – 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below. Fields with asterisk (*) shall be used for evaluation.

Position*		
Personnel information	**Name ***	**Date of birth**
	Professional qualifications	
Present employment	**Name of** Employer	
	Address of Employer	
	Telephone	**Contact (manager / personnel officer)**
	Fax	**E-mail**
	Job title	**Years with present** Employer

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From*	To*	Company, Project, Position, and Relevant Technical and Management Experience*

Declaration

I, the undersigned Key Personnel, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

I confirm that I am available as certified in the following table and throughout the expected time schedule for this position as provided in the Bid:

Commitment	**Details**
Commitment to duration of contract:	*[insert period (start and end dates) for which this Key Personnel is available to work on this contract]*
Time commitment:	*[insert the number of days/week/months/ that this Key Personnel will be engaged]*

I understand that any misrepresentation or omission in this Form may:

(a) be taken into consideration during Bid evaluation;

(b) my disqualification from participating in the Bid;

(c) my dismissal from the contract.

Name of Key Personnel: [*insert name*]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Bidder:

Signature: _____

Date: (day month year): _____

Form for Equipment

The bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III (Evaluation and Qualification Criteria). The Bidder shall provide all the information requested below.

S. No.	Item of Equipment	Description	Make	Capacity	Age (years)	Condition	No. available and present location	Owned	Leased	Purchased

Form SC-Sub Contracting

SCHEDULE OF SUBCONTRACTORS

Item	Element of work	Approximate value of sub-contract	% of bid price	Name and address of sub-contractor	Qualification and experience of sub-contractor on similar works of the elements executed

The Bidder shall enter in this schedule a list of the major sections and appropriate value of the work for which he proposes to use subcontractors *[for those costing more than 10% of the bid price for each element], together with the names, addresses and experiences of the proposed subcontractors.*

The capability of the sub-contractor will also be assessed (on the same lines as for the main Contractor) before according approval to him.

(Work should not be split into small parts and sub-contracted; but, sub-contracting specialized elements of works is acceptable).

Bidder's Qualification

To establish its qualifications to perform the contract in accordance with Section III (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder

Form-ELI -1.1: Bidder Information Form

Date: *[insert day, month, year]*
NCB No. and title: *[insert NCB number and title]*
Page *[insert page number]* of *[insert total number]* pages

1.1 Bidder Information			
Bidder's legal name			
In case of JV, legal name of each member			
Bidder's country of constitution			
Bidder's year of constitution			
Bidder's legal address in country of constitution			
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)			

Attached are copies of the following original documents.

1. In case of single entity, articles of incorporation or constitution of the legal entity names above, in accordance with ITB 4.1 and 4.3.
2. Authorization to represent the firm or JV named in above, in accordance with ITB 20.2.
3. In case of JV, letter of intent to form JV or JV agreement: in accordance with ITB 4.1 read with BDS
4. In case of government-owned entity, documents establishing legal and financial authority and compliance with the principles of commercial law in accordance with ITB 4.5 read with Sub-clause 2.1.4 of Qualification Criteria.
5. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form-ELI -1.2: JV Information Form

(Where permitted as per BDS ITB 4.1)

Each member of a JV must fill in this form

Date: *[insert day, month, year]*
NCB No. and title: *[insert NCB number and title]*
Page *[insert page number]* of *[insert total number]* pages

JV/Specialist Subcontractor Information			
Bidder's legal name			
JV Member's legal name			
JV Member's country of constitution			
JV Member's year of constitution			
JV Member's legal address in country of constitution			
JV Member's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)			

Attached are copies of the following original documents.

1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 read with BDS.
2. Authorization to represent the firm names above, in accordance with ITB 20.2.
3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB Sub-Clause 4.5 read with Sub-Clause 2.1.4 of Qualification Criteria.
4. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -1.2 A

Specialized Subcontractor's Information Form

(to be completed for each Specialized Subcontractor)

Date: *[insert day, month, year]*
NCB No. and title: *[insert NCB number and title]*
Page *[insert page number]* of *[insert total number]* pages

Bidder's legal name:

Specialized Subcontractor's legal name:
Specialized Subcontractor's country of registration:
Specialized Subcontractor's year of constitution:
Specialized Subcontractor's legal address in country of constitution:
Specialized Subcontractor's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ Authorization to represent the Specialized Subcontractor.

DETAILS OF PARTICIPATION IN THE JOINT VENTURE

PARTICIPATION DETAILS	**FIRM 'A' (Lead Member)**	**FIRM 'B'**	**FIRM 'C'**
Financial			
Name of the Banker(s)			
Planning			
Construction Equipment			
Key Personnel			
Execution of Work (Give details on proposed contribution of each)			

The Joint Venture should indicate the details of participation as above.

Form CON – 2
Historical Contract Non-Performance, Pending Litigation and Litigation History

[The following table shall be filled in for the Bidder and for each member of a Joint Venture]

Bidder's Name: *[insert full name]* Date: *[insert day, month, year]*
Joint Venture Party Name:*[insert full name]*
NCB No. and title: *[insert NCB number and title]*
Page *[insert page number]* of *[insert total number]* pages

Non-Performed Contracts in accordance with Section III, Qualification Criteria and Requirements			
☐ Contract non-performance did not occur during the (*number)* years specified in Section III, Qualification Criteria and Requirements, Sub-Factor 2.2.1. ☐ Contract(s) not performed during the *(number)* of years specified in Section III, Qualification Criteria and Requirements, requirement 2.2.1			
Year	**Non-performed portion of contract**	**Contract Identification**	**Total Contract Amount (in Indian Rupees)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for non-performance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with Section III, Qualification Criteria and Requirements			
☐ No pending litigation in accordance with Section III, Qualification Criteria and Requirements, Sub-Factor 2.2.3. ☐ Pending litigation in accordance with Section III, Qualification Criteria and Requirements, Sub-Factor 2.2.3 as indicated below.			

Year of dispute	Amount in dispute (Rupees)	Contract Identification	Total Contract Amount (Rupees)
[insert year]	*[insert amount]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Status of dispute: *[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]*	*[insert amount]*
Litigation History in accordance with Section III, Evaluation and Qualification Criteria			
☐ No litigation history in accordance with Section III, Qualification Criteria and Requirements, Sub-Factor 2.2.4. ☐ Litigation history in accordance with Section III, Qualification Criteria and Requirements, Sub-Factor 2.2.4 as indicated below.			
Year of award	**Outcome as percentage of Net Worth**	**Contract Identification**	**Total Contract Amount (Rupees)**
[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]* Status of dispute: *[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]*	*[insert amount]*

Form CON – 3: Environmental, Social, Health, and Safety

Performance Declaration

[The following table shall be filled in for the Bidder, each member of a Joint Venture and each Specialized Subcontractor]

Bidder's Name: _____
Date: _____
Joint Venture Member's or Specialized Subcontractor's Name: _____
NCB No. and title: _____
Page _____ of _____ pages

Environmental, Social, Health, and Safety Performance Declaration in accordance with Section III, Qualification Criteria, and Requirements			
☐ **No suspension or termination of contract**: An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental, Social, Health, or Safety (ESHS) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.2.5. ☐ **Declaration of suspension or termination of contract**: The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental, Social, Health, or Safety (ESHS) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.2.5. Details are described below:			
Year	**Suspended or terminated portion of contract**	**Contract Identification**	**Total Contract Amount (Rs.)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s) e.g. for GBV/ SEA breaches]*	*[insert amount]*
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s)]*	*[insert amount]*

…	…	*[list all applicable contracts]*	…
Performance Security called by an employer(s) for reasons related to ESHS performance			
Year	Contract Identification		Total Contract Amount (Rs.)
[insert year]	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for calling of performance security: *[indicate main reason(s) e.g. for GBV/ SEA breaches]*		*[insert amount]*

Financial Situation

FORMAT 3.1 Historical Financial Performances

Bidder's Legal Name: _____ Date: _____
JV Member Legal Name: _____ Bidding No.: _____
Page _____ of _____ pages

To be completed by the Bidder and by each member of a Joint Venture

	SUMMARY OF FINANCIAL STATEMENTS **Name of bidder/JV Member:**							
								(Equivalent Rs. Million)
	S. No.	**Financial Information in Rupee equivalent with exchange rate at the end of concerned year**	**Actuals for Previous five years excluding the current financial year**					**Ref. of Page Nos. of Balance Sheets**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14.	Total Assets Total Turnover Current Assets Current Assets + Loan & Advances Total Liabilities Current Liabilities Current liabilities & provision Profit before Interest and Tax Profit before Tax Profit after Tax Shareholder's Funds (Net Worth)=(Paid up equity +Reserves)-(revaluation reserves + Miscellaneous expenditure not written off) Depreciation Current Ration (2)/(5) Net cash accruals= Profit after Tax + depreciation						
This information should be extracted from the Annual Financial Statements/ Balance sheets, which should be enclosed. Year 1 will be the latest year for which audited financial statements are available. Year 2 shall be the								

year immediately preceding year 1 and year 3 shall be the year immediately preceding Year 2.

2. Financial documents

The Bidder and its parties shall provide copies of the balance sheets and/or financial statements for *[number]* years pursuant Section III, Qualifications Criteria and Requirements, Sub-factor 2.3.1. The financial statements shall:

(a) reflect the financial situation of the *Bidder* or member to a JV, and not sister or parent companies.

1. (b) be audited by a certified Chartered Accountant.

2. (c) be complete, including all notes to the financial statements.

(d) Correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

☐ Attached are copies of financial statements (balance sheets, including all related notes, and income statements) for the *[number]* years required above; and complying with the requirements (If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, the reason for this should be justified)

☐ Attached is a copy of certificate given from the commercial bank assuring cash flow (working capital for contraction) in the format attached.

FORM FIN – 3.1(A)

FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CASH FLOW
[To be given from a Nationalized or Scheduled Bank in India]

Clause 2.3.1(b) of Section II – Qualification Criteria

(1) AVAILABILITY OF CASH FLOW (WORKING CAPITAL)

This is to certify that M/s. _____ is a reputed company with a good financial standing.

If the contract for the works, namely _____ [funded by the World Bank] is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. _____ to meet their capital requirements for executing the above contract.

-- Sd. --

Name of Bank Manager

Senior Bank Manager

Address of the Bank

*** Change the text as follows for Joint venture:**

This is to certify that M/s. …… who has formed a JV with M/s. …… and M/s. …… for participating in this bid, is a reputed company with a good financial standing.

If the contract for the work, namely …… [funded by the World Bank] is awarded to the above Joint Venture, we shall be able to provide overdraft/credit facilities to the extent of Rs. …… to meet the working capital requirements for executing the above contract.

[This should be given by the JV members in proportion to their financial participation.]

Form FIN - 3.2

Annual Construction Turnover

[The following table shall be filled in for the Bidder and for each member of a Joint Venture]

Bidder's/Joint Venture Member's Legal Name: *[insert full name]*
Date: *[insert day, month, year]*
JV Party Legal Name: *[insert full name]*
NCB No. and title: *[insert NCB number and title]*
Page *[insert page number]* of *[insert total number]* pages

Annual turnover data (construction only)*		
Year	**Amount in Rupees**	
[indicate year]	*[insert amount]*	

* ***Annual construction turnover calculated as total certified payments received for work in progress or completed, for 5 years. Specified in Section III, Qualification Criteria and Requirements, Sub-Factor 2.3.2. This should be certified by a Chartered Accountant.***

JOINT VENTURE

Names of all members of a joint venture
1. Member in charge
2. Member
3. Member

Total value of annual construction turnover, in terms of work billed to clients, in Rupees

Annual Turnover Data (construction only; in Rupees *)							
Member	**Form 2 page no.**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Average**
1. Member in charge							
2. Member							
3. Member							
TOTALS							

*** To be certified by a chartered accountant**

1. **Name and address of Bankers to the Joint Venture**

Provide details regarding financial responsibility and participation (percentage share in the total) of each firm in the Joint Venture. Attach a Memorandum of Understanding for the Proposed Agreement of joint Venture which should lay down responsibility regarding work and financial arrangements in respect of each of the firm in the Joint Venture (Refer also ITB Clause 4.1).

Form EXP - 4.1
General Construction Experience

[The following table shall be filled in for the Bidder and for each member of a Joint Venture]

Bidder's/Joint Venture Member's Legal Name: *[insert full name]*
Date: *[insert day, month, year]*
JV Party Legal Name: *[insert full name]*
NCB No. and title: *[insert NCB number]*
Page *[insert page number]*of *[insert total number]*pages

[Identify contracts that demonstrate continuous construction work over the past [5] years pursuant to Section III, Qualification Criteria and Requirements, Sub-Factor 2.4.1. List contracts chronologically, according to their commencement (starting) dates.]

Starting Month / Year	Ending Month / Year	Contract Identification	Role of *Bidder*
[indicate month/year]	*[indicate month/year]*	Contract name: *[insert full name]* Brief Description of the Works performed by the Bidder: *[describe works performed briefly]* Amount of contract: *[insert amount in Rupees]* Name of Employer: *[indicate full name]* Address: *[indicate street/number/town or city/country]*	*[insert "Contractor" or "Subcontractor" or "Contract Manager"]*
		Contract name: *[insert full name]* Brief Description of the Works performed by the Bidder: *[describe works performed briefly]* Amount of contract: *[insert amount in Rupees]* Name of Employer: *[indicate full name]* Address: *[indicate street/number/town or city/country]*	*[insert "Contractor" or "Subcontractor" or "Contract Manager"]*
		Contract name: *[insert full name]* Brief Description of the Works performed by the Bidder: *[describe works performed briefly]* Amount of contract: *[insert amount in Rupees* Name of Employer: *[indicate full name]* Address: *[indicate street/number/town or city/country]*	*[insert "Contractor" or "Subcontractor" or "Contract Manager"]*

Form EXP - 4.2(a)
Similar Construction Experience

[The following table shall be filled in for contracts performed by the Bidder, each member of a Joint Venture, and specialist sub-contractors]

Bidder's/Joint Venture Member's Legal Name: *[insert full name]*
Date: *[insert day, month, year]*
JV Party Name: *[insert full name]*
*N*CB No. and title: *[insert NCB number and title]*

Page [insert page number] of [insert total number] pages

(A) Work performed as prime Contractor or Sub-Contractor or Management Contractor (*in the same name and style*) on construction works of a similar nature and volume over the last five years[12]. [*Attach certificate from the Engineer-in-charge.*]

Project Name	Name of Employer	Description of work	Contract No.	Value of contract	Date of Issue of Work Order	Stipulated Date of Completion	Actual Date of Completion	Remarks explaining reasons for Delay, if any

[12] Immediately preceding the financial year in which bids are received.

Form EXP - 4.2(b)
Construction Experience in Key Activities

Bidder's/ Joint Venture Member's Legal Name: *[insert full name]* Date: *[insert day, month, year]*
JV Party Name: [insert full name]
Nominated Sub-contractor's Legal Name[13]
NCB No. and title: [insert NCB number and title]
Page [insert page number] of [insert total number] pages

(B) Quantities of work executed as prime contractor or Sub-Contractor (in the same name and style) in the last five years:[14]

Year	Name of the Work	Name of the Employer *	Quantity of Work performed (cum) @				Remarks * (indicate contract agreement Ref for each year)
			Cement Concrete	Masonry	Earth Work	Piling	
20…20… 20…20… 20…20… 20…20… 20…20…							

@ the items or work for which date is requested should tally with that specified in Qualification Criteria

**** Attach certificates from Engineer in-charge***

[13] If applicable
[14] Immediately preceding the financial year in which bids are received.

Form for Current Contract Commitments/Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

(A) Existing commitments and on-going works:

Description of Work	Place & State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. equivalent in million)	Stipulated period of completion	Value of works[15] remaining to be completed (Rs. equivalent in million)	Anticipated date of completion	Average Monthly Invoicing Over Last Six Months (Rs./month) Equivalent in millions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

[15] *Attach certificate(s) from the Engineer(s)-in-Charge.*

(B) Works for which bids already submitted and likely to be awarded – expected additional commitment.

Description of Work	Place & State	Name and Address of Employer	Estimated value of Works (Rs. equivalent in million)	Stipulated period of completion	Date when decision is expected	Remarks, if any
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Form…..

(Name of the Project)

(*Declaration regarding tax/duty exemption for materials/construction equipment bought for the work)*

(*Bidder's Name and Address*)

To: ……..
(*Name of the Employer& address*)

Dear Sir:

Re: [*Name of Work*]…….
Certificate for Import/Procurement of Goods/Construction Equipment
Government Order/Circular Number under which tax/duty Exemption is being sought: …

1. We confirm that we are solely responsible for obtaining tax/duty waivers which we have considered in our bid and in case of failure to receive such waivers for reasons whatsoever, the Employer will not compensate us.

2. We are furnishing below the information required by the Employer for issue of the necessary certificates in terms of the Government of India's relevant Notifications.

3. The goods/construction equipment for which certificates are required are as under:

Items *(modify the list suitably for each specific work)*	Make/ Brand Name	Capacity [*where applicable*]	Quantity	Value	State whether it will be procured locally or imported *[if so from which country]*	Remarks regarding justification for the quantity and their usage in works.
Goods						
[a] Bitumen						
[b] Cement						
[c] Steel						
Construction Equipment						

4. We agree that no modification to the above list is permitted after bids are opened.

5. We agree that the certificate will be issued only to the extent considered reasonable by the Employer for the work, based on the Bill of Quantities and the construction program and methodology as furnished by us alongwith the bid.

6. We confirm that the above goods and construction equipment will be exclusively used for the construction of the above work and the construction equipment will not be sold or otherwise disposed of in any manner for a period of five years from the date of acquisition.

Date: _____ (*Signature*) _____
Place:_____ (*Printed Name*)_____
(*Designation*)_____
(*Common Seal*) _____

[***This certificate will be issued within 60 days of signing of contract and no subsequent changes will be permitted.***]

**** Modify the above to suit the requirements given in Government of India's Notifications as current of date of bidding.***

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Services in Bank-Financed Procurement

1. In reference to ITB 4.7, and 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this bidding process:

Under ITB 4.7 (a) and 5.1 *: None*

Under ITB 4.7 (b) and 5.1 *: None*

Section VI. Bank Policy - Corrupt and Fraudulent Practices

(Section VI shall not be modified)

Guidelines for Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers, dated January 2011:

"**Fraud and Corruption:**

1.16 It is the Bank's policy to require that Borrowers (including beneficiaries of Bank loans), bidders, suppliers, contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts.[16] In pursuance of this policy, the Bank:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;[17];

(ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;[18]

(iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;[19]

(iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;[20]

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in

[16] In this context, any action to influence the procurement process or contract execution for undue advantage is improper.

[17] For the purpose of this sub-paragraph, "*another party*" refers to a public official acting in relation to the procurement process or contract execution. In this context, "*public official*" includes World Bank staff and employees of other organizations taking or reviewing procurement decisions.

[18] For the purpose of this sub-paragraph, "party" refers to a public official; the terms "benefit" and "obligation" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution.

[19] For the purpose of this sub-paragraph, "parties" refers to participants in the procurement process (including public officials) attempting either themselves, or through another person or entity not participating in the procurement or selection process, to simulate competition or to establish bid prices at artificial, non-competitive levels, or are privy to each other's bid prices or other conditions.

[20] For the purpose of this sub-paragraph, "party" refers to a participant in the procurement process or contract execution.

order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 1.16(e) below.

(b) will reject a proposal for award if it determines that the bidder recommended for award, or any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

(c) will declare misprocurement and cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement or the implementation of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

(d) will sanction a firm or individual, at any time, in accordance with the prevailing Bank's sanctions procedures,[21] including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated[22];

(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers, to permit the Bank to inspect all accounts, records, and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by the Bank."

[21] A firm or individual may be declared ineligible to be awarded a Bank financed contract upon: (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross-debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of these Guidelines.

[22] A nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

PART 2 – Works Requirements

Section VII – Works' Requirements

CHAPTER - 1

1.1 INTRODUCTION

1.1.1 Back Ground

The Jammu & Kashmir region owing to its geographical and geo-climatic setting is a multi-hazard prone region that has experienced natural disasters like earthquakes, floods, landslides, avalanches, high velocity winds, and snowstorms. Most parts of the Kashmir Valley fall in Seismic Zone V. The rest of the State falls in the Seismic Zone IV. Floods and flash floods are also frequent. Floods generally occur in the summer when heavy rains are followed by snowmelt. Flooding of the river Jhelum is the main cause of floods in the region. Floods also occur occasionally in Jammu and neighbouring districts. In September 2014, the northern region of India experienced torrential monsoon rains in the region causing major flooding and landslides. The continuous spell of rains from September 2nd to 6th, 2014, caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River also breached its banks flooding many low-lying areas in Anantnag, Srinagar and adjoining districts. In many districts, the rainfall exceeded the normal by 600 percent. The Indian Meteorological Department records precipitation above 244.4 mm an extremely heavy rainfall and the region received 588 mm of rain fall in June- September period, as against the normal 477.4 mm. For example the district of Qazigund recorded 550 mm of rainfall in 6 days as against a historic normal of 6.2 mm over the same period. Due to the unprecedented heavy rainfall the catchment areas particularly the low laying areas were flooded more than two weeks. Some areas in urban Srinagar stayed flooded for 28 days. Water level was as high as 27 feet in many parts of Srinagar. The areas from the main tributaries of river Jhelum vis-a-vis Brengi nallah, Vishav nallah, Lider nallah and Sundran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum River to rise. Subsequently, the discharge of the river Suran was 200 thousand cusecs as against an average 50 thousand cusecs. With the excessive discharge of water, the river Suran affected the basin areas and also took a different course at various locations causing damages to the surrounding villages in the catchment area. Water level also increased in rivers of Chanab and Tawi, both of which the water flowing above normal levels. Due to the rivers overflowing nearly 20 districts were impacted. The total damage ad loss caused by the flood is about INR 211,975 million, most of it to housing, livelihoods, and roads and bridges, which combined represented more than 70% of the damages in terms of value. Public service infrastructure and equipment of hospitals and education centres were also severely damaged and are still not fully operational. The project “Jhelum & Tawi Flood Recovery Project” will focus on restoring critical infrastructure using international best practice of resilient infrastructure. Given the region’s vulnerability to both flood and earthquakes, the infrastructure will be designed with upgraded resilient features, and will include contingency planning for future disaster events. Therefore, the project aims at both restoring essential services disrupted by the floods and improving the design standards and practices to increase resilience.

1.2 Project Objective

The project objective is to connect uncovered areas (MISSING LINKS) to a suitable point of the existing pipe drain/cc drain leading to respective D/W pumping station of the area on Project Components:

The objective is a step towards development of gaps in the existing stormwater drainage system by way of construction of missing links in areas under Zone I.

1.3 Need of the Project

The need of this project is to fill up the gaps that have remained undone due to some reason while constructing the storm water drainage system under the domain of respective pumping stations.

7.1.1 CIVIL WORKS

SUB-SECTION – 1

General.

7.1.1. 1. SCOPE

Bids scope shall broadly include but not be restricted to "Manufacture, supply, laying, jointing, testing and commissioning of RCC NP3 class pipes of varying diameters, construction of covered cement concrete drain & pump house including all electromechanical works" given in bid documents. Entire work shall be carried out under overall supervision of PIU/ERA to their full satisfaction.

7.1.1. 2. DESCRIPTION OF WORK

The major works covered are as given below:

- Earthwork excavation for trenches of pipe line
- Manufacture, supply, laying, jointing, testing and commissioning of RCC NP3 class pipes varying from 300 mm to 1000 mm diameter & construction of covered cement concrete drains.
- Construction of circular type reinforcement cement concrete manholes including inlet and necessary connections to the manholes wherever required.
- Refilling trenches with approved sand/crushed stone dust.
- Construction of compound wall, retaining wall , gate, sluice valve chamber, screen chamber, silt chamber, sump well, pump house building and construction/restoration of road/pavements and all allied civil works.
- Supply, erection, testing and commissioning of pump sets, motors, valves etc., and all allied mechanical and electrical works including trial running of the pumping station for three months after completion.
- Field test of pipe line/ manholes
- Any other works to be carried with the approval of Engineer.

7.1.1. 3.SPECIFICATION DRAWINGS

The specifications and drawings are incorporated in bid documents. These drawings are made for bidder’s guidance only. "Good for construction" drawings will be issued to the contractor during progress of the work. "Good for construction" drawings may be revised and revised copies shall be issued to the contractor, wherever necessary, during execution of the work. It shall be appreciated that for type of the work included in this contract, there are limitations for issuing construction drawings at biding stage and hence" "Good for Construction" drawings, to be issued progressively during construction & broadly conforming to the basic scheme as shown in the bid drawings, shall form a part of the contract. No claim will be entertained on the score that details shown on "Good for Construction" drawings are different from those

shown in the bid drawings, unless the drawings indicate that such items of work are not a part of the Bill of Quantities of contract agreement.

7.1.1.4.ENVIRONMENTAL IMPACT

The contractor should comply with state and national environmental standards and guidelines.

7.1.1.5. MATERIALS

Approval of Materials
Approval of all sources of material for Works shall be obtained in writing from the Engineer before their use on the project.
Quality assurance plan of the material RCC pipe etc. shall be submitted before the dispatch of the material from the works for the approval of the Engineer.

Cement, sand, aggregate, bricks, steel, steel frame etc. samples shall be submitted for the approval of the Engineer

The term "Materials" shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment and plant of every kind to be supplied by the Contractor for incorporation in the works. The materials required for construction purposes are includes of all mechanical as well as manual carriages.

Materials shall be transported, handled and stored in such a manner as to prevent deterioration, damage or contamination failing which such damaged materials will be rejected and shall not be used on any part of the Works under this contract and shall be removed as directed by the Engineer.

7.1.1.6.SAMPLES AND TESTS OF MATERIALS

A. The Contractor shall submit samples of such materials including manhole covers, RCC NP3 pipes as may be required by the Engineer and shall carry out the specified tests directed by the Engineer at the site, at the supplier's premises or at a laboratory approved by the Engineer. (The rates shall include cost of Np3 pipes & polycrete manhole covers with frame which are taken for testing of thickness, reinforcement & leakage tests as per the standard procedure and engineering practices for sampling & testing of such items and nothing extra shall be paid for such destructive tests.)

B. Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer.

C. The Contractor shall give the Engineer seven days notice in writing of the date on which any of the materials will be ready for testing or inspection at the supplier's premises or at a laboratory approved by the Engineer. The Engineer shall attend the test at the appointed place within seven days of the said date on which the materials are expected to be ready for testing or inspection according to the Contractor, failing which the test may proceed in his absence unless instructed by the Engineer to carry out such

a test on a mutually agreed upon date in his presence. The Contractor shall in any case submit to the Engineer within seven days of every test such number of certified copies (not exceeding six) of the test readings as the Engineer may require.

D. Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineer's powers under the Contract particularly as to the provisions of under the Conditions of Contract. The provisions of this clause shall also apply to materials supplied under any nominated sub-contract.

7.1.1.7. QUALITY CONTROL ON WORKS AND MATERIALS

The Contractor shall be responsible for the quality of the work in the entire construction work within the contract. He shall, therefore, have his own independent and adequate set-up for ensuring the same.

The Engineer shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, by his Testing and Quality Control Units or by any other agency deemed fit by him), procedures and tests as directed by the Engineer shall be followed.

The Contractor shall provide necessary cooperation and assistance in conducting the tests and obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labour, attendance, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests.

The Contractor shall carry out modification in procedure of work, if any, as directed by the Engineer during inspection.

Works falling short of quality shall be rectified by the Contractor as directed by the Engineer at his own cost.
Where the Engineer considers that in the interest of the control of the quality on materials or workmanship, modifications, if any, are necessary, such modifications shall be carried out by the Contractor at no extra cost.
The Contract rate quoted for various items of work in the Bill of Quantities shall be deemed to be inclusive of all costs of the provisions indicated in the above mentioned clauses.

7.1.1.8. STANDARDS

The special attention of the Contractor is drawn to the relevant Sections and Clauses of the National Building Code of India 1984 and latest IS specifications (latest editions as amended) and should follow all the specifications and conditions.

a. Materials and workmanship shall comply with the relevant Indian Standards (with amendments) unless a more recent amendment is specified hereinafter, or with the requirements of any other authoritative standard approved by the Engineer which shall be no less exacting in the opinion of the Engineer than the corresponding standard

quoted herein.

b. Where the relevant standard provides for the furnishing of a certificate to the Employer, at his request, stating that the materials supplied comply in all respects with the standard, the Contractor shall obtain the certificate and forward it to the Engineer.

c. The specifications, standards and codes listed below are made a part of this specification. All standards, tentative specifications, specifications, codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.

d. If no standard is indicated, the relevant Indian Standard, if any, shall apply. Indian standards are published by:

Indian Standards Institution
Manak Bhavan, 9, Bahadur Shah Zafar Marg NEW DELHI - 110002

e. In case of discrepancy between the Specification and the Standards referred to herein, the Specification shall govern.

SUB-SECTION - 2

SUBMITTALS

1.DESCRIPTION

This section covers additional requirements for submittals and forms a part of all other sections in which submittals are required. It is subjected to General Conditions of Contract. Submittal requirements to be included:

i. CPM Progress Schedule
ii. Samples
iii. Material lists and equipment
iv. Factory test reports
v. Certificates
vi. Laboratory test reports

2.SUBMITTAL REQUIREMENTS

Work Schedule:

Within 14 days of award of the bid, the contractor shall submit a critical path method analysis for construction progress control and make such revisions as are required for approval. The contractor shall clearly indicate all construction activities, sub activities like Pre construction survey, soil investigation, preparation and submission of survey drawings, GA drawing & QAP for electromechanical works, Providing & laying of pipe line/ covered C.C drain, manholes & collection chambers & Road restoration, Miscellaneous works (Retaining wall , compound walling ,Thrust block ,gate, finishing items & internal road/pavement & etc.), Construction of sump well, silt chamber , screen chamber value chamber, pump house, Installation & testing of all Electromechanical equipments & allied works to achieve the mile stones fixed for completion of the work in a time oriented manner. The contractor shall update and resubmit the charts monthly, flag all slippage's and mile posts and attach a narrative description of the proposed corrective actions to the resubmitted charts. Include the following minimum information for each activity and critical path item:

i. Date and initial submittal, as applicable.
ii. Ordering dates for long lead time items.
iii. Dates for materials on site.
iv. Testing and clean up.
v. Final completion and handing over.

3. SAMPLES

The Contractor has to submit samples of all materials used for the work prior to start the works and get the approval of the Engineer in charge. Label or tag each sample or set of samples, identifying the manufacturer's name and address, brand name, catalogue number, project title and intended use.

4.MATERIAL LISTS AND EQUIPMENT DATA

The Contractor has to submit all material lists. Equipment lists etc. well in advance before starting the work and get the approval from the Engineer in charge.

5. PROGRAM OF WORKS

In respect of the program of works required, the works shall be programmed in such a way as to minimize disruption to public traffic

- Works shall not be carried out simultaneously over large areas of the site but shall be sequenced so that all operations likely to cause disruption to public traffic shall be undertaken and completed in discrete area before commencement of operations in other areas.

- Works which, by their nature, will create disruption and / or obstructions to vehicular or pedestrian traffic, such as pavement rehabilitation or trench – work shall be programmed to be undertaken in a continuous sequence of events from the initial disruption until the restoration of access without and significant delay between operations.

- The program submission shall be accompanied by outline traffic management plans in sufficient detail to indicate to the Engineer that the Contractor has considered this aspect the work in his program. Notwithstanding, acceptance of the Contractor's program will not in any way relieve of his responsibilities for traffic management under Specification.

- The Contractor's Program shall, in so far as it is practicable to do so, take into consideration the commercial interest of individual shopkeepers e.g. operations should not be sequenced so as to disrupt access to individual shops having only one access from the road.

The Contractor's Program of Works, submitted in accordance with the General Conditions of Contract, shall be subject to the approval of the Engineer and of Employer. If the Contractor's program, in the opinion of the Engineer/Employer has not properly achieved the objectives of the program, then the Contractor shall be instructed to revise his Program and the Contractor shall do so forth; for this reason the Contractor is advised to liaise closely with the Engineer during the production of his Program.

In addition to the Works Program required under the General Conditions of Contract, the Contractor shall produce individual program for each element of the works likely to cause significant disruption to public and vehicular traffic, for the approval of the Engineer and prior to commencement of the element of the works, clearly showing the sequencing of construction operations is such a manner as to minimize the duration of the disruption.

The Contractor shall note that different work in various parts of site by other contractors

may be in progress or may commence during the Contract Period. It will be the Contractor's responsibility to liaise with contractors on adjacent sites in order to ensure the detail progress. The Contractor's Program may be phased and the Contractor shall make full allowance for the need for a cooperative timing with adjacent contractors.

The Contractor has to decide the following issues:

Check the profile of road, longitudinally and laterally, the type, strata and evolve a complete system from starting and completion with due interaction with owners,. The system shall be so evolved that there shall not be any hindrance to any day-to-day activities taking place in the area. He shall spell out likely danger, difficulty, and hindrance and suggest & provide suitable remedial measures to obviate them, keeping authorities in confidence. Suitable sign boards shall be designed and exhibited at proper places in local and English language to keep users informed of the guidance, notice etc.

Fixing of the levels of entry and exist keeping in view profile conditions of existing road surface, minimum cover required for safety and structural safety as to avoid collapse of the road surface. This shall be also be reviewed and requirement to be included in the quoted price with respect to natural soil conditions, water table, water logging etc., with suitable provisions for diversion, dewatering including well point system, sheet piling etc., as required for expeditious completion of the work.

SUB-SECTION–3

SITE PREPARATION

1.BENCH MARKS

Permanent bench marks shall be fixed, carried from nearest GTS Bench marks before any work is started by the contractor in any section; These benchmarks shall be fixed away from the field of work so as not to be disturbed during the contract period and shall be accurately fixed in concrete. No separate payment shall be paid towards fixing of bench marks.

2.CLEARING SITE OF LARGE TREES, STRUCTURES ETC.

This shall include the removal of large trees, stumps, structures, services such as cables, water supply pipeline, urban drain drains etc. or parts thereof lying along the alignment of pipe line. The contractor should inform the Engineer in charge before removing trees, structures, other services and structures etc. well in advance. Large trees and other valuables are the property of the Government and it should be properly stacked along the side of the road and conveyed to the place as per directions of the departmental Engineer. The cutting of trees or demolition of structure are done in such a way that it should not disturb the traffic and pedestrians.

3.REMOVAL OF TOP SOIL, SHRUBS AND OTHER VEGETATION

The work has to be tackled in between two adjacent manholes only. All shrubs, vegetation and other plants shall be removed and cleared from the selected stretch of the site. All debris and unsuitable material up to a depth of 30 cm between ground level or road level shall be removed. All debris and unsuitable material shall be carted away from the site as per the direction of departmental engineer. The payment against this item as per Bill of Quantities includes loading, unloading, carting the material to a site selected by the contractor at his own cost.

4.PREPARATORY WORK, SIGHT-RAILS AND BONING STAVES

The centre line of the trench is first marked out on the ground duly driving pegs at convenient intervals. Before commencement of earth work excavation, levels shall be taken along the centre line of the proposed pipe line at intervals of say 10 m and at the manhole locations. A longitudinal section (LS) of the profile of the ground surface showing the proposed pipeline, indicating the gradients and giving the invert levels of the pipeline as well as the manholes is provided with the bid. This L.S may be updated by the contractor and approved by the Engineer before taking up the work. The width of the trench to be excavated is marked on both sides of the centre line and excavation lines cut out.

Two wooden posts 100mmx100mmx1800mm high shall be firmly, erected/fixed across the centre line i.e. on either side at nearly equal distance, from the centre line and sufficiently clear of all intended excavation such that the poles/posts are not disturbed during the course of execution of the work. These posts are so arranged and fixed that a sight rail when fixed at a level against these posts shall cross the centre line of pipeline or centre of the manhole, as the case may be.

The sight-rail made from 250 mm wide x 40 mm thick wooden planks shall be screwed to the poles. The sight-rails shall be truly horizontal. The centre line of the pipeline shall be marked on the sight-rail by fixing a nail or otherwise as determined by the Engineer. The sight-rails may be fixed about 1.25 m above the ground, which is convenient distance for sighting by a leveling

instrument. The sight-rails have to be so fixed that when a line sighted along the top edge of the sight-rails shall represent the true fall or gradient of the proposed pipeline. This gradient is transferred below the ground level by means of boning-rod. Boning is carried out between the sight-rails with the help of a cord or a rope extended from nail to nail fixed on the sight-rails.

Boning rods with cross section 75x50 mm of various lengths shall be prepared with wood. Each length shall be a certain number of meters and shall have fixed tee-head. (A cross piece of 450x 100 mm is to be fixed with nails at the top of the boning rod so as to form shape like a Tee-square) and a cross piece about 300 mm long fixed at the bottom of the boning staff. The distance between the top of Tee head and the cross piece shall depend upon the site requirements viz., dia. of pipe, depth of cutting, level of sight-rail, designed level of pipeline, etc. The boning rod must be marked on two sides to indicate its full length. According to the circumstances of each case, a suitable length of boning rod, duly fixing the cross piece, will be determined upon the reduced level of the invert of pipe at each sight-rail.

The sight-rail and vertical posts shall be perfectly square and planed smooth on all sides and edges. This arrangement of erecting poles with sight-rail shall be done at suitable intervals depending on the site requirements, as directed by the Engineer. The posts and rails must in no case be removed until the trench is excavated, the pipes are laid and permission given to proceed with the filling in.

5. PROBING PITS

Before starting the excavation of trenches, the contractor shall dig probing pits of size 1 m x 1 m and 1.5 m deep including road cutting at every 100 m interval along the alignment to accurately locate and determine the position of existing utilities and obstructions. The contractor shall refill the probing pits in layers of 15 cm. with excavated earth up to the original ground level. In all cases the probing pits are to be excavated in accordance with the specification for excavation, refilling etc. No separate payment will be made for these probing pits.

6.UTILITIES PROTECTION

All utilities known to exist within the site, such as water, storm and sewage mains, will generally be shown on the drawings. The accurate location also can be had from the probing pit results at various intervals. All utility lines and structures, whether indicated on the drawings or not, which are to remain in service shall be protected by the contractor from any damage likely to result from his operations. Relocation wherever necessary, shall be with the approval of the Engineer and the Utility Authority. Payment will be made only for relocating the utilities. Any damage to any utility resulting from the contractor's operations shall be repaired at the contractor's expense.

7. PAVEMENT REMOVAL

The contractor must inform the Engineer before the starting of work well in advance so that it can be communicated to other concerned departments. The contractor must provide and maintain proper and efficient traffic control system such as safety lamps, sign boards etc. operating day and night for the full duration of work. PIU ERA shall not be responsible under any circumstances for any mis-happenings. The width of trenches shall be minimum as per table-1 and only such widths

shall be taken into account for computing quantities for payment. For other elements of work such as manholes, making cross connections, fixing other appurtenances etc. the engineer shall prescribe the dimensions for removal of pavement from time to time.

8. MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

The work shall be carried out in such a manner which will cause the least interruption to traffic, and the road/street may be closed in such a manner that it causes the least interruption to traffic, Where it is necessary for traffic to cross open trenches, suitable bridges shall be provided. Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.

9. INTERRUPTION TO SERVICE

No valve or other control of the existing services shall be operated without the permission of the authority.

10.WORKS DURING NIGHTS

It is expected that the intensity of traffic is likely to be less in the nights from 10.00 hours to 5.00 hours. Hence, for efficient uninterrupted work, the contractor shall equip himself with the required manpower, materials, and machinery to do the work exclusively in the above periods alone. No extra payment will be made for doing the work in the nights. The contractor shall get prior approval from the Engineer-in-charge before starting the work during nights.

SUB-SECTION–4

EARTH WORK

1.DESCRIPTION

The work specified in this section includes the provision of all labor, machinery, construction equipment and other appliances required to perform all earth work shown on the drawing or otherwise specified or required, in a sound, workmanlike manner.

2.GENERAL

Excavation shall be required to be done for the following works:

a. for underground pipelines
b. for pipeline lines below service utilities
c. for Sump well, screen chamber slit chamber &manholes, collection chambers, pedestals etc.

3. Scope

This Specification covers the general requirements of earthwork in excavation in trenches and drains or otherwise and in different varieties of soil for the construction of drains and allied works in accordance with requirements of the specifications and as shown in the drawings or as directed by the Engineer. This specification also includes side grading, filling in trenches, filling back around foundations, conveyance and disposal of surplus soils or stacking them properly and all operations covered within the intent and purpose of this specification. Excavation will also include the shoring & strutting of trenches in any kind of soil.

4.Applicable Codes

All applicable Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

Safety code for excavation work.
Code of practice for measurement of Civil Engineering Works.
Method of test of soils (All parts)
Classification & identification of soils for General Engineering Purposes

5.SOIL INVESTIGATIONS

Soil analysis reports of proposed pipeline alignment are available in the DPR. Additional soil tests if necessary shall be carried out along the alignment and the soil boring logs shall be prepared by the contractor at his own cost. Where off-site materials have to be used, the contractor shall, if the Engineer desires, make available certified soil test reports including information regarding sieve analysis, plastic limit, liquid limit, maximum density, optimum moisture content etc. from an approved testing laboratory.

6. CLASSIFICATION

The excavation work shall be classified into the following categories:

a) For pipeline line trenches
   i) Loamy, clayey soils like BC soils, red earth, ordinary gravels, hard gravel, mixture of gravel and soft disintegrated rock, ordinary gravel, stony earth and earth mixed with fair sized boulders, hard disintegrated rock or soft rock or conglomerate rock, to be removed by pick axes and crow bars,
   ii) Hard rock and boulders to be removed only by chiseling and benching.

b) **Manholes, pedestals etc.**

   i) Loamy, clayey soils like BC soils, red earth, ordinary gravels, hard gravel, mixture of gravel and soft disintegrated rock, ordinary gravel, stony earth and earth mixed with

fair sized boulders, hard disintegrated rock or soft rock or conglomerate rock, to be removed by pick axes and crow bars.

ii) Hard rock and boulders to be removed by benching and chiseling.

7.Classification of Excavated Material

Authority for classification

The classification of excavation shall be similar for all kind of soils or as decided by the Engineer and his decision shall be final and binding on the Contractor.

8. **TRENCH EXCAVATION**

GENERAL

Trench excavation means excavation of trenches into which the pipe is to be laid/covered C.C drain is to be constructed. The line and levels of trenches shall be as shown on the drawings or as may be directed by the Engineer in charge. Before commencing trench excavation, the alignment of the trenches shall be pegged out accurately and the natural ground levels shall be recorded/agreed with the Engineer in charge.

9.**Excavation**

Excavation shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings or to such other lines and grades as may be specified by Engineer.

Contractor may, for facility of his work or similar other reasons, excavate, and also backfill later, if so approved by Engineer, at his own cost, outside the lines shown on the drawings or directed by Engineer. Should any excavation be taken below the specified level, contractor shall fill it up to the required level as directed by the Engineer. No extra payment shall be claimed by contractor on this account.

All excavations shall be done to the minimum dimension as required for safety and working facility. Prior approval of Engineer shall be obtained by contractor in each individual case, for the method he proposes to adopt for the excavation, including setting out, dimensions, side slopes, dewatering, disposal, etc. This approval, however, shall not in any way relieve contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as directed by the Engineer and precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for. Excavation dimensions shall be as indicated in the drawings.

Sometimes it may not be possible to store the excavated material beside the working area because of site construction. In such cases the contractor will be required to haul the excavated materials to a nearby storage space and subsequently bring back the selected excavated material during backfilling. The contractor only under exclusive approval of the Engineer shall take up such work. No extra payment for such item will be made. The bidder must study the sites thoroughly to ascertain such conditions before quoting.

The width of trenches measured at the crown of the pipe shall permit adequate working space. The trenches shall be widened at sockets and other structures as may be found necessary. The widths to be adopted are shown in drawings. If the widths of actual excavation are more than the

widths shown in drawings, it has to be made by the contractor. Care should be taken to avoid excessive trench widths and thereby increasing the load on the pipes.

10. **DEPTH OF EXCAVATION OF TRENCH**

The depths for the trenches will be calculated from the existing ground level to the bed of the pipes and in case when a layer of bedding is to be placed below the pipe line, the depth to the bottom of the bedding will be paid. The depth of excavation for manholes shall be measured from the surface of the existing ground level to the bottom of foundation. No payment will be given beyond this depth.

11. MAXIMUM LENGTH OF OPEN TRENCH

The stretch of work to be tackled shall be limited to two adjacent manholes. However, the Engineer may permit only reasonable trench excavation in advance of the lengths between two adjacent manholes to ensure laying and jointing of pipes can reasonably be expected to be completed and the trench refilled not later than 3 days after excavation of the trench. The Contractor will not be permitted to keep trenches open for unduly long periods, creating public hazards. The Engineer's decision in this respect shall be final.

12. TRENCH SIDES

Loose boulders shall be removed from the sides of the trenches before allowing workmen into the excavation, and the trench sides shall be stabilized with screening or other methods approved by the Engineer. Trench slopes shall be kept moist where necessary to prevent local sliding as ordered by the Engineer.

1. WIDENING TRENCH AT JOINTS, ETC.

Any widening or deepening of the trench, whether in ordinary soil or rock, necessary to accommodate curves, joints or bends as shown on the drawings or ordered by the Engineer shall be carried out by the contractor.

14. OVER-EXCAVATION OF TRENCH BOTTOMS

All excavation carried below the grades shown on drawings, shall be refilled with compacted bedding material at the Contractor's expense.

15.**EXCAVATED MATERIAL**

The material from the excavation shall be deposited on either side of the trench leaving clear space of at least 40 cm wide on either side of the trench or at such further distance from the edges of the trench as may be necessary to prevent the weight of materials from causing the side of the trench to slide down, or at such a distance and in such a manner as to avoid covering fire-hydrants, sluice valves, manhole covers and the like so as to avoid damage to any wall or structure or causing

inconvenience to the public or other persons or otherwise as the engineer may direct, till it is carted away.

The excavated soil should be so placed and handled as not to cause inconvenience to the usual traffic, till it is carted away. The contractor should also provide necessary walk ways over the excavated trenches for the house-holders and pedestrians to cross over and vehicular crossings if required anywhere at no extra cost. If the Engineer decides that there is no hindrance to traffic due to not carting away the excavated earth, he will give instructions to that effect.

16.PIPE BEDDING

Bedding for the pipe

The type of bedding to be provided shall be as per the specifications & details of construction drawings or as decided by the Engineer. The various types of bedding are specified below:

While laying Pipe line with spigot and socket joints, the socket ends shall face upstream. In case the foundation conditions are found unusual such as in the proximity of trees or holes etc. the pipe shall be encased all-around in 15 cm thick cement concrete 1:4:8 (1 cement : 4 fine sand : 8 graded stone aggregate 30 mm nominal size) or filled with compacted sand or gravel.

Gravel Bedding

The time interval between placing bedding material on the trench formation and commencing pipe laying shall be as short as is practicable. The bedding material shall extend to the full width of the trench and shall be compacted in layers not exceeding 200 mm. The bedding material shall be carefully compacted using a plate vibrator or other approved equivalent mechanical method. Sufficient passes of a plate vibrator or other approved mechanical method are required to achieve positive deflection of flexible pipes to ensure that final deflections are within the specified limits. Hand tamping or punning will only be permitted where insufficient space is available to allow the use of mechanical plant.

Recesses shall be formed in the bedding to accommodate pipe joints while ensuring continuous even support along the pipe length. Bedding material shall be prevented from entering pipe joints. After the joint has been made bedding material shall be carefully placed and hand compacted beneath the joint barrel to close any void left by the recess.

Wherever rock is met with, it shall be removed up to minimum 150 mm below the bottom level of the pipe to a minimum width equal to the width of the trench and the resulting space shall be filled up with good quality compacted gravel/moorum. The granular material shall be filled in the trench up to the level of 1/2 the outer diameter of the pipeline, above the bottom of trench and well compacted. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

The graded granular bed material shall be used in Class B bedding and surrounding fill shall consist of durable gravel, crushed stone or disintegrated rock. Any imported bed and surround materials shall be to the approval of the Engineer and shall be supplied with certification, which gives details of its content, source and grading. In all cases the soluble sulphate and chloride content of the granular material shall not exceed 0.5% and 0.06% by weight respectively. All graded material shall pass through test sieves to IS 460 (Part 1) in the following proportions by mass:

Aperture Size	% Passing
50 mm	100 %
37.5 mm	90 – 100 %
20 mm	35 – 70 %
14 mm	25 – 55 %
10 mm	10 – 40 %
5 mm	0– 5 %

Special bedding in poor sub grades

During the progress of work, if the sub grade is observed to be of poor quality which is unsuitable for laying the pipe line and which is not the result of the Contractor's negligence, the Engineer may direct the Contractor to strengthen the sub grade. The strengthening shall be done either by crushed stone or local lime stone, or by gravel, with depth not exceeding 225 mm or by plain concrete of mix 1:4:8 or as directed by the engineer.

17.TRENCH EXCAVATION IN HARD ROCK

If any material which in the opinion of the Contractor can be classified as rock, is encountered, he shall immediately inform the Engineer and the level, extent and description of the material encountered shall be measured jointly and recorded before excavation. Only such proportion of material notified and measured which is certified by the Engineer as "rock", shall be paid for as rock excavation.

Excavation for trenches in rock shall be so carried out that the clearance between the pipe, when laid in position and the sides and trench bottom shall be kept to the minimum limits necessary to provide for specified thickness of bedding, and surround to the pipe as specified. Excavation outside the limits shall not be paid for and any additional expenses incurred in providing additional strength to the pipe to overcome the increased trench loads on account of increased width shall be at the Contractor's expenses.

18.EXCAVATION FOR APPURTENANCES

Excavation in trenches for foundation of manholes, pedestals etc. shall be as per the plan or as directed by the Engineer. The dimensions of the excavation shall be measured as per the projection in plan of the outermost edges of the structure.

19.DEWATERING BY PUMPING OR DIVERSION FOR GRAVITY.

General

The works included in this Section are as follows:

Dewatering

If water is met within the excavations due to seepage, subsoil water level & rain, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry whenever so required during the course of execution or as directed by the Engineer. Care shall be taken to discharge the drained water into suitable outlet so as not to cause damage to the works or any other property. Dewatering shall not cause choking of other drain/drainage pipes. If it does so, then the choking shall be removed / cleaned by contractor at no extra cost. Sumps made for dewatering must be kept clear off the excavations / trenches required for further work. Method of dewatering/ pumping shall be approved by Engineer; but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction.

When there is a continuous considerable inflow of water along with sand boiling 'Well Point System' - single stage or multistage may be adopted as directed by the Engineer. Contractor shall submit to Engineer his scheme of well point system including the stages, the spacing, number and diameter of well points, headers, discharge point etc. and the number, capacity and location of pumps for approval as per provisions of the contract

The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water from the excavation. Dewatering shall be either continuous or intermittent using diesel pump or any other method approved by the Engineer. The method of dewatering shall depend on site condition and should be furnished by the Contractor and approved by the Engineer. The method of dewatering shall be either sump pumping or well pointing system. The effectiveness of each method will depend upon the nature of the soil, the proportions of the trench and degree of lowering required. Pumping test may be necessary to determine which method is suitable. If sump pumping is not practicable, then other control methods shall be considered and should be approved by the Engineer. The trenches should be kept dry till the completion of work, which includes excavation, pipeline laying, jointing, testing and commissioning and backfilling. Precaution should be taken against the flotation of the pipes. The Contractor shall conduct ground studies if found necessary and the cost for such studies have to borne by the Contractor himself.

The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water met due to all causes from the excavation for laying drainage pipe lines, construction of manholes, wet wells and all types of constructions in the scope of work . In case of failure to make such provisions or any other provisions, which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility.

Should the Contractor select to use a gravel sub-grade with or without un jointed pies with the gravel layers to facilitate flow of water to pumps or other points of disposal, such gravel sub grade with or without conveying pipes shall not be measured or paid as an extra item.

20. PUMPING OUT WATER

The contractor shall provide and work at his own cost all pumps, engines and machinery requisite to keep the trenches for the pipelines or foundations and all other excavations clear of water, whether sub-soil water, urban drain, sewage, leakage from tanks, wells, drains, pipelines, water mains or pipes etc., so that there may be no accumulations of such water and that no setting out may be done, no masonry may be laid, no concrete deposited, no joints made and no measurements taken in water. The pumping shall be continued so long after execution of any portion of the work and repeated so after as the Engineer may consider necessary. The pumps and power applied must be such as the Engineer may consider necessary for the work to set. The pumps and power applied must be such as the Engineer may determine to be sufficient to any particular time, or he may himself supply pumps and power at contractor's expense, so he may stop the work altogether until he is satisfied and also impose a fine upon the contractor.

21.KEEP EXCAVATION CLEAR OF WATER

Where ground water is encountered or anticipated the contractor shall provide sufficient pumps to handle the ingress of water and must provide and maintain in working order. Standby pumping units are to be made available and employed in the event of mechanical failure. The contractor must also arrange for night and day operation of the pumps wherever necessary to ensure that the work proceeds at all times.

22.BARRICADING, WATCHING, LIGHTING

The parts of the barricading shall be as per details in drawings, securely fixed in the ground. They shall not be less than 1.5 m above the surface of the ground.. All along the edges of the excavated trenches, a bund of earth about 1 m high shall be formed when so required by the Engineer for further protection. Proper provision shall be made for lighting at night and watchmen shall be kept to see that this is properly done and maintained. In addition to the normal lighting arrangements the contractor shall provide, whenever such work is in progress, battery operated blinking lights (6 volts) in the beginning and end of a trench with a view to provide suitable indication to the vehicular traffic. The contractor shall also provide and display special boards printed with fluorescent prints indicating the progress of work along-the road. In the event of the contractors not complying with the provisions of the clause, they will be imposed a fine at Rs.250/- per day. Further, in all such cases the work may be carried out departmental at the risk and cost of the contractor. The contractor shall be held responsible for all claims for compensation as a result of accident or injury to person/non-provision of red flags.
The contractor shall provide all notice boards before opening of roads as directed by the Engineer. Arrangements shall be made by the contractors to direct traffic when work is in progress. Payments for such Items of work shall be paid as per the provisions in BOQ.

23.REFILLING TRENCHES

Backfilling

Backfilling of trenches and excavations shall be done as directed by the Engineer with approved sand /dust. The backfilling shall be carried out in such a way as not to cause undue thrust on any part of the construction. The compaction shall be done with the help of suitable equipment such as mechanical tamper, rammer, plate vibrator etc., after necessary watering, so as to achieve at least 95% proctor density. Fill material shall be free from clods, salts, sulphates, organic or other foreign material The whole backfilling shall have to be carried out with local approved sand/dust as directed by Engineer. The sand used shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water to ensure maximum consolidation.

Testing, backfilling and compaction

In general, requirement of routine testing for backfilling is not being anticipated in this project. However, Engineer may ask for standard proctor density test for any compacted back filling at site. In any case extent of such testing will be kept limited to one number for every 500m. However, requirement for such tests shall be at the sole discretion of the Engineer. Contractor shall demonstrate adequately at his cost, by field and laboratory tests that the specified density has been obtained. To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by Contractor at his own cost.

A. With a view to restrict the length of open trenches, on completion of the pipe, laying operations, refilling of trenches shall be started immediately by the contractor. Pipe laying and testing shall follow closely upon the progress of trench excavation and the contractor shall not permit unreasonable excessive lengths of trench excavation to remain open while waiting testing of the pipe line.

B. The trench shall be filled by sand/crushed stone dust up to at least 20 cm. above the top of pipe, back filling is to be done keeping at least 90 cm. length of pipe open at the joints, for verification of joints for water tightness during testing.

C. Care shall be taken while back filling, not to injure or disturb the pipe. Filling shall be carried out simultaneously on both the sides of the pipes so that unequal pressure does not occur.

D. Walking or working on the completed pipeline shall not be permitted unless the trench has been filled to a height of at least 30 cm over the top of the pipe except as may be necessary for tamping, etc., during back filling work.

E. Filling-in shall be done in layers not exceeding 150 mm in thickness accompanied by adequate watering, ramming, etc., so as to get good compaction up to 300 mm above the top of the pipe. Above this level, nallah muck/GSB free from big boulders shall be placed in layers of 225 mm, watered and compacted by tamping.

F. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place.

G. Before and during the backfilling of the trench, precautions shall be taken against the

floatation of the pipeline due to the entry of large quantities of water into the trench causing an uplift of the empty or the partly filled pipeline.

24.DISPOSAL OF EXCAVATED MATERIALS

Excavated materials shall not be used for refilling etc. and shall be carted to the outskirts of corporation for a distance and disposing safely as directed by the engineer in charge for which payment shall be governed by Bill of Quantities of contract agreement. Where the Engineer feels that there is no hindrance to the traffic by not carting away the material, he will give instructions to that effect.

25. ALL WORKS TO BE CLEAR, CLEAN AND PERFECT

The contractor, after completion of entire work and before seeking settlement of his final bill, shall prove at his expense that the entire line is clear, clean and perfect in the presence of the Engineer or his authorized subordinate. He should provide suitable instruments, appliances etc., and pass them through the pipes and shall show that water passes freely through the entire reach from higher end to lower end.

Note: Necessary precautions such as those indicated hereunder may be taken by the contractor while checking the completed pipeline line for its effective functioning, wherever required.

The manholes should be kept open, as required for one hour prior to the starting of checking operations and should be so kept open during the whole duration of checking operations. This is to be done for allowing the gases to escape, naturally. In order to prevent the fire and explosions, endangering the life, properties, pipelines and other utility services due to presence of combustible gases, no lighted match sticks or other similar material should be thrown in the manhole.

Meshes should be placed over the opened manholes to prevent pedestrians etc., from falling in. Likewise, caution boards printed in fluorescent letters such as "DANGER MANHOLE IS KEPT OPEN" etc., shall be provided.

26. MEASUREMENT AND PAYMENT

The payment of excavation shall be made on quantity basis as per the actual dimensions of the trench excavated limited to the width shown in construction drawings.

All excavation in earthwork shall be measured net. Dimensions for purpose of payment shall be reckoned on the mean of the excavation multiplied by the mean depth from the surface below the road hard crust (whenever applicable) as given in BOQ. All planks, boards, walling, verticals, struts, props and all other materials required for close timbering/shoring and subsequent safe dismantling and removal shall be quoted separately under the relevant item of BOQ of contract.

Excavation for road crust shall be included in the earth excavation item and shall not be taken separately for making the payments.

Cost of all operations involved in filling inside excavated trenches with selected material shall be

deemed to have been covered in the rate quoted for filling. Payment for filling item of work will be made on the basis of net fill dimensions i.e. excavated dimension minus the volume occupied by structures or pipes etc.
Actual quantity of consolidated sand filling, stone crushed dust, nallah muck/ GSB supplied by the contractor shall be measured and paid in cubic meters as per B.O.Q

a) Trench excavation

The length of the trench excavation shall be measured along the centre line of pipe at various depths stated in the Bill of Quantities, the total length being segregated into stretches according to the various depths of excavation contained in the Bill of Quantities to fall into the specified categories. Within each stretch the depth applicable shall be within the range specified in Bill of Quantities.

The depth of excavation shall be measured from the top of the trench at the centre before excavation up to the bottom of the bedding under the pipe. If no bedding is provided, the measurement shall be to the level of the bottom of the pipe line. The width of the trench shall be measured on the basis of vertical side walls and the widths given in construction drawings. No additional payment shall be made for the widening at sockets, specials, haunching or surrounds beyond the dimensions contained in construction drawings.

b) Structures

Measurement for structure excavation shall be made as per the projection in plan of the outermost edges of the, structure as per the plan at the bottom.

c) Disposal of excavated material

Nothing extra shall be paid to the contractor for disposal of surplus excavated earth as the earth work in excavation item in Bill of Quantities includes loading, unloading, transporting of surplus excavated earth for its disposal to a dumping site for a lead specified there in or as directed by the Engineer.

SUB-SECTION 5

Concrete And Allied Works

1.**General**

The quality of materials, method & control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specification.
The Engineer in-charge shall have the right to inspect the source/s of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer-in-charge's approval obtained, prior to starting of concrete work. However, this shall not relieve the contractor with any of his responsibilities and all the materials, which do not conform to the specifications, will be rejected.

2.**Applicable Codes**

The following specifications, standards and codes, including all official amendments/revisions and other specifications & codes referred to therein to therein, should be considered a part of this specification. In all cases the latest issue/edition/revision shall apply. In case of discrepancy between this specification and those referred to herein this bid document, this specification shall govern.

Materials

IS: 29 Specification for 33 grade ordinary Portland cement
IS: 455 Specification for Portland slag cement.
IS: 1489 Specification for Portland-pozzolana cement.
IS: 8112 Specification for 43 grade ordinary Portland cement.
IS: 12330 Specification for Sulphate resisting Portland cement.
IS: 383 Specification for coarse and fine aggregates from natural sources for concrete
IS: 432 Specification for mild steel and medium tensile steel (Parts-I & II) bars and hard-drawn steel wires for concrete reinforcement.
IS: 1786 Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS: 1566 Specification for hard-drawn steel wire fabric for (Part-I) concrete reinforcement.
IS: 9103 Specification for admixtures for concrete.
IS: 2645 Specification for integral cement waterproofing compounds.
IS: 4990 Specification for plywood for concrete shuttering work.

Material Testing

IS: 4021 Methods of physical tests for hydraulic cement. (Parts-1 to 13)
IS: 4032 Method of chemical analysis of hydraulic cement.
IS: 650 Specification for standard sand for testing of cement.
IS: 2430 Methods for sampling of aggregates for concrete.
IS: 2386 Methods of test for aggregates for concrete. (Parts-I to VIII)
IS: 3025 Methods of sampling and test (physical and chemical) water used in industry
IS: 6925 Methods of test for determination of water-soluble chlorides in concrete admixtures

Materials Storage

IS: 4082 Recommendations on stacking and storing of construction materials at site.

Concrete Mix Design

IS: 10262 Recommended guidelines for concrete mix design.
SP: 23 Handbook on Concrete Mixes. (S & T)

Concrete Testing

IS: 1199 Method of sampling and analysis of concrete.
IS: 516 Method of test for strength of concrete.
IS:9013 Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
IS: 8142 Method of test for determining setting time of concrete by penetration resistance.
IS: 9284 Method of test for abrasion resistance of concrete.

IS: 2770 Methods of testing bond in reinforced concrete.

Equipment

IS: 1791 Specification for batch type concrete mixers.
IS: 2438 Specification for roller pan mixer.
IS: 4925 Specification for concrete batching and mixing plant.
IS: 5892 Specification for concrete transit mixer and agitator.
IS: 7242 Specification for concrete spreaders.
IS: 2505 General Requirements for concrete vibrators: Immersion type.
IS: 2506 General Requirements for screed board concrete vibrators.
IS: 2514 Specification for concrete vibrating tables.
IS: 3366 Specification for pan vibrators.
IS: 4656 Specification for form vibrators for concrete.
IS: 7251 Specification for concrete finishers.
IS: 2722 Specification for portable swing weigh batchers for concrete (1 & 2 bucket type).
IS: 2750 Specification for steel scaffoldings.

Codes of Practice

IS: 456 Code of practice for plain and reinforced concrete.
IS: 457 Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
IS: 3370 Code of practice for concrete structures for storage of liquids(Parts-I to IV)
IS: 3935 Code of practice for composite construction.
IS: 2204 Code of practice for construction of reinforced concrete shell roof.
IS: 2210 Criteria for the design of reinforced concrete shell structures and folded plates.
IS: 25 Code of practice for bending and fixing of bars for concrete reinforcement.
IS: 5525 Recommendation for detailing of reinforcement in reinforced concrete works.
IS: 2751 Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
IS: 9417 Specification for welding cold worked bars for reinforced concrete construction.
IS: 3558 Code of practice for use of immersion vibrators for consolidating concrete.
IS: 3414 Code of practice for design and installation of joints in building.
IS: 4326 Code of practice for earthquake resistant construction of building.
IS: 4014 Code of practice for steel tubular scaffolding. (Parts-I & II)
IS: 2571 Code of practice for laying in-situ cement concrete flooring.
IS: 7861 Code of practice for extreme weather concreting Part-I: Recommended practice for hot weather concreting; Part-II: Recommended practice for cold weather concreting.
IS:13920 Ductile Detailing of Reinforced Concrete Structure subjected to 1993 seismic forces
SP-16 Design Aids for Reinforcement Concrete to IS: 456-1978 (S&T) - 1980
SP-24 Explanatory Handbook on IS: 456-1978
SP-34 Handbook on Concrete Reinforcement and Detailing (S&T) – 1987

Construction Safety

IS: 3696 Safety code for scaffolds and ladders. (Parts-I & II)
IS: 7969 Safety code for handling and storage of building materials
IS: 8989 Safety code for erection of concrete framed structures.

Measurement

IS: 1200 Method of measurement of building and engineering works.
IS: 3385 Code of practice for measurement of civil engineering

3.Materials for Standard Concrete

The ingredients to be used in the manufacture of concrete shall consist solely of Ordinary Portland Cement, and Sulphate resistant cement, clean sand, natural coarse aggregate, clean water, and admixtures, if specifically called for on conditions at site warrant its use. Only good quality sand shall be used for all works.

4.Cement

The contractor will have to make own arrangements for procuring cement and steel. The Contractor will have to make his own arrangements for transport from supplier go down and storage of adequate quantity of cement. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from the ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangement shall be approved by the Engineer-in-charge. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery.
Cement held in storage for a period of ninety (90) days or longer shall be tested. Should at any time the Engineer-in-charge have reasons to consider that any cement is defective, then irrespective of its origin, date of manufacture and or manufacturer's test certificate, such cement shall be tested immediately at the Contractor's cost at an approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. Testing certificates for each batch of cement should be submitted by the contractor to the Engineer in charge, before starting the concreting work. The Contractor shall not be entitled to any claim of any nature on this account.
Aggregates

6.General

Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete (Vide BIS 456 & BIS 383) and confirming to tests as per BIS: 2386 (Part I to VI) "Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve. All fine and coarse aggregates proposed for use in the works shall be subject to the Engineer-in-charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-charge. Aggregates shall consist of natural sands, stone (crushed or uncrushed) and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation

and shall be based on the "mix design" and preliminary tests on concrete specified later. Aggregate source shall be approved by Engineer.

7.Sampling and Testing

Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of the Engineer in-charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates, shall be furnished to Engineer in-charge in advance of the work, for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by the contractor.

8.Storage of Aggregates

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign material and earth during storage and while heaping the materials shall be avoided. The aggregates must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Aggregates shall be piled in layers not exceeding 1.20 m in height to prevent coning or segregation. Each layer shall cover the entire area of stockpile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

9.Specific Gravity

Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be used.

10.Fine Aggregate

a. Fine aggregate shall consist of natural or crushed sand conforming to BIS 383 confirming to tests as per BIS 2386 part I to VI. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt, or other deleterious substances, which can be injurious to the setting qualities/strength/durability of concrete.

b. Screening and Washing: Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.

Foreign Material limitations: The percentage deleterious substances in sand delivered to the mixer shall not exceed the following:

Table: Foreign Material Limitations in Fine Aggregate

Foreign Material	% by weight uncrushed	% by weight crushed
Material finer than 75 micron BIS sieve	3	15
Shale	1	-
Coal and Lignite	1	1
Clay Lumps	-	1
Total	5	17

Gradation: Unless otherwise directed or approved by the Engineer-in-charge, the grading of sand shall be within the limits indicated hereunder:

Table : Grading of Sand for Fine Aggregate

BIS : Sieve Designation	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	99-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns	5-20	8-30	12-40	15-50
150 microns	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 microns IS sieve, by total amount not exceeding 5%, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to grading zone IV shall be used. Mix designs and preliminary tests shall show its suitability for producing concrete of specified strength and workability.

Fineness Modulus: The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.36 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by 100. Only Good quality sand shall be used.

11.Coarse Aggregate

Coarse aggregate for concrete, except as noted above, shall conform to IS 383 & IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

Screening and Washing: Crushed rock shall be screened and or washed for the removal of dirt or dust coating, if so requested by the Engineer in-Charge.

Grading

i)Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits:

BS sieve Size (mm)	Percentage passing for single sized aggregate of normal size in mm					Percentage Passing For Graded Aggregate Of normal Size in mm			
	40	20	16	12.5	10	40	20	16	12.5
63	100	-	-	-	-	100	-	-	-
40	85-100	100	-	-	-	95-100	-	-	-
20	0-20	85-100	100	-	-	30-70	95-100	100	-
16	-	-	85-100	100	-	-	-	90-100	-
12.5	-	-	-	85-100	100	-	-	-	90-100
10	0-5	0-20	0-30	0-45	85-100	10-35	25-35	30-70	40-85
4.75		0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36	-	-	-	--	0-5	-	-	-	-

ii) The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability of concrete. The maximum size of coarse aggregate shall be 40 mm for M-7.5 and M-10 and 20mm for M-15 to M-20 concrete, or as directed by the Engineer-in-charge or specified otherwise. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than 1/4th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover to reinforcement whichever is smaller.

12.Foreign material limitations

The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following:

Table: Foreign Material Limitations in Coarse Aggregate

Foreign Material	% by weight uncrushed	% by weight crushed
Material finer than 75 micron BIS	3	3
Coal and Lignite	1	1
Clay Lumps	1	1
Soft fragments	3	-
Total	8	5

13.Water

a. Water used for washing, mixing and curing shall be free from injurious amounts of deleterious materials. Potable water is generally satisfactory for mixing and curing concrete. Physical and chemical analysis of the water should be submitted to the Engineer-in-charge, before starting the work.

b. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

c. Average 28 days compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The cubes shall be prepared, cured and tested in accordance with the requirements of BIS: 516.

d. The initial setting time of test block must be made with the appropriate test cement and the water proposed to be used. It shall not be less than 30 minutes and shall not differ by more than +30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test block shall be prepared and tested in accordance with the requirements of BIS: 4031.

e. Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-charge may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values.

1. To neutralize 200 ml sample of water, using phenolphthalein as indicator, it should not require more than 2 ml of 0.1 normal NaOH. The details of test shall be as per BIS: 3025.

2. To neutralise 200 ml sample of water, using methyl orange as an indicator, it should not require more than 10 ml of 0.1 Normal HCl. The details of test shall be as per BIS: 3025.

3. Percentage of solids, when tested in accordance with the method indicated below shall not exceed the following:

Solids	Percent	Method of test
Refer to Column in IS:3025 Organic		
(organic solid = total solids minus ignited residue)	0.02	10 and 11
Inorganic	0.03	11(ignited residue)
Sulphates (as So4)	0.05	20
Alkali Chlorides (as Cl)	0.20	24
Suspended matter	0.20	12
The pH value of water shall not generally be less than 6.		

14.Controlled Concrete

All concrete in the works shall be "Controlled Concrete" as defined in IS: 456 except for M-7.5 and M-10 for which normal mix concrete shall be used. Whether reinforced or otherwise, all concrete works to be carried out under this specification shall be divided into the following classifications:

Note: It shall be very clearly understood that whenever the grade of concrete such as M-20, etc. is specif

Class	Preliminary Test N/mm2		Works Test N/mm2		Maximum Size of Aggregate mm	Locations For Use As indicated
	7 days	28 days	7 days	28 days		
M40	33.5	50	27	40	20	Specifications/ as
M35	30	44	23.5	35	20	-do-
M30	25	38	20	30	40 or 20	-do-
M25	22	32	17	25	40 or 20	-do-
M20	17.5	26	13.5	20	40 or 20	-do-
M15	13.5	20	10	15	40 or 20	-do-

strength shall be 390 kg/m3 for 20 mm downgraded aggregate.

15.Mix Design

General

It is essential for investigating the grading of aggregates, water-cement ratio, workability and the quality of cement required to give preliminary and works cubes of the minimum strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Determination of mix proportions shall be carried out as per the "Recommended guidelines for Concrete Mix Design" conforming to IS: 10262.

Whenever there is a change either in required strength of concrete, or water-cement ratio or workability or the source of aggregates and/or cement, preliminary tests shall be repeated to determine the revised proportions of the mix to suit the altered conditions. While designing proportions, over-wet mixes shall always be avoided.

While fixing the value for water/cement ratio for preliminary mixes, assistance may be derived from the graph Appendix A, BIS 456 showing the relationship between the 28 day

compressive strengths of concrete mixes with different water/cement ratios and the 7-day compressive strength of cement tested in accordance with IS: 269.

Preliminary tests

Test specimens shall be prepared with at-least two different water/cement ratios for each class of concrete, consistent with work ability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the properties of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength, it will be contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer-in-Charge a statement of proportions proposed to be used for the various concrete mixes. For preliminary tests, the following procedure shall be followed.

Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water cement and aggregates for each batch shall be determined by weight to an accuracy of 1 part in 100 parts.

Mixing concrete shall be done by hand (for small quantities, as directed by Engineer-in-Charge) or in a small batch mixer as per IS: 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in color. The coarse aggregate shall then be added, mixed and water added and the whole batch mixed thoroughly for a period of not less than two minutes until the resulting concrete is uniform in appearance. Each batch of concrete shall be such a size as to leave about 10% excess concrete, after molding the desired number of test specimens.

The consistency of each batch of concrete shall be measured immediately after mixing, by the slump test in accordance with IS: 1199. If in the slump test, care is taken to ensure that no water or other material is lost, the material used for the slump test may be re-mixed with the remainder of the concrete for making the specimen test cubes. The period of re-mixing shall be as short as possible yet sufficient to produce a homogeneous mass.

The samples for compression tests of concrete shall be made as per IS: 516 on 15 cm cubes. Each mould shall be provided with a metal base plate having a plate surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete, the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits. Height and distance between the opposite faces of the mould shall be of specified size +0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom faces of mould shall be 90-degree +0.5 degree. The interior faces of the mould shall be plane surfaces with a permissible variation of 0.03 mm.

Concrete test cubes shall be moulded by placing fresh concrete in mould compacted as specified in IS 516.

Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temperature of $27^{o}C + 2^{o}C$ for 24 hours +2 hours from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at $27^{o}C$ +2 degree C temperature until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum

temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

The strength shall be determined based on not less than five cube test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to the Engineer-in-charge. The test results shall be accepted by the Engineer-in-charge if the average compressive strengths of the specimens tested is not less than the compressive strength specified for the age at which specimens are tested subject to the condition that only one out of the five consecutive tests may give a value less than the specified strength for that age. The Engineer-in-charge may direct the contractor to repeat the tests if the results are not satisfactory and also make such changes, as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by the contractor at his own cost in an approved laboratory.

16.Proportioning, Consistency, Batching and Mixing of Concrete

The determination of the water cement ratio and proportion of aggregates to obtain the required strength shall be made from preliminary tests by designing the concrete mix. Controlled concrete shall be used on all concrete work complying with all the requirements of IS: 456. Cube tests shall be carried out by the contractor on the trial mixes before the actual concreting operation starts. Based on the strength of the concrete mix sanction for the use has to be obtained from engineer in charge.

If during the execution of the works it is found necessary to revise the mix because of the cube tests showing lower strengths than the required one due to inconsistency of quality of material or otherwise, The Engineer in charge shall ask for fresh trial mixes to be made by the contractor. No claim to alter the rates of concrete work shall be entertained due to such change in mix variations, as it is the contractor's responsibility to produce the concrete of the required grade.

Great care shall be exercised when mixing the actual works concrete using the proportions of the selected trial mix. The final concrete mix shall have the same proportions of cement, fine and coarse aggregates and water as that of the approved selected mix.

A reasonable number of bags should be weighed separately to check the Net weight, where the weight of cement is determined by accepting the manufacturer's weight per bag at the site. Proper control of mixing water is deemed to be of paramount importance. If mixers with automatic addition of water are used, water should be either measured by volume in calibrated buckets, tins or weighed. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked and certified and the Engineer-in-Charge's approval obtained.

The Engineer-in-Charge may require the contractor to carry out moisture content tests in both fine and coarse aggregates. The amount of the added water shall then be adjusted to compensate for any observed variations in the moisture contents. BIS: 2386 shall be referred to for determination of moisture content.

No substitution in material, used on the work or alteration in the established proportions shall be made without additional tests to show that the quality and strength of concrete are satisfactory. No alterations shall be permitted without the prior sanction of the Engineer-in-Charge.

17.Mixing of Concrete

The mixing of concrete shall be strictly carried out in an approved type of mechanical Concrete mixer. The mixing equipment shall be capable of combining the aggregates. Cement and water within the specified time into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation. The entire batch shall be discharged before recharging. Mixing periods shall be measured from the time when all of the solid materials are in the mixing drum, provided that all of the mixing water shall be introduced before one fourth of the mixing time has elapsed. The mixing time in no case shall be less than two minutes. The mixer speed shall not be less than 14 or more than 20 revolutions per minute.

Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in color and consistency. Hand mixing of concrete shall not be permitted at all.

18.Grade of Concrete

The different grades of concrete specified shall conform to the strengths as required by IS: 456-1987. Standard deviation shall be calculated as stated in 14.5 of IS: 456-1978. The acceptable criteria for concrete shall be as stated in clause 15 of IS: 456 -1978.The assumed standard deviations as given in table 6 of IS: 456-1978 has to be followed and are given here under. However, the minimum cement content shall be as per “Table: Grade of Concrete” in this bid document.

Table: Grade of Concrete

Grade of Concrete	Assumed Standard Deviation N/sq.mm
M 10	2.3
M 15	3.5
M 20	4.6
M 25	5.3

In order to get a quick idea of quality of concrete the optional tests are conducted as stipulated in 14.1.1 of IS: 456-1978 and the results are analyzed according to table 5 on page 41 of IS: 456-1978.

Controlled Concrete

Controlled concrete shall be used on all concreting works except where specified otherwise the mix proportions for all grades of concrete shall be designed to obtain strengths corresponding to the values specified in “Table : Compressive Strengths at 28 days” below for respective grades of concrete.

Table : Compressive Strengths at 28 days

Grade	Specified Characteristic Compressive Strength (Works strength) at 28

	days (N/sq.mm)
M10	10
M15	15
M20	20
M25	25
M30	30

The maximum Water: Cement ratio for all controlled concrete works shall be as specified in IS: 456-1978 as Preliminary tests as specified in the BIS code and required by the Engineer-in-Charge shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative samples of aggregates and cement expected to be used on the job to ascertain the ratios by weight of cement of total quantity of fine and coarse aggregates and the water cement ratio required to produce a concrete of specified strength and desired workability.

The minimum cement content for each grade of concrete shall be as per "Table: Minimum Cement Content in Concrete" Table: Minimum Cement Content in Concrete

Grade of Concrete	Minimum Cement Content in Concrete
M 15	310
M 20	390
M 25	425
M30	500

At least 4 (four) trial batches are to be made and 7 test cubes should be taken for each batch noting the slump on each mix. These cubes shall then be properly cured and two cubes for each mix shall be tested in a testing laboratory approved by the Engineer-in-Charge at 7 days and others at 28 days for obtaining the ultimate compressive strength. The test reports shall be submitted to the Engineer in charge. The cost of mix design and testing shall be borne by the contractor. On the basis of the preliminary test reports for trial mix, a proportion of mix by weight and water cement ratio will be approved by the Engineer in charge, which will be expected to give the required strength. Consistency and workability and the proportions so decided for different grades of concrete shall be adhered to during all concreting operations. If however at any time the Engineer-in-Charge feels that the quality of material, being used has been changed from those used for preliminary mix design, the contractor shall have to run similar trial mixes to ascertain the mix proportions and consistency.

The mix once approved must not be varied without prior approval of the Engineer-in-Charge. However should the contractor anticipate any change in the quality of future supply of materials than that used for preliminary mix design, he shall inform the same to the Engineer in charge and bring fresh samples sufficiently ahead to carry out fresh trial mixes. The engineer in charge shall have access to all places and laboratory where design mix is prepared. Design mix will indicate by means of graphs and curves etc. the extent of variation in the grading of aggregates which can be allowed.

In designing the mix proportions of concrete, the quantity of both cement and aggregate shall be determined by weight. All measuring equipment shall be maintained in clean and serviceable condition and their accuracy periodically checked.

To keep the water cement ratio to the designed value, allowance shall be made for the moisture contents in both fine and course aggregates and determination of the same shall be made as

frequently as directed by the Engineer-in-Charge. The determination of moisture contents shall be according to IS: 2386 (Part III).

19.Strength Requirements

Where ordinary Portland cement conforming to IS: 269 or Portland blast furnace slag cement conforming to IS: 455 are used the compressive strength requirements for various grades of concrete shall be as shown in table below. Where rapid hardening Portland cement is used the 28 days compressive strength requirements specified in Table hereunder shall be met in 7 days. The strength requirements specified in table shall apply to both controlled concrete and ordinary concrete.

Table : Strength Requirements of Concrete

Grade of Concrete (IS: 456-1978)	Minimum Compressive Strength of 15 cm cube specimen (IS:			
	at 7 days		at 28 days	
	Work Test	Preliminary	Work Test	Preliminary
M 15	100	135	150	200
M 20	135	175	200	260
M 25	170	220	250	320
M 30	200	250	300	380

Other requirements of concrete strength as may be desired by the Engineer in charge shall be in accordance with Indian Standard IS: 456 (latest revision). The acceptance of strength of concrete shall be as per clause 5.4 "Sample size and Acceptance Criteria" of IS: 456 (latest revision) subjects to stipulation and/or modifications stated elsewhere in this specification if any.

Concrete work found unsuitable for acceptance shall have to be dismantled and replaced to the satisfaction of the Engineer-in–Charge by the contractor free of cost of the owner. No payment will be made for the dismantled concrete, the relevant Formwork and reinforcement; embedded mixtures etc. wasted in the dismantled portion shall be made. In the course of dismantling if any damage is done to the embedded items or adjacent structures, the same shall also be made good free of charge by the contractor to the satisfaction of the Engineer in charge. If the water quantity has to be increased in special cases, cement also is increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete.

20.Workability

The workability of concrete shall be checked at frequent intervals by slump test. Where facilities exist and if required by the Engineer-in-Charge, alternatively the compacting factor test in accordance with IS: 1199 shall be carried out. The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of form work and round the reinforcement to give the required surface finish shall depend on the type and nature of the structure and shall be based on experience and tests. The limits of consistency for structures are as specified in the "Table Limits of Consistency" below:

Table : Limits of Consistency

Placing Conditions	Degree of Workability	Values of Workability

Concreting of shallow Sections with vibration	Very low	20-10 seconds VB time or 0.75-0.80 compacting factor
Concreting of lightly Reinforced sections With vibration	Low	10-5 seconds or 0.80-0.85 compacting factor
Concreting of lightly Reinforced sections Without Vibration or Heavily reinforced Section with Vibration	Medium	5-2 seconds VB time or 0.85-0.92 compacting factor or 25- 75 mm slump for 20 mm Aggregate
Concreting of heavily Reinforced sections compacting Without vibration factor	High	Above 0.92 compacting factor or 75-125 mm slumps for 20 mm aggregate

Workmanship

All workmanship shall be according to the latest relevant standards. Before starting a pour the contractor shall obtain the approval of the Engineer-in-Charge in a "Pour Card" maintained for this purpose. He shall obtain complete instructions about the material and proportion to be used, slump, workability of water per unit of cement, number of test cubes to be taken, finishing to be done and any admixture to be added etc.

Sampling and Testing Concrete in the Field

a) Facilities required for sampling materials and concrete including whether proof buildings to house the facilities in the field, should be provided by the contractor at no extra cost. The following equipment with operator shall be made available in serviceable conditions.

i. Concrete cube-testing machine suitable for 15 cm3 of 100 MT capacity with proving calibration ring - 1 no.
ii. Cast iron cube moulds 15 cm size - 6 nos. (min)
iii. Slump cone complete with tamping rod - 1 set
iv. Laboratory balance to weigh up to 5 kg with sensitivity of 10 gm - 1 no.
v. BIS sieves for coarse and fine aggregates - 1 set
vi. Set of measures from 5 liters to 0.1 liter - 1 set
vii. Electric oven with thermostat up to 120oC - 1 no.
viii. Flakiness gauge - 1 no.
ix. Elongation index gauge - 1 no.
x. Sedimentation pipette - 1 no.
xi. Calibrated glass jars 1.0 liter capacity - 2 nos.
xii. Glass flasks and metal containers - As required
xiii. Chemical reagents like sodium hydroxide, tannic acid, litmus paper etc–

As required Laboratory balance of 2 kg capacity and sensitivity of 1 gm - 1 no

b) No concrete of any kind may be placed until the field concrete testing laboratory as specified is provided to the satisfaction of the Engineer. The contractor shall notify the Engineer in advance of all concrete and concrete material testing as provided in the clause to provide the Engineer/his representative with an opportunity to witness all prescribed tests.

c) At least 6 test cubes of each class of concrete shall be made of every 50cum concrete or part thereof or from different batches as directed by Engineer-in-charge. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The cubes must be casted from various batches to arrive at an average strength. The laboratory test results shall be tabulated and furnished to the Engineer. The Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength.

d) Consistency: Slump tests shall be carried out as often as requested by the Engineer and invariably from the same batch of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

21.Concrete Tests

The Engineer-in-Charge, may order tests to be carried out on cement, sand, coarse aggregate, and water in accordance with the relevant Indian standards.
Tests on Cement shall include:

- Fineness test
- Test for normal consistency
- Test for setting time
- Test for soundness
- Test for tensile strength
- Test for compressive strength
- Test for heat of hydration (by experiment & calculations) as per BIS 269

Tests on Sand shall include:

- Sieve test
- Test for organic impurities
- Decantation test for determining clay and silt content
- Specific gravity test
- Test for unit weight and bulk age factor
- Test for sieve analysis and fineness modulus

Tests on Coarse Aggregate shall include:

- Sieve analysis
- Specific gravity and unit weight of dry, loose and ridded aggregate
- Soundness and alkali aggregate reactivity
- Petrography examination
- Deleterious materials and organic impurities
- Test for aggregate crushing value

Any or all these tests would normally be ordered to be carried out only if the Engineer feels the materials are not obtained and shall be performed by the contractor at an approved test laboratory The contractor shall bear the charges of these optional tests. Concrete not made to

the requirements of specification in all respects may be rejected by the Engineer-in-Charge in which case it shall be removed and reconstructed entirely at the expense of the contractor.

Load test on Members or any other tests

a. In the event of any work being suspected of material or workmanship or both, the Engineer-in-charge requiring its removal and reconstruction may order, or the contractor may request that it should be load tested in accordance with the following provisions.
b. The test load shall be 125% of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of concrete. During the test, struts strong enough to take the whole load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.
c. If within 24 hours of the removal of the load, the structure does not show a recovery of at least 75% of the maximum deflection shown during the 24 hours under load, the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75% of the maximum deflection shown during the second test. If the structure is certified as failed by the Engineer-in-Charge, the cost of all the new construction and the load tests shall be borne by the contractor.
d. Any other tests, e.g. taking out in an approved manner concrete cores, examination and tests on such cores removed from such parts of the structure as directed by the Engineer-in-charge, sonic testing etc. shall be carried out by the contractor, if so directed, at no extra cost.

22.Unsatisfactory tests

Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction, the contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by the Engineer-in-Charge.

23.Admixtures

General

Admixtures may be used in concrete where required, only with the approval of the Engineer-in-Charge. However it should be seen that, with the passage of time, neither the compressive strength nor its durability is reduced. Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the weight of the cement in each batch of concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instruction and in the manner and with the control specified by the Engineer-in-Charge.

24.Air Entraining Agents

Neutralized Vinson resin or other approved air in the concrete mix agents shall conform to the requirements of ASTM standard 6.260; Air Entraining Admixtures for Concrete. The recommended total air content of the concrete is 4% + 1%. The method of measuring air content shall be as per IS: 1199.

Water Reducing Admixtures

Water reducing lignosulfonate admixture may be added in quantities approved by the Engineer-in-charge. The admixtures shall be added in the form of a solution.

25.Retarding Admixtures

Retarding agents may be added to concrete mix in quantities approved by the Engineer-in-Charge.

26.Water Proofing Agent

Water proofing agents shall conform to IS: 2645.

27.Other Admixtures

The Engineer-in-Charge may at his discretion allow the contractor to use any other admixture in the concrete.

28.Preparation Prior to Concrete Placement, Final Inspection and Approval

i. Before the concrete is actually placed in position, the insides of the Formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottoms of columns and wall forms, to permit removal of sawdust, wood shavings, binding wire, dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be suitably plugged later.
ii. The various agencies shall be permitted ample time to install drainage and plumbing lines, floor and trench drains, conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as specified or required or as is necessary for the proper execution of the work as specified in the drawings.
iii. All embedded parts, inserts, etc. the contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.
iv. All anchor bolts shall be positioned and kept in place with the help of properly manufactured templates unless specifically waived in writing by the Engineer-in-charge.
v. Slots, openings, holes, pockets etc. shall be provided in the concrete work in the position specified in drawing or required or as directed by the Engineer-in-charge.
vi. Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.

vii. Prior to concrete placement, all work shall be inspected and approved by the Engineer-in-Charge and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected.

viii. Approval by the Engineer-in-Charge of any and all materials and work as required herein shall not relieve the contractor from his obligation to produce finished concrete in accordance with the requirements of the specifications.

ix. Rain or wash water: No concrete shall be placed in wet weather or on a water-covered surface. Any concrete that has been washed by heavy rains shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture. To guard against damage, which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted before leaving the work unattended. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed

x. Concrete, suitable drains and sumps shall be provided. During summer season, temperature of water should be maintained, as per the criteria and for the same, icing should be done for concreting work.

xi. Bonding Mortar: Immediately before concrete placement begins, prepared surfaces except Formwork, which will come in contact with the concrete to be placed, shall be covered with a bonding mortar as specified.

xii. The corrosive matters on the reinforcement should be removed by means of wire brush.

xiii. Laitance should be removed by means of chiseling from top concrete layer which was earlier concreted.

28.Transportation

General

All buckets, containers or conveyors used for transporting concrete shall be mortar-tight, leak proof irrespective of the method of transportation adopted; concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of the Engineer-in-charge and concrete shall not be re-handled before placing.

Re-tempered or Contaminated Concrete

Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing. Concrete, which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by the Engineer-in-Charge.

30.Avoiding Segregation

Concrete shall, in all cases, be deposited as nearly as practicable directly, in its final position and shall not be re-handled to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded insets, or impair its strength. For locations where direct placement is not possible, and in narrow forms, the Contractor shall provide suitable drop and “Elephant Trunks” to confine the movement of concrete. Special

care shall be taken when concrete is dropped from a height, especially if reinforcement is in the way, particularly in column and the walls.

31.Placing by Manual Labour

Except when otherwise approved by the Engineer-in-Charge, concrete shall be placed in the shuttering by shovels or other approved implements, and shall not be dropped from a height more than 1.0 m or handled in a manner, which will cause segregation.

32.Placing by Mechanical Equipment

The following specification shall apply when placing concrete by use of mechanical equipment is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharge. Concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to throughout all stages of delivery until the concrete comes to rest in its final position.

33.Types of Buckets

Central-bottom-dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping positions shall be employed. In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and then lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1.0 m. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner, which results in separation of ingredients or disturbance of previously placed concrete, will not be permitted.

34Placement of Restricted Forms

Concrete placed in restricted forms by barrows, bugles, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

35.Chuting

Where it is necessary to use transfer chutes, specific approval of Engineer-in-charge must be obtained to type, length slopes, baffles, vertical terminals and timing of operations. These shall be so arranged that an almost continuous flow of concrete be obtained at the discharge and without segregation. Concrete should flow smoothly in the chute and there should not be any obstruction to the flow. To allow for the loss of mortar against the sides of the chutes, the first mixes shall have less coarse aggregate. During cleaning of chutes, the wastewater shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1.0 m. Chutes, when approved for use shall have slopes not flatter than 1 vertical, 3 horizontal and not steeper than 1 vertical, 2 horizontal. Chutes shall be of metal or metal lines end of rounded cross section. The slopes of all chute sections shall be approximately the same.

The slopes of all chute sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

36.Placing by Pumping/Pneumatic Placers

Concrete may be conveyed and placed by mechanically operated equipment e.g., pumps or pneumatic placers only with the written permission of the Engineer-in-Charge at no extra cost. The slump shall be held to the minimum necessary for conveying concrete by this method.
When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. Care shall be taken to avoid stoppages in work once pumping has started.
When a pneumatic placer is used, the manufacturer's advice on layout of the pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's recommendations shall be followed regarding concrete quality and all other related matters when pumping/ pneumatic placing equipment is used. It should be noted that no extra payment is made for these items, if required and directed by Engineer-in-Charge.
Concrete in layers

Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 cm to 45 cm directed by Engineer-in-Charge. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by the Engineer-in-charge.

37.Cover Blocks

Cover blocks of required size depending on the cover of the reinforcement as mentioned in the drawings should be prepared in 1:3 cement mortar with fine aggregates.

38.Bedding of layers

The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed. Top layer should be rough and with key for further extension of work.

39. Compaction

Concrete shall be compacted during placing with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, as specified in the IS, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms against hardened concrete at joints is free from voids or

cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over vibrate the concrete to the point those segregation results.

40. **Type of vibrators**

Vibrators shall conform to BIS specifications. Type of vibrator to be used shall depend on the structures where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

Use of Vibrators

The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention be paid to vibration at the top of a lift e.g. in a column or wall.

41.Melding Successive Batches

When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration blending and melding of the concrete between the succeeding layers.

42.Penetration of Vibrators

The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

43. Vibrating against Reinforcement

Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

44.Use of Form Attached Vibrators

Form attached vibrators shall be used only with specific authorization of the Engineer-in-Charge.

45. **Use of surface vibrators**

The use of surface vibrators will not be permitted under normal conditions. However, for thin slabs, surface vibrating by specially designed vibrators may be permitted, upon approval of Engineer-in-charge.

46.Stone Pockets and Mortar Pondages

The formation of stone pockets and mortar pondages in corners and against faces of forms shall not be permitted. In case of these occur, they should be dug out, reformed and refilled to sufficient depth and shape for thorough bonding, as directed by the Engineer-in-charge.

47.Placement Interval

Except when placing with slip forms, each placement of concrete in multiple lift work shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequent placement.

48.Special Provision in Placing

When placing concrete in walls with openings, in floors of integral slabs and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls or bottom horizontal surface of the slab, as the case may be. P lacing shall be resumed before the concrete in place takes initial set, but not until it has had time to settle as determined by the Engineer-in-Charge.

49. Placing Concrete through Reinforcing Steel

When placing concrete through reinforcing steel, care shall be taken to prevent segregation of the coarse aggregate. Where the congestion of steel makes placing difficult, it may be necessary to obtain Engineer in-Charge's permission for temporarily moving the top steel aside for proper placement & for restoring reinforcement as per drawing.

50.Bleeding

Bleeding or free water on top of concrete being deposited into the forms shall be the cause to stop the concrete pour and the conditions causing this defect corrected before any further Concreting is resumed.

51.Application of Araldite for Bonding of New and Old Concrete

General

Araldite epoxy resins will be used to bond fresh concrete to concrete that is fully cured, to give a monolithic bond capable of transmitting high stresses when traditional bonding agents such as cement slurry cannot always be relied upon to provide good adhesion which is particularly the case when large areas are involved.

a. The Araldite based formulation shall be applied to suitably prepare concrete sub-strata and fresh concrete poured as soon as possible, but always during the 'open time' of adhesive.
b. Materials used shall be of best quality and approved by the Engineer.
c. Manufacturer's instructions shall be followed in all respects.
d. No separate payment shall be paid for this item of work.

52.Formulation

Araldite	GY250	100	Parts by weight
HardenerHY825	20	Parts by weight	
HardenerHY830	20	Parts by weight	
HardenerHY850	20	Parts by weight	
Silica Flour		20	Parts by weight

53.Application

Preparation of the Substrata

To obtain good adhesion, it is necessary to have clean and sound substrata. Preparation can be carried out using a variety of techniques including chemical treatment and mechanical methods such as grinding, milling, and abrading, planning and sand blasting. Dust and loose particles resulting from the pre-treatment should be removed by vacuum cleaning or oil-free or blast.

54.Mixing

The resin and hardener should be thoroughly mixed in the dry filler. The mixed, ready to use adhesive should not contain lumps of un wetted filler and should be of uniform color. For a total weight of 1 kg or less hand mixing should be sufficient. For quantities in excess of 1 kg, the use of a mechanical mixer is recommended

Pot life and 'Open time'

The pot life is the period during which the ready to use ARALDITE based formulation must be applied. After this period, the mix can no longer be worked and will have begun to set in its container. The table below indicates the pot life at different temperatures:

Mix Temperature (Degree Celsius)	Pot life (minutes)
25	90

30	60
35	45
(The figures in this table are for batches less than 1 kilogram).	

The 'Open time' is the maximum period of time allowable between application of the ARALDITE adhesive and pouring the fresh concrete. Exceeding the 'Open time' would result in considerably reduced adhesion. The adhesive should be applied to the pre-treated substrata as soon as the components have been mixed and fresh concrete poured immediately afterwards. Accurate knowledge of the 'Open time' is essential in case the work is interrupted.
Table gives the 'Open time' of ARALDITE based formulations as a function of substrata temperature. In all cases, the adhesives shall be applied immediately after mixing. Any delay between mixing and application will reduce the 'Open time'. Fresh concrete must be poured before the adhesive begins to gel. New to old concrete bonding is not recommended at temperatures below 5oC, as curing cannot be assured under these circumstances.

55.Methods of Application

The shape and size of the concrete structure will determine the method of application used. The ARALDITE based adhesive may be applied by hand using brushed, brooms or any other suitable applicator.

56.Suitability of Fresh Concrete

Best results are obtained when the water/ cement ratio of the new concrete is low as is practicable.

57.Coverage

One kilogram of the mixed ARALDITE adhesive including hardeners and filler covers an area of 2 to 3 m2. When applied with a stiff nylon bristle brush. However, the coverage is very much dependent on the finish in the concrete.

58.Handling Precautions

Epoxy resins can cause irritation of the skin in sensitive person if incorrectly handled. Certain safety precautions must therefore be observed and those handling the resins and hardeners should be given suitable instructions. Those working with epoxy resins should, above all, be instructed that personal cleanliness at the place of work is essential. The resin and hardener should not be allowed to come into direct contact with the skin. The most effective protection is achieved by wearing rubber or polythene gloves, the latter having the advantage that they can be replaced when dirty. They are more pleasant to wear if cotton gloves are worn underneath. Parts of the skins, which have come into contact with the resin or hardener, should be washed with lukewarm water and a mild soap. Special cleaning creams may be used as they have proved to be highly suitable.

59.Tolerances in Concrete Surfaces

- Concrete surfaces for the various classes of unformed and formed finishes specified in various clauses shall comply with the tolerances shown in Table hereunder, except where different tolerances are expressly required by the specification.

- In the table 'line and level' and 'dimension' shall mean the lines, levels and cross-sectional dimensions as specified and required.
- Surface irregularities shall be classified as 'abrupt' or 'gradual'. Abrupt irregularities include by shall not be limited to offsets and fins caused by displaced or misplaced formwork, loose knots and other defects in formwork materials, and shall be tested by direct measurement. Gradual irregularities shall be tested by means of a straight template for plane surfaces and 1.5 m long formed surfaces.

Class of finish	Maximum tolerance (mm) in:			
	Line & level	Abrupt irregularity	Gradual irregularity	Dimension
U 1	12	6	6	--
U 2	6	3	3	--
U 3	6	3	3	--
F 1	12	6	6	+12-6
F 2	6	6	6	+12-6
F 3	3	3	3	+6-6

60.Curing, Protecting, Repairing and Finishing

Curing

All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays, or pounded water, continuously saturated coverings of sacking, canvas, hessain or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot weather as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

61.Curing with Water

Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete, following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin as soon as the concrete has hardened. Water shall be applied to formed surfaces immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

62.Continuous Spraying

Curing shall be assured by use of an ample water supply under pressure in pipes, with all necessary appliances of hose, sprinklers and spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by the Engineer-in-charge

63.Alternate Curing Methods

Whenever in the judgment of the Engineer-in-charge, it is necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during curing period. For curing of concrete in sidewalks, floors, flat roofs of other level surfaces, the ponding method of curing is preferred. The method of containing the pounded water shall be approved by the Engineer-in-charge. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these areas. The pounded areas shall be kept continuously filled with water during the curing period.

64.Curing Compound

Surface coating type-curing compounds shall be used only by special permission of Engineer-in-Charge. Curing compounds shall be liquid type white pigmented, conforming to US Bureau of Reclamation specification. No curing compound shall be used on surfaces where future blending with concrete, water of acid proof membrane or painting is specified.

65.Curing Equipment

All equipment & materials required for curing shall be on hand and ready for use before concrete is placed.

66.Protecting Fresh Concrete

Fresh concrete shall be protected from defacements and damage due to construction operations by leaving forms in place for an ample period. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by the Engineer-in-Charge shall also be taken to protect immature concrete from damage by debris, excessive lading, vibration, abrasion or contact with other materials, etc. that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that the workmen enter the area of freshly placed concrete, the Engineer-in-Charge may require that bridges be placed over the area.

67.Repair and Replacement of Unsatisfactory Concrete

General

Immediately after the shuttering is removed, the surface of concrete shall be very carefully gone over and all defective areas called to the attention of the Engineer-in-charge who may permit patching of the defective areas or also reject the concrete unit either partially or in its entirety. Rejected concrete shall be removed and replaced by the contractor. Holes shall be filled with mortar composed of one part of cement to one and half parts of sand passing 2.36

mm IS sieve after removing any loose stones adhering to the concrete. Concrete surfaces shall be finished as described in specifications or as directed by the Engineer-in-charge. Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering, in the presence of the Engineer-in-charge and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by the Engineer-in-charge, the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities, care being taken to avoid damaging the surface. Surface irregularities shall be removed by grinding. If reinforcement is exposed or the honeycombing occurs at vulnerable positions e.g. ends of beams or columns, it may be necessary to cut out the member completely or in part and reconstruct. The decision of the Engineer-in-charge shall be final in this regard. If only patching is necessary, the edges being cut perpendicular to the affected surface or with a small undercut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place. An area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

68.Use of Epoxy

The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of the Engineer-in-charge. Epoxies shall be applied in strict accordance with the instructions of the manufacturer.

69.Method of Repair

Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bolts, grout insert holes and slots cut for repair of cracks shall be repaired as follows:

The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops. A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float and left slightly protrude of the surrounding surface. The concrete patch shall be built up in 10 mm thick layers, after an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and a smooth finish obtained by wiping with hessian. A steel trowel shall be used for this purpose. The mix for patching shall be of the same materials and in the same proportion as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible. Mortar filling by air pressure (gunniting) shall be used for repair of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the color and texture of the surrounding concrete. White cement shall be substituted for ordinary cement, if so directed by the Engineer-in-charge, to match the shade of the patch with the original concrete.

Curing of Patched Work

The patched area shall be covered immediately with an approved non-staining, water-saturated material such as gunny bags which shall be kept continuously wet and protected against sun

and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by a fine spray, or sprinkling for not less than 10 days. All fillings shall be tightly bounded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and dried.

Approval by the Engineer-in-Charge

All materials, procedures and operations used in the repair work shall be subject to the approval of the Engineer-in-Charge.

70.Finishing

General

The type of finish for formed concrete surfaces shall be as follows, unless varied by the Engineer-in-Charge. When the structure is in service all the surfaces shall receive no special finish, except repair of damaged or defective concrete, removal of fine and abrupt irregularities, filling defective concrete, filling of holes left by form ties and rods and clean up of loose or adhering debris. Surfaces which will be exposed to the weather and which would normally be level shall be sloped for drainage. Unless a horizontal surface or the slope required is specified, the tops of narrow surfaces such as stair treads, walls, curbs and parapets shall be sloped across the width approximately 1 in 30. Broader surfaces such as walkways and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete, subfloors to be covered with concrete topping, terrazzo or quarry tiles and similar surfaces shall be smooth ascended and leveled to produce even surfaces. Surface irregularities shall not exceed 6 mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, side-walks, floors and slabs, shall be consolidated, screened and floated. Excess water and laitance shall be removed before final finishing. Floating may be done with hand or power tools and started as soon as the screened surface has attained a stiffness to permit finishing operations and these shall be the minimum required to produce a surface uniform in texture and free from screened marks or other imperfections. Joints and edges shall be tooled as specified or as directed by the Engineer-in-Charge.

71.Standard Finish for Exposed Concrete

Exposed concrete shall mean any concrete, other than floors or slabs, exposed to view upon completion of the works. Unless otherwise specified, the standard finish for exposed concrete shall be a smooth finish. A smooth finish shall be obtained with the use of lined or plywood forms having smooth and even surfaces and edges. Panels of forms shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, protections etc., removed leaving the surfaces smooth.

72.Integral cement concrete finish

When specified, integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded, as specified or directed by the Engineer-in-charge. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or toweling of finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement & sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

73.Rubbed finish

A rubbed finish shall be provided only on exposed concrete surfaces. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, offsets leveled and voids and/or damaged sections immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. The surfaces shall then be thoroughly wetted and rubbed with carborundum or other abrasive. Cement mortar may be used in the rubbing, but the finished surfaces shall not be brush coated with either cement or grout after rubbing. The finished surfaces shall present a uniform and smooth appearance.

74. Protection

All concrete shall be protected against damage until final acceptance by the Engineer-in-Charge.

Placing Concrete Underwater

a. Under all ordinary conditions, all foundations shall be completely dewatered and concrete placed in the dry. However, when concrete placement under water is necessary, all work shall conform to IS: 456 and the procedure shall be as follows:

- Method of Placement: Concrete shall be deposited underwater by means of tremies, or drop bottom buckets of approved type.
- Direction, Inspection and Approval: All work requiring placement of concrete underwater shall be designed, directed and inspected with due regard to local circumstances and purposes. All underwater concrete shall be placed according to specifications approved by Engineer-in-Charge.

b. Special care shall be taken for prevention of lifting of concrete due to uplift pressure of subsoil water.

75.Precast Concrete

General

Precast concrete units, whether manufactured on or off site, shall comply in every way with the provisions of the contract for in situ concrete. Wherever possible, precast units shall be hydraulically pressed. When ready for incorporation in the works, precast units shall be

responsible for the accuracy of the level, shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

76.Stripping Forms

Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.

77.Precast Units

The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place, contractor shall satisfy the Engineer-in-charge or his representative that the methods he proposes to adopt for these operations will not over-stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.

78.Curing

All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits.

79.Slots, Openings, etc.

General

Slots, openings or holes, pockets, etc., shall be provided in the concrete work in the approved positions or as directed by Engineer-in-charge. Short pipes with puddle collar shall be fixed in the sidewall of suction pipes. They shall be supplied at the appropriate time during construction. Any deviation from the approved drawings shall be made good by contractor at own expense, without damaging any other work. Sleeves, bolts, inserts etc., shall also be provided in concrete work where so required.

80. Grouting

Standard Grout

The proportions of grout shall be such as to produce a flow able mixture consistent with minimum water content and shrinkage. Grout proportions shall be limited as per “Table: Proportions for Standard Grout.”
Table: Proportions for Standard Grout.

	Use	Grout thickness	Mix proportions	W/c ratio (max.)
1	Fluid	Under 25 mm	1 part cement:1 part	0.44
2	General	25mm & over but less than 50mm	1 part cement:2 parts sand	0.53
3	Stiff Mix	50mm & over	1 part cement:3 parts sand	0.53

Sand shall be such as to produce a flow able grout without any tendency to segregate. Sand for general grouting purposes shall be graded within the following limits:

- Passing BIS 2.36 mm sieve 95 to 100%
- Passing BIS 1.18 mm sieve 65 to 95%
- Passing BIS 300 micron sieve 10 to 30%
- Passing BIS 150 micron sieve 3 to 10%

Sand for fluid grouts shall have the fine material passing the 300 and 150 micron sieves at the upper limits specified above. Sand, for still grouts, shall meet the usual grading specifications for concrete laitance. Anchor bolts, anchor bolt holes and the bottoms of equipment and column base plates shall be cleaned of all oil, grease, dirt and loose material. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete surfaces to be grouted shall be saturated with water. Water in anchor bolt holes shall be removed before grouting is started. Forms around base plates shall be reasonably tight to prevent leakage of the grout. Adequate clearance shall be provided between forms and base plate to permit grout to be worked properly into place. Grouting, once started, shall be done quickly and continuously to prevent segregation, bleeding and breakdown of initial set. Grout shall be worked from one side of one end to the other to prevent entrapment of air. To distribute the grout and to ensure more complete contact between base plate and foundation and to help release trapped air, link chains can be used to work the grout into place. Grout throughout holes in base plates shall be by pressure grouting. Variations in grout mixes and procedures shall be permitted if approved by the Engineer-in-charge.

81.Non-Shrinking Grout for Equipment Foundation

Non-shrinking grout shall be used for grouting of machine base plates, anchor bolts, other anchoring devices and at locations where ordinary grouts are ineffective due to shrinkage. It shall be composed of a type of expansive hydraulic sheeting binder and select-graded aggregates. It shall have properties as per “ Table: Proportions for Non-Shrinking Grout”.

Table: Proportions for Non-Shrinking Grout

S.N.	Properties	Values
1	Maximum grain size	6 mm
2	Water % (for 80% flow)	15.17
3	Density of hardened grout	2.27 - 2.30 gm/m1
4	Compressive strength N/sq.mm	
	- Minimum 3 days	23

	- 7 days	34
	- 28 days	45
5	Expansion %	
	- Free	0.10 - 0.20
	- Restrained	0.08 - 0.12

Mixing, batching, cleaning, preparation of surface and curing of non-shrinking grout shall be done as per manufacturer's instructions.

83.Inspection

a. All materials, workmanship and finished construction shall be subject to continuous inspection and approval of the Engineer-in-Charge.
b. All materials supplied by the Contractor and all work or construction performed by the Contractor which is rejected as not being in conformity with the specifications and requirements, shall be immediately replaced.
c. All concrete shall be protected against damage until final acceptance by the Engineer-in-Charge.

84.Clean-Up

a. Upon completion of the concrete work, all forms, equipment, construction tools, protective coverings and any debris resulting from the work shall be removed from the premises.
b. All debris i.e. empty containers, scrap wood, etc., shall be removed to "dump" daily, or as directed by the Engineer-in-Charge.
c. Finished concrete surfaces shall be left in a clean condition satisfactory to the Engineer-in-Charge.

85.Records of Concreting

An accurate and up to date record showing times, dates, weather and temperature conditions when various positions of all the concrete structures forming the works were concreted will be kept by the Engineer-in-charge and shall be countersigned by the Contractor. If the Contractor fails to sign the Engineer-in-Charge's record; it shall nevertheless be regarded as correct and binding on the Contractor. The Contractor has to submit concrete pour card in duplicate duly to be signed to the Engineer-in-Charge for each type of concreting work. Contractor shall keep copy of it, after Engineer-in-Charge has checked and signed the pour card.

86.Supply of Cement

Contractor shall procure / purchase the cement and shall be stacked and well maintained as specified in the earlier sections. Contractor shall procure cement in those quantities required for maximum one month of concreting work and more than the prescribed time limit is not allowed. For any damage to cement the contractor will be responsible and the damaged cement should not be used in the work.

87.Foundation Bedding, Bonding and Jointing

a. All surfaces upon or against which concrete will be placed shall be suitably prepared by thoroughly cleaning, washing and dewatering, as specified or as the Engineer-in-charge may direct, to meet the various situations encountered in the work.
b. Soft or spongy areas shall be cleaned out and backfilled with lean concrete or clean sand fill compacted.

c. Prior to construction of formwork for any item where soil will act as bottom form, approval shall be obtained from the Engineer-in-Charge for the suitability of the soil.

88.Preparation of Rock Strata of Foundations

a. To provide tight bond with rock foundations, the rock surface shall be prepared and the following general requirements shall be observed.
b. Concrete shall not be deposited on large sloping rock surfaces. Where required by the Engineer-in-charge, the rock shall be cut to form rough steps or benches to provide roughness or a more suitable bearing surface.
c. Rock foundation stratum shall be prepared by picking, barring, wedging and similar methods which will leave the rock in an entirely sound and unshattered condition.
d. Shortly before concrete is placed, the rock surface shall be cleaned with high pressure water and air jet even though it may have been previously cleaned in that manner.
e. Prior to placing concrete, the rock surface shall be kept wet for a period of 2 to 4 hours unless otherwise directed by the Engineer-in-Charge.
f. Before placing concrete on rock surfaces all water shall be removed from depressions to permit thorough inspection and proper bonding of the concrete to the rock.

SUB-SECTION–6

FORMWORK

1.Fixing of Formwork

All formwork shall be constructed of plywood or sheet metal. Plywood used for form work shall be conforming to IS: 4990 i.e. Specification for plywood for concrete shuttering works. The materials for form work shall get approved by the Engineer before starting the work. Form work shall be firmly supported, adequately strutted, braced and tied to withstand the placing and vibrating of concrete and the effects of weather. The tolerance on line and level shall not exceed 3 mm and the soffits of beams other than pre-stressed beams shall in the absence of any specified camber, be erected with an upward camber of 6 mm for each 3 meters of span.

The Contractor shall be responsible for the calculations and designs for the formwork, and if required, shall submit them to the Engineer for approval before construction. on formwork to external faces which will be permanently exposed, all horizontal and vertical formwork joints shall be so arranged that joint lines will form a uniform pattern on the face of the concrete. Where the Contractor proposes to make up the formwork for standard sized manufactured formwork panels, the size of such panels shall be approved by the Engineer before they are used in the construction of the Works. The finished appearance of the entire elevation of the structure and adjoining structures shall be considered when planning the pattern of joint lines caused by formwork and by construction joint to ensure continuity of horizontal and vertical lines. Faces of formwork in contact with concrete shall be free from adhering foreign matter, projecting nails and the like, splits or other defects, and all formwork shall be clean and free from standing water, dirt, shavings, chippings or other foreign matter. Joints shall be sufficiently watertight to prevent the escape of mortar or the formation of fins or other blemishes on the face of the concrete.

Formwork shall be provided for the top surfaces of sloping work where the slope exceeds 150 from the horizontal (except where such top surface is specified as spaded finish) and shall be anchored to enable the concrete to be properly compacted and to prevent flotation, care being taken to prevent air being trapped.

Openings for inspection of the inside of the formwork and for the removal of water used for washing down shall be provided and so formed as to be easily closed before placing concrete. Before placing concrete, all bolts, pipes or conduits or other fixtures which are to be built in shall be fixed in their correct positions, and cores and other devices for forming holes shall be held fast by fixing to the formwork or otherwise. Holes shall not be cut in any concrete without approval of the Engineer.

All exterior angles on the finished concrete of 900 or less shall be given 20 mm x 20 mm chamfers unless otherwise ordered by the Engineer.

No ties or bolts or other device shall be built into the concrete for the purpose of supporting formwork without the prior approval of the Engineer. The whole or part of any such supports shall be capable of removal so that no part remaining embedded in the concrete shall be nearer than 50 mm from the surface in the case of reinforced concrete and 150 mm in the case of un-reinforced concrete. Holes left after removal of such supports shall be neatly filled with well rammed dry-pack mortar.

Formwork in contact with the concrete shall be treated with a suitable non-staining mould oil to prevent adherence of the concrete except where the surface is subsequently to be rendered. Care shall be taken to prevent the oil from coming in contact with reinforcement or with concrete at construction joints. Surface retarding agents shall be used only where ordered by the Engineer.

2.Removal of Formwork

Formwork shall be so designed as to permit any removal without resorting to hammering or levering against the surface of the concrete. The periods of time elapsing between the placing of the concrete and the striking of the loads likely to be imposed on the concrete and shall in any case be not less than the periods showed in Table below. Where soffit formwork is constructed in a manner during and after such removal of a sufficient number of adequate supporting props in an undisturbed condition, the Contractor may, with the agreement of the Engineer, remove the formwork at the earlier times listed below provided that the props are left in position.

Position of Form Work	Days for Striking
Walls	1
Sides of beams and columns	2
Slabs (Drops left under)	3
Props to slabs (Span not exceeding 4.5 m)	7
Props to slabs (span exceeding 4.5 m)	14
Beams soffits (props left under)	7
Props to beams (Span not exceeding 6 m)	14
Props to beams (span exceeding 6 m)	21

Notwithstanding the foregoing, the Contractor shall be held responsible for any damage arising from removal of formwork before the structure is capable of carrying its own weight and any incidental loading.

Striking shall be done slowly with utmost care to avoid damage to projections and without shock or vibration, by gently easing the wedges. If after removing the form work it is found that timber has been embedded in the concrete. It shall be removed and made good as specified earlier.

Reinforced temporary openings shall be provided, as directed by the Engineer, to facilitate removal of formwork which otherwise may be inaccessible.

The rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hours not later than 40 hours after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled toward the inside face. Cutting ties back from the faces of the walls and grade beams will not be permitted.

For liquid retaining structures, no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25 mm depth or more from the surface and then the hole shall be made good by cement sand mortar of the same proportions as the concrete just after striking the formwork.

3. Formed Surfaces – Classes of Finish

Finishes to formed surfaces of concrete shall be classified as F1, F2, or F3, or such other special finish as may be particularly specified. If class of finish is not specified the concrete shall be finished to Class F1.

Formwork for Class F3 finish shall be lined with as large panels as possible of non-staining material with a smooth unblemished surface such as sanded plywood or hard compressed fiber board,

arranged in a uniform approved pattern and fixed to back formwork by oval nails. Enfaced wrought boarding or standard steel panels shall not be permitted.

Formwork for Class F2 finish shall be faced with wrought tongued and grooved boards or plywood or metal panels arranged in a uniform approved pattern free from defects likely to detract from the appearance of the surface.

Formwork for Class F1 finish shall be constructed in sheet metal. Surfaces subsequently to be rendered, plastered or tiled shall be adequately scrabbled or hacked as soon as the formwork is removed to reduce the irregularities to not more than half the thickness of such rendering, plastering or bedding for tiles and to provide a satisfactory key.

4.Defects in Formed Surfaces

Workmanship in formwork and concreting shall be such that concrete shall normally require no making good, surfaces being perfectly compacted and smooth.

If any blemishes are revealed after removal of formwork, the Engineer's decisions concerning remedial measures shall be obtained immediately. These measures may include, but shall not be limited to the following:

i) Fins, pinhole bubbles, surface discoloration and minor defects may be rubbed down with sacking immediately after the formwork is removed.

ii) Abrupt and gradual irregularities may be rubbed down with carborundum and water after the concrete has been fully cured. These and any other defects shall be remedied by methods approved by the Engineer which may include using a suitable epoxy resin or, where necessary, cutting out to a regular dovetails shape at least 75 mm deep and refilling with concrete over steel mesh reinforcement sprung into the dovetail.

5.Holes to be Filled

Holes formed in concrete surfaces by formwork supports or the like shall be filled with dry-pack mortar made from one part by weight of ordinary Portland cement and three parts fine aggregate passing IS sieve 1.18 mm. The mortar shall be mixed with only sufficient water to make the materials stick together when being moulded in the hands.

The contractor shall thoroughly clean any hole that is to be filled with dry-pack mortar and where the surface has been damaged, the contractor shall break out any loose, broken or cracked concrete or aggregate. The concrete surrounding the hole shall then be thoroughly soaked after which the surface shall be dried so as to leave a small amount of free water on the surface. The surface shall then be dusted lightly with ordinary Portland cement by means of a small dry brush until the whole surface that will come into contact with the dry-pack mortar has been covered and darkened by absorption of the free water on the surface. The surface shall then be dusted lightly with ordinary Portland cement by means of a small dry brush until the whole surface that will come into contact with the dry-pack mortar has been covered and darkened by absorption of the free water by the cement. Any dry cement in the hole shall be removed.

The dry-pack material shall then be placed and packed in layers having a compacted thickness not greater than 15 mm. The compaction shall be carried out by use of a hardwood stick and a hammer and shall extend over the full area of the layer, particular care being taken to compact the dry-pack against the sides of the hole. After compaction, the surface of each layer shall be scratched the dry-pack fill and striking the block several times. Steel finishing tools shall not be used and water shall not be added to facilitate finishing.

6.Tolerances

Tolerance is a specified permissible variation from lines, grade or dimensions given in approved drawings. No tolerance specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances will be permitted:

Tolerances for RCC Structures

i) Variation from the plumb

a) In lines and surfaces of columns, piers, walls 5 mm per 2.5 m or 25 mm, whichever is less?

b) For exposed corner columns and other conspicuous lines

In any bay or 5 m maximum	5 mm
In 10 m or more	10 mm

ii) Variation from the level or from the grades indicated on the approved drawings

a) In slab soffits, ceilings, beam soffit, and in arises

In 2.5 m	5 mm
In any bay or 5 m maximum	10 mm
In 10 m or more	15 mm

b) For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines

In any bay or 5 m maximum	5 mm
In 10 m or more	10 mm

iii) Variation of the linear building lines from established position in plan and related position of columns, wall and partitions

In any bay or 5 m maximum	10 mm
In 10 m or more	20 mm

iv) Variation in the sizes and locations of sleeves, openings in walls and floors except in the case of and for anchor bolts 5 mm

v) Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and walls

Minus	5 mm
Plus	10 mm

vi) Footings

a) Variation in dimension in plan

Minus	5 mm
Plus	10 mm

b) Misplacement or eccentricity 2% of footing width in the direction of misplacement but not more than 50 mm

c) Reduction in thickness Minus 5% of specified thickness subject to a maximum of 50 mm

vii) Variation in steps

a) In a flight of stairs

Rise	3 mm

Tread 5 mm

b) In consecutive steps

Rise 1.5 mm

Tread 3 mm

Tolerances in other Concrete Structures

viii) All structures

a) Variation of the constructed linear outlines from established position in plan

In 5 m 10 mm

In 10 m or more 15 mm

b) Variations of dimensions to individual structural features from established positions

In 20 m or more 25 mm

In buried construction 50 mm

c) Variation from plumb, from specified batter or from curved surfaces of all structures

In 2.5 m 10 mm

In 5 m 15 mm

In 10 m or more 25 mm

In buried construction twice the above amounts

d) Variation in level or grade indicated on approved drawings in slab, beams, soffits, horizontal grooves and visible arises

In 2.5 m 5 mm

In 7.5 m or more 10 mm

In buried construction twice the above amounts

e) Variation in cross-sectional dimensions of columns, beams, buttresses, piers and similar members

Minus 5 mm

Plus 10 mm

ix) Footings for columns, piers, walls, buttresses and similar members

a) Variation of dimensions in plan

Minus 10 mm

Plus 50 mm

b) Misplacement or eccentricity

2% of footing width in the direction of misplacement but not more than 50 mm.

c) Reduction in thickness

5% of specified thickness subject to a maximum of 50 mm

x) Tolerance in other types of structures shall generally conform to those given in Clause 2.4 of Recommended Practice for Concrete Formwork (American Concrete Institute Act 347).

xi) Tolerance in fixing anchor bolts shall be as follows:

a) Anchor bolts without sleeves + 5 mm

b) Anchor bolts with sleeves + 5 mm for bolts up to 20 mm dia

+ 3 mm for bolts above 32 mm dia

c) Embedded parts + 5 mm in all directions

7.Bracing, Struts and Props

Formwork shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bearers.

The formwork for beams and slabs shall be so erected that the formwork on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Re-propping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the formwork.

If the formwork for a column is erected for the full height of the column, one side shall be left open and built up in sections as placing of the concrete proceeds, or windows may be left for pouring concrete from the sides to limit the drop of concrete to 1.0 m as directed by the Engineer.

SUB-SECTION–7

REINFORCEMENT

1.General

Reinforcement shall be high strength deformed bars as per IS: 1786. Wire mesh or fabric shall be in accordance with IS: 1566. Substitution of reinforcement will not be permitted except upon written approval of the Engineer.

2.Storage

The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber sleepers or the like.

If the reinforcing rods have to be stored for a long duration, they shall be coated with cement wash before stacking and/or be kept under cover or stored as directed by the Engineer.

Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion & deterioration.

3.Quality

No re-rolled material will be accepted. If requested by the Engineer, the contractor shall submit the manufacturer's test certificate for the steel. Random tests on steel supplied by the contractor may be performed by the Engineer as per relevant Indian Standards. All costs incidental to such tests shall be at the contractor's expenses. Steel not conforming to specifications shall be rejected.

All reinforcements shall be clean, free from grease, oil paint, dirt, loose mill scale, loose rust, dust bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer. If welding is approved, the work shall be carried out as per IS: 2751 according to the best modern practices and as directed by the Engineer. In all cases of important connections, tests shall be made to prove that the joints are of full strength of bars welded. Special precautions, as specified by the Engineer, shall be taken in the welding of cold worked reinforcing bars and bars other than mild steel.

4.Laps

Laps and splices for reinforcement shall be as per IS: 456. Splices in adjacent bars shall be staggered and the locations of all splices shall be approved by the Engineer.

5.Bending

Reinforcement bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done cold and without damaging the bars. All bars shall be accurately bent according to the sizes and shapes shown on the approved detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and re-bent in a manner that will injure the material; bars containing cracks/splits shall be rejected. They shall be bent cold, except bars of over 25 mm in diameter which may be bent hot if specifically approved by the Engineer. Bars which depend for their strength of cold working shall not be bent hot. Bars bent hot shall not be treated beyond cherry red colour (nor exceeding 845°C) and after bending shall be

allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and re-bending be such as shall not, in the opinion of the Engineer, injure the material. No reinforcement shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

6.Fixing

Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the approved Drawings by the use of blocks, spacers and chairs, as per IS:2502, to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be securely bound together at all such points with number 16 gauge annealed soft iron wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

7.Nominal Cover to Reinforcement

Nominal cover is the design depth of concrete cover to all steel reinforcements, including links. It is the dimension used in design and indicated in the drawings. It shall be not less than the diameter of the bar.

Minimum values for the nominal cover of normal weight aggregate concrete which should be provided to all reinforcement, including links depending on the condition of exposure described in Clause-8.2.3 and as given in Table –16 of IS:456/2000.

However for a longitudinal reinforcing bar in a column nominal cover shall in any case not be less than 40 mm, or less than the diameter of such bar. In the case of columns of minimum dimension of 200 mm or under, whose reinforcing bars do not exceed 12 mm, a nominal cover of 25 mm may be used. For footings minimum cover shall be 50 mm.

Table IS: 456 - 2000 – Nominal cover to meet Durability Requirements

Exposure	Normal Concrete cover in mm not less than	
Mild	20	
Moderate	30	
Severe		45
Very severe		50
Extreme	75	

The correct cover shall be maintained by cement mortar cubes or other approved means. Reinforcement for footings, grade beams and slabs on sub-grade shall be supported on pre-case concrete blocks as approved by the Engineer. The use of pebbles or stones shall not be permitted.

The 28 days crushing strength of cement mortar cubes/precast concrete cover blocks shall be at least equal to the specified strength of concrete in which these cubes/blocks are embedded.

The minimum clear distance between reinforcing bars shall be in accordance with IS: 456.

8.Inspection

Erected and secured reinforcement shall be inspected and approved by the Engineer prior to placement of concrete.

9.Welding of Reinforcement

Reinforcement which is specified to be welded shall be welded by any process which conforms with the requirements of IS:2751 and which the Contractor can demonstrate by bend and tensile tests will ensure that the strength of the parent metal is not reduced and that the weld possesses a strength not less than that of the parent metal. The welding procedure established by successful test welds shall be maintained and no departure from this procedure shall be permitted.

Welds in positions other than those shown on the approved Drawings shall not be permitted. Tack welding to lightly secure reinforcement in place will be permitted subject to approval of the Engineer.

10.Supply of Reinforcing Bars

Contractor shall make their own arrangements for the supply of steel reinforcement, high yield strength (fe 500D) deformed bars etc. required for the works. Further, the Contractor shall be responsible for payments of applicable duties and taxes etc.

SUB-SECTION – 8

PIPE LINE APPURTENANCES

1.MANHOLES

Manholes shall be constructed in RCC on the drains in the positions shown in the drawings or in such position as the Engineer may direct. The work shall be done strictly in accordance with the detailed drawings except where alterations are required by the Engineer. The excavation shall not be larger than sufficient to admit of the trench being properly timbered.

The bottom of the excavation shall be properly leveled up, rammed and a bed of concrete laid thereon. When the concrete has sufficiently set the construction of the brick walls shall than be proceeded with and all stoneware pipe connections through the walls shall be made and all ironwork fixed in as constructions proceeds.

Manholes shall be topped with a circular frame with cover or cover of such pattern may be ordered by the Engineer. The manhole frame shall be fixed to the top in cement concrete.

The Contractor shall include in his prices for completing all manholes in accordance with the drawings.

The manhole shall be provided with extra heavy duty FRC manhole cover frame of size 560 mm dia for manholes.

The following Indian Standards and its latest revisions shall be applicable for the works included in the contract unless otherwise mentioned below: IS: 4111(part1)-1986

i) The manhole shaft and corbelling portion shall be constructed with RCC M25 grade. The thickness of corbelling and the barrel thickness is to be provided as per details of the construction drawings .

ii) Depth

The depth of the manholes shall be reckoned from the ground level/road level to the top of raft.

iii) Rungs

Rungs shall be provided in all manholes and shall be of plastic coated steps and of suitable dimensions as per IS: 5455-1969. These rungs may be 300 mm apart vertically and shall project a minimum of 100 mm beyond the finished surface of the manhole wall. The top rung shall be 450 mm below the manhole cover and the lowest not more than 300 mm above the benching.

iv) FRC Manhole covers and frames

The size of manhole covers shall be such that there shall be clear opening of not less than 560 mm diameter for manholes. When heavy duty fiber reinforced concrete manhole covers and frames are used they shall conform to IS: 1728 (Parts 1) 1974. The frames of manhole shall be firmly embedded in concrete alignment and level in plain concrete on the top.

2.Drop Manholes

Wherever the difference between the invert levels of downstream pipe and upstream pipe is greater than 60 cm, a drop manhole shall be provided at that position. The locations of the drop manholes shall be provided in construction drawings.

SUB-SECTION -9

SPECIFICATION FOR FRC MANHOLE COVERS

1.SCOPE

Contractor's scope includes the design, manufacture, supplying and fixing the FRC manhole frame and covers. The wet concrete mix is subjected to pressure applied through a hydraulic jack through a plunger kept at the top of the wet mix. The FRC manhole covers shall be able to resist 35 MT load bearing capacity. The thickness of the heavy duty manhole covers shall not be less than 10.5 cm. A 25x3 mm thick MS Flat all around the frame is welded to the main reinforcement of the frame so as to get a clear opening of 560 mm diameter. A 18 SWG MS strap all around the cover and lifting arrangement of 12 mm diameter MS bars welded to the main reinforcement are also to be provided for lifting the manhole covers. A coat of epoxy paint shall be applied to the underside and sides of the frame and cover.

2.GENERAL

a) The quality of materials, method of testing shall be approved by the Engineer in Charge.

b) The Engineer shall have the right to inspect the source/s of material/s, the layout and procurement, the equipment, quality control system, testing of material etc. If the Engineer desires the sample of the FRC cover or materials used for the manufacture of FRC covers, test certificate from approved laboratory. Then the contractor shall arrange the same without any extra cost.

3.MATERIAL

a) Cement

Unless otherwise specified in the specification or called for the engineer, cement shall be ordinary Portland cement as per the relevant IS code. More details are mentioned on the section of concrete under this bid document.

b) Fine aggregates

The details of this have been mentioned in the section concrete and allied works of this bid document.

c) Coarse aggregate

Coarse aggregate for concrete, shall conform to IS 383. This shall consist of crushed stone and shall be clean and free from elongated flaky or laminated pieces, adhering coating, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter, the maximum size of the aggregate shall be 12 mm.

d) Water

Water for use in concrete and curing shall conform to IS 456/1964 and its subsequent amendments.

e) Water/cement ratio

The water-cement ratio shall be 0.40 to 0.45 to yield a good workability. The workability can be increased by using appropriate admixtures.

e) Fiber Reinforcement

The fibers are cut from 0.40 mm dia. high tensile steel wires of about 12000 kg/cm2 ultimate stress. The fiber content for the manufacture of FRC covers is of the order 1 to 1.25% by volume of the concrete.

g) Design Mix

The vendor shall design the mix design of the concrete which is expected to give a concrete compressive strength of about 350 kg/cm2 at 28 days.

h) Mixing

Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency.

i) Placing and Compaction

The reinforcement shall be placed in proper position in steel moulds coated with a thin layer of mould oil. Concrete shall be filled to slightly overfill the moulds and compacted by vibration and struck off level with a trowel.

Use of needle vibrators for compacting the wet concrete mix containing fibers is not recommended since the holes left by the vibrator in the wet mix may not close after its removal owing to interlocking of the fibers with the mix. Compaction by means of shutter or form or table vibrators is recommended. In case of extra heavy duty and heavy duty cover frames, compaction by means of pressure cum-vibration technique may also be employed so as to achieve dense and strong concrete. Clear cover to reinforcement shall be not less than 15 mm. After de-moulding, cover frames shall be protected until they are sufficiently hardened to permit handling without damage.

j) Curing

The hardened concrete manhole cover frame shall be placed in a curing water tank or taken to the curing yard where they shall be kept continuously moist for at least 28 days. Frames may be water cured by immersion in water, covering with water saturated material or by a system of perforated pipes, mechanical sprinklers or any other approved method that will keep to cover frames moist during the specified curing period. Steam curing of manhole cover frames may be adopted instead of method specified above provided the requirements of pressure or non pressure steam curing are fulfilled and the manhole cover frames meet the requirements specified in this section.

k) Edge Protection and Finishing

The top and inside surface of cover frames shall be smooth. To prevent the top outer edge

from possible damages, it shall be protected by 25 mm x 3 mm mild steel flat as part of the frame. Sufficient number of steel connectors shall be welded to the inner surface of the mild steel flat so as to connect it with the frame reinforcement and these shall be embedded in the concrete during casting. Exposed surface of mild steel flat shall be given suitable treatment with anticorrosive paint or coating. Suitable arrangements may be made for fixing the manhole cover frames in position on the manholes by mutual agreement between the manufacturer and the purchaser.

l) Physical requirements

GENERAL

All the frames shall be sound and free from cracks and other defects which interfere with the proper placing of the units or impair the strength or performance of the units. Minor chippings resulting from the customary methods of handling and transportation shall not be deemed ground for rejection.

m) Dimensions

The inside dimensions at top shall match with the corresponding covers so that the maximum clearance at top between the frame and the cover is not more than 5 mm and the top surface of the frame and cover is in level within a tolerance of .± 5 mm.

h) Scale of Sampling

LOT

In a consignment 500 precast concrete manhole cover frames or a part thereof, of the same type and dimensions and belonging to the same batch of manufacturer, shall be grouped together to constitute a lot for ascertaining conformity to the materials in the lot to requirements of this specification, samples shall be tested from each lot separately. The number of cover frames to be selected from the lot shall depend on the size of lot and shall be according to the following table:

SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF EFECTIVES

No. of cover Frames in the Lot Dimensional Requirement

Sample size	Acceptance Number
Up to 100	3

100 to 200	5
200 to 300	10
301 to 500	15

SUB-SECTION 10

RCC SOCKET SPIGOT NON-PRESSURE PIPES

1.GENERAL

RCC NP3 class pipes shall be used. These pipes shall be in accordance with the specifications mentioned in IS: 458-1988 with amendments NO.1 & 2 and subsequent modifications made thereon, if any.

2.MATERIALS

For pre cast concrete pipes, materials complying with the requirements given in (i) to (v) shall be used.

i) Cement: Cement used for the manufacture of reinforced concrete pipes shall conform to IS: 2691989.

ii) Aggregates: Aggregates used for the manufacture of reinforced concrete pipes shall conform to IS: 3831970. The maximum size of aggregate should not exceed one third the thickness of the pipe or 20 mm, whichever is smaller.

ii) Reinforcement: Reinforcement used for the manufacture of the reinforced concrete pipes shall be mild steel Grade I or medium tensile steel bars conforming to IS: 226-1975. Where soft grade wire is used, it shall conform to IS: 280-1978.

iv) Concrete or Mortar: Concrete used for the manufacture or reinforced cement concrete pipes and collars shall conform to IS: 456-1978 and shall also be in accordance with Concrete and Allied works Section of Technical Specifications.

The concrete for non-pressure pipes shall have a minimum compressive strength of 20 N/mm2 at 28 days. If mortar is used, it shall have a minimum cement content of 450kg/m3 and a compressive strength not less than 20 N/mm2 at 28 days. Compressive strength tests shall be conducted on 15 cm cubes in accordance with the relevant requirements of IS: 456-1978 and IS: 516-1959.

The manufacturer shall give a certificate indicating quantity of cement in the concrete mix.

v) Rubber Ring: Rubber ring chords used in pipe Joints shall conform to Type 1A of IS: 5382-1985.

3.DESIGN

i) General

Reinforced concrete pipes either spun or cast shall be designed such that the maximum tensile stress in the circumferential steel due to specified hydrostatic test pressure does not exceed the limit of 125 N/mm2 in the case of mild steel rods, 140 N/mm2 in the case of hard-drawn steel wires and high strength deformed steel bars and wires, the barrel thickness shall be such that under the specified hydrostatic test pressure, the maximum tensile stress in concrete, when considered as effective to take stress along with the tensile reinforcement shall not exceed 2

N/mm2 but the wall thickness shall be as per IS:458-1988.
Longitudinal reinforcement shall be provided to ensure rigidity and correct location of cages (grids) longitudinally and to limit the effects of transverse cracking. Minimum longitudinal reinforcement shall be as given in Table 2 of 7 of IS:458.

ii) Reinforcement

The reinforcement in the reinforced concrete pipe shall extend throughout the length of the pipe and shall be so designed that it may be readily placed and maintained to designed shape and in the proper position within the pipe mould during the manufacturing process. The circumferential and longitudinal reinforcement shall be adequate to satisfy the requirements specified under (i) above. The pitch of circumferential reinforcement shall be not more than the following:

a) 200 mm for pipes of nominal internal diameter 80 to 150 mm,
b) 150 mm for pipes of nominal internal diameter 200 to 350 mm, and
c) 100 mm for pipes of nominal internal diameter 400 mm and above.

The pitch shall also be not less than the maximum size of aggregate plus the diameter of the reinforcement bar used.
The quantity and disposition of steel in pipes may be decided by mutual agreement between the PIU ERA and the supplier; however, it shall be proved by calculations and tests that the quality of the pipes conforms to all the requirements specified in the standard. In the absence of calculations and tests, the reinforcement given in Tables 2 to 7 of IS:458 shall be used as minimum reinforcement.
If so required by the Engineer, the manufacturer shall give a certificate indicating the details relating to quality, quantity and dispersion of steel in the pipes as well as the clear cover to the steel provided in the pipe.

iii) Ends of Pipes

Dimensions of spigot and socket for rubber ring roll on jointed pipes shall be as given in Tables 9 to 13 of IS:458. Reinforcement in socket of rubber ring jointed pipes shall be as given in Table 14 of IS458-1988.

4.MANUFACTURE

i) General

The methods of manufacture shall be such that the form and dimensions of the finished pipe are accurate within the limits specified in this standard. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis.

ii) Concrete mixing

Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour ad consistency, but in no

case shall mixing be done for less than two minutes. Water-cement ratio shall be less than 0.5.
The concrete shall be placed before setting has commenced. It should be ensured that the concrete is not dropped freely so as to cause segregation. The concrete shall be consolidated by spinning. Vibrating, spinning combined with vibrations, or other appropriate mechanical means.

iii) Reinforcement Cages

Reinforcement cages for pipes shall extend throughout the pipe barrel. The cages shall consist of spirals or rings and straight of hard-drawn steel wire or mild steel rod and may be circular. Circular cages and longitudinal reinforcement shall be placed symmetrically with respect to the thickness of the pipe wall. The spirals shall end in a complete ring at both the ends of a pipe.
Pipes having barrel thickness above 75 mm shall have double reinforcement cage and the amount of steel in the outer cage shall be 75% of the mass of the inner cage whilst the total shall conform to the requirements specified in ,the relevant tables of this standard. The total longitudinal steel pipe shall be given in the relevant tables of the standard but the distribution shall be such that the round shape of the cage is not disturbed.
Diagonal reinforcement may be provided in pipes for which the cages are not welded so as to help in binding the cage securely. It shall, however, be ensured that the clear cover for any reinforcement is not below the limits specified in 5.4 of IS 458. If diagonal reinforcement is provided, it sl1all be considered as part of the longitudinal reinforcement given III Tables 2 to 7 of IS.458.Single reinforcement cage shall be located near the inner surface of the pipe with adequate clear cover.

iii) Water Curing

Pipes manufactured in compliance with this standard shall be water cured for a period of not less than 2 weeks in case of pipes made from ordinary Portland Cement or Portland slag cement or Portland pozzuolana cement or hydrophobic Portland cement, and not less than 1 week in case of pipes made from rapid-hardening Portland cement or 43 grade ordinary Portland cement. Pipes may be water-saturated material or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other approved method that will keep the pipe moist during the specified curing period. In the case of large pipe projecting partly above the water level, the projected portion shall be kept wet by any suitable means.

5. DIMENSIONS

i) Pipes

The internal diameter, wall thickness, length of pipes, minimum reinforcements and strength test requirements for different classes of pipes shall be as specified in Tables 1 to 7 of IS 458. The manufacturer shall inform the PIU of the effective length of spigot and socket that he is able to supply. All the Pipes shall be manufactured using Sulphate resistant cement. The ends of the pipes shall conform to Clause 5.3 of IS 458 as applicable for S&S joints. The rubber ring shall conform to IS 5382 and IS 12820 as applicable for drainage pipe lines and shall be of type 'IA'. The diameters of pipes shall be as required for drainage pipes as per designs and drawings.
The method of manufacture shall be such that the form and dimensions of the finished pipes are accurate within the limits specified in relevant IS: 458. Pipes manufactured in compliance with IS: 458 shall be either water cured or steam cured in accordance with the relevant requirements of IS: 458.
The Internal diameter, wall thickness, length of barrel, reinforcement (longitudinal and spiral), type of ends and minimum clear cover to reinforcement, strength test requirements, tolerances on - overall length, internal diameter or dimensions of sockets / spigots of pipes shall be as per the relevant clauses / tables of IS: 458. Minimum clear cover to reinforcement shall be 15 mm. The tolerances regarding overall length, internal diameter of pipes or socket and barrel wall thickness shall be as per relevant clauses of IS: 458. Each pipe can be in lengths of 2 m to 4 m based on availability, ease in handling, transportation and laying.

	Dimensions	Tolerances
a.	Overall length	+1% of standard length
b.	Internal diameter of pipes/socket:	
	i) up to and including 300 mm	+ 3 mm
	ii) Over 300 mm up to and including 600 mm	+ 5 mm
	iii) Over 600 mm up to and including3 300 mm to 800 mm	+ 7 mm
	iv) over 300 mm to 800 mm	+ 10mm
c.	Up to 30 mm (Including)	+/- 2 mm
	i. Over 30 mm up to and including 50 mm	+/- 3 mm
	ii. Over 50 mm up to and including 65 mm	+/- 4 mm
	iii. Over 65 mm up to and including 80 mm	+/- 5 mm
	iv. Over 80 mm up to and including 95 mm	+/- 6 mm
	v. Over 95 mm	+/- 7 mm

The workmanship and finish for the pipe will conform to the relevant Standard Specifications. Cleaning of pipes shall conform to Standard Specifications. Jointing of pipes with Spigot and socket joints shall conform to Standard Specifications.

6.Testing of pipes during manufacture

During manufacture, tests on concrete shall be carried out as per IS: 456. The specimen of pipes for the following tests shall be selected in accordance with Sub-Clause 9.1 of IS: 458 and tested in accordance with the methods described in IS: 3597:

1. Hydrostatic testing

2. Three edge bearing test
3. Absorption test

7.Laying of the pipe

Laying of concrete pipes shall conform to the Code of practice of IS: 783. Pipes shall be laid underground with a minimum earth cover of 1.0m. Pipes shall be generally laid in sections of 300 m each. Laying of pipes shall be as per Clause 15, Standard Specifications for Procurement of Project Works. All pipes, fittings and material shall be tested and approved by the Engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material. Before laying the pipe, necessary bedding shall be provided wherever required as per Sub-Clauses 6.4.1, 6.4.2, 6.4.3 and 6.4.4 of this section.

Pipes and fittings shall be laid and jointed in accordance with all relevant recommendations of the manufacturer. Any variations between the manufacturer's recommendations and this specification shall be highlighted in the Contractor's Method Statements and a ruling will be given with the Engineer's agreement. Pipes and fittings shall be checked for soundness and be thoroughly cleaned out immediately prior to laying and jointing.

The setting of the pipeline to the required levels and alignment shall be carried out by approved procedure such as boning between sight rails or the use of laser systems. Sight rails, if used, shall be at a suitable height vertically above the line of pipes or immediately adjacent thereto, and there shall, at no time, be less than three sight rails in position on each length of pipelines under construction to any one gradient. Large diameter pipes, 1000 mm diameter or greater, shall be individually set to level and line by instrument.
For pipelines laid in trenches and headings the permissible tolerances in line and level unless otherwise specified shall be ± 3 mm in level and ± 12 mm from centre line between manholes or access points. Also where a gravity pipeline shown as a straight line between manholes it will not be accepted as having passed the final test unless a full circular light can be sighted through the bore of the pipe for the length concerned.

8.Jointing of pipes

The pipe joints shall be of flexible joints, jointed by rubber ring of type 'IA', as per IS 783-1985. The sections of the pipe shall be jointed in such a manner that there shall be as little unevenness as possible along the inside of pipe. Care should be taken while jointing to provide the correct gap between the end of spigot and back of the socket to ensure flexibility at each joint and correct location. For pipeline jointing systems incorporating flexible jointing rings pipes shall be laid with a gap between the end of the spigot and the base of the socket, or between spigots. This gap shall be not less than 6 mm or greater than one third of the straight draw test dimension specified for the pipe joint or as recommended by the pipe manufacturer, and it shall be achieved by approved means, such as marking the outside of the pipe or using removable metal or hardwood feelers.
The annular space between the pipe and the socket at a flexible joint shall be sealed with an approved joint sealant to prevent the ingress of loose material or concrete. Sealing shall be done

on completion of a satisfactory preliminary testing prior to concreting or backfilling, but not prior to the test.

After laying a length of pipeline but before preliminary testing is carried out, the pipeline shall be checked for level and gradient on top of the pipes. If a pipe is not at the correct level, it shall be unjointed and removed, the bed shall be adjusted and the pipe shall be re-laid and rechecked for line and level. After the joint has been made and the preliminary testing completed the annular gap at a socket or collar outside the flexible jointing ring shall be closed with fine grained clayey soil or cotton waste to prevent the entry of granular material.

Pipelines shall be temporarily capped when pipe laying ceases to prevent the ingress of foreign matter. The Contractor shall ensure that the pipes remain clean and free from obstructions, and if required by the Engineer, the pipelines shall be cleaned out using approved methods and equipment which do not damage the internal lining of the pipes and manholes. The joints shall be finished as directed by the Engineer. The quality of rubber ring, tolerances, etc., shall be in conformity with IS 5382-1985.

9.Measurement of pipes

The length of the drainage pipes shall be measured between the inner surfaces of consecutive manholes at the invert level of the pipes along the central line of pipeline to the nearest centimeter.

10.Testing and Commissioning

Site Testing of all Appliances

Following tests shall be carried out as per IS 1742

Smoke Test:

All soil pipes, waste pipes, and vent pipes and all other pipes when above ground shall be approved gas tight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have filled with water. The smoke shall be produced by burning oil or tarpaper or similar material in the combustion chamber of a smoke machine, Chemical smokes shall not be used.

Water Test

After laying and jointing of GSW, RCC and CI Pipes and before backfilling the trenches, the entire section of the drainage pipe is to be checked for water tightness as per Sub-Clause 7.1.5.1 of CPHEEO Manual on "Drainage pipe age and Sewage Treatment", second edition.
The pipeline shall be tested for Water tightness of joints. The test shall be carried out from manhole to manhole. All pipe ends in the manholes except those of the section under testing, shall be closed and the pipeline shall be filled with water so that water level is upto the top of the manholes.
The pipeline shall be subject to a test pressure of 2.5 meters head of water at the highest point of section under test for 10 minutes. The leakage or quantity of water to be supplied to maintain the

test pressure during the period of 10 minutes shall not exceed 0.2 lit/mm dia. of pipe per km length per day.

For non-pressure pipe it is better to observe the leakage for 24 hrs if feasible.
A knuckle bend shall temporarily be joined at the top end and a sufficient length of the vertical pipe jointed so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation. Subsidence of the test water may be due to one or more of the following causes:

a. Absorption by pipes and joints
b. Sweating of pipes or joints
c. Leakage at joints or from defective pipes and
d. Trapped air

Allowance shall be made for (a) by adding water until absorption has ceased after which the test procedure should commence. Any leakage will be visible and the defective part of the work should be cut and made good. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe or joint shall be watched for and taken as indicating a defect to be made good. This test will not be applicable to sanitary pipe work above ground level.
The pipe section shall be retested after rectification of defects. In case joints are found to leak, they shall be repaired or redone and test shall be repeated until the joints are approved by Engineer-in-Charge, without any extra cost.
After completion of the test all temporary seals will be removed, the test water shall be drained out / pumped out and the line cleaned properly.

Test for Straightness and obstruction

Before commissioning the cleanliness of the pipeline is to be checked by the following tests.

11. Torch & Mirror Test

In this method of testing, a torch will be held one end of the pipeline inside a manhole and its image through the pipeline will be reflected and seen on a mirror held at the opposite end of the pipeline, inside the next manhole. Any obstruction / debris / major mis-alignment will not give a clear image in which case the pipeline will again be cleaned / rectified and the test re-done.

Ring Test

In this method of testing two steel/ wooden rings of suitable thickness and design shall be fixed facing each other at a distance of 2 feet or more. The block of rings shall be inserted from one end of the pipeline, inside manhole and pulled by a rope fixed to the block from the other end of the pipeline, inside the next manhole. The rings shall be of dia 2” less than the inside dia of pipe under testing. The rope used for pulling the ring block may be inserted in the pipeline by suitable means. Any construction / debris/major misalignment will prevent the ring to pass through the pipeline in which case the pipeline will again be cleaned/rectified and the test redone, and no extra payment will be made. The ring test shall be performed for the complete network of the drainage pipe system before the same is put in commission and/or

By inserting at the high end of the drainage pipe or drain a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball should roll down the invert of the pipe and emerge at the lower end.

12.Test Records

Complete test records shall be kept of all tests carried out of drainage pipes both during construction and after being service. All tests at factory at site shall be carried out in the presence of the Engineer or his representative only.

Commissioning

After satisfactory testing of the entire drainage pipe lines including laterals, branch and mains shall be commissioned for operation.

13.Trial Run of the Water Carriage System (UGD SYSTEM)

After commissioning, the Contractor shall run the system for 30 (thirty) days to demonstrate satisfactory performance to the Engineer prior to taking over by the Employer. The cost towards Contractor's Engineer and other operating personnel during the said period of trial run, along with cost of tools and spare parts, which are required for maintenance of the system, shall be borne by the Contractor and shall be included in his price.

In the event that the system or any of the facilities do not satisfactorily achieve the required performance standards during this period, the trial run period shall be extended until such time as the Contractor has satisfactorily rectified any deficiencies as may be necessary to satisfy the performance requirements. No additional compensation will be paid to the Contractor for such extension.

SUB-SECTION 11

Collection Sump Well & Pump House Building.

1.Scope of work

Collection Sump Well, Silt chamber, Valve chamber– Location: within the pumping station site at Bonpura - Padshahibagh.
All other items such as delivery pipe, valves, specials, pressure gauges shall be as per specifications given in Bill of Quantities and drawings.

Collection Sump Well, Silt chamber, Valve chamber.
The Wet wells shall be constructed using M25 grade concrete for raft; walls. The entire RCC wall shall be form finished and smoothly finished. Necessary arrangements for Monorail, chequered plates for opening shall be provided as per specifications.
The Pump house building shall be of framed structure constructed as per drawings provided. The wall shall be built and painted as per specifications given in Bill of Quantities. All windows shall be wooden-glazed windows as per specification. Rolling shutters, ventilators, hand railing, MS ladders, flooring, brackets, steps, ramps shall be provided as per construction drawing and standard specifications.

Valve pits, foundation for pumps with foundation bolts & nuts etc., rain water pipes, , screens for screen chamber shall be provided as per construction drawing and standard specifications. Other miscellaneous works like providing compound wall, gates, steps, handrails and MS ladder, which has been proposed for wells shall be executed as per bill of quantities.

Suitable arrangements shall be made for dewatering the sub soil water continuously during earthwork excavation and sinking operation of well steining of sump well , screen chamber, silt chamber & valve chambers. It shall be taken care that the subsoil water is lowered continuously until the completion of excavation, sinking operation ,bottom plugging and the completion of the structures as per details and specification of construction drawings. Necessary care should be taken during execution of the work in all respects as directed by the Engineer. The external sides around the wells shall be backfilled using suitable selected material to the satisfaction of the Engineer. The excess earth shall be disposed at a place shown by the Engineer in charge. No extra payment shall be paid.

Before quoting the rate for this contract, the contractor should acquaint himself about the topography & sub strata of the area where the storm water pipe drain is to be laid and dewatering station including its all ancillary structures are to be
The entire RCC wall shall be form finished & smoothly finished

2.Screen Chamber

The screens shall be provided using coarse bar & fine bars screens as per the details given in construction drawings and arranged in inclined position .The partition/internal walls, perforated platform etc., shall be constructed using M25 concrete. The chamber shall be provided with PVC encapsulated foot rests & ladder for access as specified in the construction drawings.

3.Control Panel Room

The Control Panel Room as mentioned in the drawings shall be housed in RCC framed structure. The Grade of concrete shall be M25 as mentioned. All the wall shall be constructed using table moulded bricks in CM 1:4, and plastered internally in CM 1:4, 20mm thick and externally in CM 1:4, 20mm thick. The wall shall be painted as per specifications mentioned in Bill of Quantities. The building shall be provided with plinth protection as per specification in this Section.

4.Operators Rooms

The Operator Room as mentioned in the drawings shall be housed in RCC framed structure. The Grade of concrete shall be M25 as mentioned. All the wall shall be constructed using table moulded bricks in CM 1:4, and plastered internally in CM 1:4, 20mm thick and externally in CM 1:4, 20mm thick. The wall shall be painted as per specifications mentioned in Bill of Quantities. The building shall be provided with plinth protection as per specification.

5.General Civil Specifications

The following civil specifications shall be applicable for providing and executing all such items which are not mentioned in foregoing paras but are necessary to be provided and for the items which are mentioned above but require some elaboration. No extra cost shall be paid for such items.

It should clearly be understood by the Contractors/tendering firms that all civil specifications mentioned here below shall be treated as part of the technical specifications already mentioned. The specific requirement of different items of work involved in the construction, completion and commissioning of the Drainage scheme as a whole, shall be provided in accordance with the requirement given in these civil specifications.

The superstructure and substructure of all building works shall be as specified, for which, prior approval from the Engineer is to be obtained before setting out for the work

6.Brick Work Masonry

All brick work in foundation, substructure or superstructure, including partition walls, with bricks of standard size, with necessary centering, scaffolding and curing shall be done in accordance with the Standard Specifications. Nothing extra would be paid for any lift and minor architectural work required to be done as per drawings / directions of the Engineer.

All Partition walls shall be built in brick masonry as per drawing, in 1:4 cement mortar with two numbers of 6 mm diameter MS bars at every third course embedded in cement mortar.

7.Brick Work in CM 1:4

All brickwork in foundation, substructure or superstructure, including partition walls, with table moulded bricks of standard size, with necessary centering, scaffolding and curing shall be done in accordance with the Standard Specifications. Nothing extra would be paid for any lift and minor architectural work required to be done as per drawings / directions of the Engineer.

All Partition walls shall be built as per drawings in brick masonry, in 1:4 cement mortar with two numbers of 6 mm diameter MS bars at every third course embedded in cement mortar. The outer walls of room shall be built in 230 mm brick walls, in cement mortar 1:6.

8.Cement Plaster over Brick Work

Cement mortar plastering shall be done on all brickwork at any height or depth. The thickness of cement plaster shall be 12 mm for walls of 115 mm thick and it shall be 20 mm thick for wall greater than 115 mm thick. The mix of cement mortar for plastering shall be 1:4. for internal and CM 1:4 for external walls. The work shall include providing and removing necessary scaffolding, lime rendering for inside plastering curing, and rounding of corners etc., complete.

9.Minimum clear cover over Reinforcement

Minimum clear cover over the steel reinforcement shall be 50mm for the members contact with soil/ground water. For other faces the clear cover over the reinforcement shall be as per latest IS Codes.

10.Tested Steel

Only tested steel reinforcement shall be used on the work, and the Contractor shall produce the test certificate of the manufacturer to the Engineer. The grade of steel shall be Fe: 500 D conforming to relevant IS codes.

11.Chajjas and Canopies

RCC Chajjas shall be provided over the external windows and ventilators, projecting 600 mm wide all round, unless otherwise specified. The RCC canopies over the main entrance door and rolling shutter shall have a minimum projection of 1.50m to-2.0 m over the full width of the door / rolling shutter + 450 mm. (minimum) The average thickness of the chejjas shall be 75mm.The top of the chejjas shall be sloping towards the front outer edge, with proper bedding and drip moulding at the edge.

12.Flooring and Finishing

The flooring of all buildings, unless otherwise specified shall be laid in PCC (M15 grade) over which appropriate flooring with mosaic tiles shall be provided unless or otherwise mentioned.

Flooring and Finishing

Whenever heavy duty flooring is required, it shall be of minimum 15mm thick with floor hard ate or iron ate and cement mixed well in dry state in the proportion of 1:4 by weight (at 3.45 Kgs iron ate/sq.m) in one part to two parts by volume of crushed granite 6mm and downsize. These flooring shall be laid over cement concrete bed of M15 with 10 cm thick granite jelly, provided on RCC slab/raft. The flooring shall be well finished.

13.Filling below flooring

The portion below the flooring should be provided with approved filling material including watering and compacting in layers of 150mm thick, for a depth of 300 mm minimum.

14.Backfilling of trenches and around foundations of structures

General

The Contractor shall use selected surplus soils from excavated materials for backfilling. All fill material shall be subject to Engineer's approval. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities. The detailed specifications for backfilling shall be as per Clause 8 of IS: 3114-1994.

15.Disposal of Surplus Excavated Material

The Contractor shall have to cart the surplus excavated material from the site and dispose off to the place decided by the Engineer.

16.Doors, Windows, Ventilators, Rolling shutter, GI Pipe Railing & MS Ladder

Doors, Windows, Ventilators, and Rolling shutter shall be provided in the building as per construction drawings, bill of quantities and standard specifications. The following specifications shall be followed during execution unless or otherwise there are changes.

The Contractor shall submit the drawings for approval and upon approval shall provide and fix the same. The work shall include cost of cartage, manufacturing, all skilled and unskilled labour, tools and plants, all fittings including lock and required painting as directed of approved quality.

17. MS Rolling Shutters

These shall be provided and fixed in the pump house/ Operator room, Diesel generator, switchgear and control room as per relevant Indian Standard specification.

All the rolling shutters shall be of the sizes as given in the relevant specifications of pump house or switchgear and control room. The rolling shutter shall be of pull and push type made out of 18 gauge x 7.50 cm MS lathers of convex corrugations complete with side guides and bottom rails with inter locking arrangements for steel lathers by means of alternate and clips. The suspension shafts shall be provided with high-tension coil type springs. The rolling shutters shall be provided with top cover, locking arrangements, pulling hooks, handles with all fittings and other accessories. The rolling shutter shall be painted with two coats of red oxide factory finish and two coats of synthetic enamel painting over shop painting etc., complete. The minimum height of the rolling shutter shall as specified in the construction drawing.

Top cover of pull and push rolling shutters made out of 20 gauge MS sheet bend to shape including cost of red lead primer and providing and applying enamel paint two coats, applied after surface brushing to give a even shade after cleaning oil, grease, girt and any

other foreign matter, including cost of materials, labour, HOM of machinery, with all lead and lifts complete as per specifications and as directed by the Engineer.

18.GI Pipe Railing

All platforms, floors etc., shall be provided and fixed with 40 mm internal diameter pipes in three rows, fixed to 1:2:4 vibrated RCC post of size 100mm x 100mm at top and 150mm x 150mm at bottom placed at 2.0m intervals, for height of 750mm including curing, fixing the post firmly using (1:2:4) concrete in the floors, finishing the posts smooth, curing, painting the GI pipe with anti corrosive paint over one coat of primer etc., complete as directed by the Engineer.

19.MS Ladders with hand railing

Sturdy MS ladders, 450 mm wide, using angle iron 65mm x 65mm x 8mm size and 20mm MS bars at 25cms c/c with necessary supports of same angle iron as directed including hand railing on both sides with 25mm dia GI pipes with angle iron props at 2m intervals and 0.50m height with two coats of non-poisonous anticorrosive bituminous paint. It shall include the cost of all material, skilled and unskilled labour, fabrication, transportation, painting etc.

20.Painting Wood Work and Steel Work

All steel doors, windows, ventilators, rolling shutters, pipe railing, MS grills, outer surfaces of pipes, valves, gates etc., shall be painted with two or more coats of superior quality enamel paint of approved shade and make over a priming coat of superior quality primer. The surface shall be cleaned, rubbed and made smooth evenly, before applying a priming coat and enamel paint.

This painting will include cost of all material, skilled and unskilled labour, cartage and applying wherever required as mentioned above.

21.**Water Proofing Cement Paint**

The external faces of all walls, chejjas and parapets of all structures and buildings from ground level to the top of the structure shall be provided with two coats of water proofing cement paint of approved make, quality and shade. This cement painting shall be done over one coat of primer of approved make, quality and shade. Before applying primer coat, the surface shall be rubbed, cleaned and made even. Any paint stains wherever not necessary shall be cleaned. The work shall include cost of all material, necessary centering, scaffolding, skilled and unskilled labour, tools, brushes, transportation etc.
In general all the RCC structures above the ground level/ partially below G.L shall be painted using approved quality of waterproof cement paint after getting approval from the Engineer.

21.**Foot-rests (PVC encapsulated steps)**

PVC encapsulated MS footrests shall be provided and fixed at all such units already mentioned in the technical specifications and at valve chambers, sludge pits, manholes, septic tanks etc. It shall comprise steel bar of 23 mm x 25 mm minimum cross-section encapsulated with minimum 5 mm thick plastic all-round as per IS 10910 with the overall minimum length of 263mm and width 165 mm and anchored in cement concrete and fixed

23.**Inspection Chamber**

Inspection chamber of size 60cms x 60cms (inner dimensions), 65cmx45 cm and 45cm x 45cm shall be constructed with cement concrete in 1:2:4, 20 cm thick on a bed of 15 cm. thick CC 1:3:6, including providing and fixing cover in CC 1:2:4, 75mm thick and other details as per standard specification.

24.**Valve chambers**

Valve chambers and manholes are to be constructed as per drawings and as per specification, wherever required as directed by the Engineer, minimum thickness in bottom floor and wall thickness shall be as per construction dawing. The valve chambers and manholes shall be covered by RCC slab or with medium duty CI manhole cover or with CI frame or MS Grills as per engineer's requirement. The PVC encapsulated MS foot rests shall be provided in the valve chambers.
The size of the valve chamber shall be worked out on the basis of size of the valve plus 0.6 m minimum space around on all faces of any valve. Floor will have minimum 300 mm gap under the valves. The valve chamber floor shall have a mild slope towards an opening provided on one of the sidewalls, to drain off any collected or scoured water. The valves shall be supported on suitable foundations. The foundations of valve chamber shall be designed considering scouring action. The other specifications of the valve chamber shall be as per Standard Specifications.

25.Foundation for Pumps, Motors and Transformers

The foundations for pumps and motors shall be designed based on sound engineering practices and manufacturers recommendations, taking into consideration all vibration and other forces acting upon them. Foundations for transformers shall conform to IS: 10028 (Part-II).

26.Nuts and bolts

All nuts and bolts shall be of mild steel but shall have coating of zinc (Galvanised), unless otherwise specifically mentioned.

27.**Protection against Floatation due to Uplift Pressure**

The Contractor shall ensure that all structures constructed underground by lowering sub soil water level, shall be protected against uplift and consequent floatation and tilting. An adequate measure including non-stop dewatering shall be taken as per relevant IS codes.

SUB-SECTION 12

Road Restoration Works

EXTRACT OF SECTION 400 OF MORTH AND SPECIFICATIONS. WATER BOUND MACADAM SUB- BASE / BASE

1.Scope.

This work shall consist of clean, crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary and water laid on a properly prepared sub grade / sub-base/ base or existing pavement, as the case may be and finished in accordance with the requirements of these Specifications and in close conformity with the lines, grades, cross-sections and thickness as per approved plans or as directed by the Engineer.

It is, however, not desirable to lay water bound macadam on an existing thin black topped surface without providing adequate drainage facility for water that would get accumulated at the interface of existing bituminous surface and water bound macadam.

2. **Materials**

Coarse aggregates: Coarse aggregates -shall be either crushed or broken stone, crushed slag, over burnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel/ shingle is used, not less than 90 per cent by weight of the gravel/ shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-6. The type and size range of the aggregate shall be specified in the Contract or shall be as specified by the Engineer. If the water absorption value of the coarse aggregate is greater than 2 %, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part 5).

Crushed or broken stone: The crushed or broken Stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and. other deleterious material.

TABLE 400-6. Physical Requirements of Coarse Aggregates For Water Bound Macadam for Sub-Base/Base Courses.

Z	Test Method	Requirements
1.Los Angeles Abrasion value * Aggregate Impact value	I S:2386 (Part4) IS:2386 (Part-4) or IS:5640	40% (Max) 30% (Max)
2. Combined Flakiness Elongation Indices (Total)	IS:2386 (Part-1)	30% (Max)

* Aggregate may satisfy requirements of either of the two tests.

** Aggregates like brick metal, kankar, laterite etc. which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with IS: 5640.

*** The requirement of flakiness index and elongation index shall be enforced only in the case of crushed broken stone and crushed slag.

Crushed slag: Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed 'slag shall not be less than 11.2 kN per m3 and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

Chemical stability: To comply with requirements of appendix of BS: 1047
Sulphur content : Maximum 2 per cent
Water absorption: Maximum 10 per cent

. Over burnt (Jhama) brick aggregates: Jhama brick aggregates shall be made from over burnt bricks or brick bats and be free from dust and other objectionable and deleterious materials.

. Grading requirement of coarse aggregates: The coarse aggregates shall conform to one of the Grading given in Table 400-7 as Specified, provided, however, the use of Grading No.l shall be restricted to sub-base courses only.

TABLE 400-7. GRADING REQUIREMENTS OF COARSE AGGREGATES

Grading No.	Size Range	IS Sieve Designation	% by weight passing
1	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2	63 to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings i.e. 2 & 3, it shall be 75 mm.

Screenings: Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate. However, where permitted, predominantly non-plastic material such as moorum or gravel (other than rounded river borne material) may be used for this purpose

provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 per cent.

Screenings shall conform to the grading set forth in Table 400-8. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400-9. The table also gives the quantities of materials (loose) required for 10 m2 for sub-base/base compacted thickness of 100/75 mm.

The use of screenings shall be omitted in the case of soft aggregates such as brick metal, kankar, laterites, etc. as they are likely to get crushed to a certain extent under rollers.

TABLE 400-8. GRADING FOR SCREENINGS

Classification	Size of Screenings	IS Sieve	% by weight passing the IS Sieve
A	13.2 mm	13.2 mm 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10
B	11.2 mm	11.2 mm 5.6 mm 180 micron	100 90-100 15-35

TABLE 400-9. Approximate Quantities Of Coarse Aggregates and Screenings Required For 100/75 MM Compacted Thickness Of Water Bund Macadam (WBM) Sub-Bas/Base Course For 10M2 AREA.

Classification	Size Range (mm)	Compacted Thickness (m)	Loose Qty.	Screenings			
				Stone Screening		Crushable type such as Moorum or Gravel	
				Grading Classification & Size (mm)	For WBM, Sub-base / base course (Loose quantity)	Grading Classification & Size	Loose quantity
Grade 1	90 to 45	100	1.21 to 1.43 m3	Type A 13.2	0.27 to 0.30 m3	Not uniform	0.30 to 0.32 m3
Grade 2	63 to 45	75	0.91 to 1.07 m3	Type A 13.2	0.12 to 0.15 m3	Not uniform	0.22 to 0.24 m3
- do -	- do -	- do -	- do -	Type B 11.2	0.20 to 0.22 m3	Not uniform	- do -
Grade 3	53to 22.4	75	- do –	- do –	0.18 to 0.21 m3	Not uniform	- do –

Binding material : Binding material to be used for water bound macadam as a filler material meant for preventing raveling, shall comprise of a suitable material approved by the Engineer having a Plasticity Index(PI) value of less than 6 as determined in accordance with IS: 2720 (Part-5).

The quantity of binding material where it is to be used will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06-0.09 m3 / 10m2 and 0.08-1010m3 / 10m2 for 100 mm compacted thickness.

The above-mentioned quantities should be taken as a guide only, for estimation of quantities for construction etc.

Application of binding materials may not be necessary when the screenings used are of crushable type such as moorum or gravel wearing course where water bound macadam is proposed to be laid over it. However, where the intensity of rain is' low and the interface drainage facility is efficient, water bound macadam can-be laid over the existing thin bituminous surface by cutting 50 mm x 50 mm furrows- at an angle of 45 degrees to the centre line of the pavement at one meter intervals in the existing road. The directions and depth of furrows shall be such that they provide adequate bondage and also serve to drain water to the existing granular base course beneath the existing thin bituminous surface.

Inverted choke: If water bound macadam is to be laid directly over the sub grade, without any other intervening pavement course, a 25 mm course of screenings (Grading B) or coarse sand shall be spread on the prepared sub grade before application of the aggregates is taken up. In case of a fine sand or silty or clayey sub grade, it is advisable to lay 100 mm insulating layer of screening or coarse sand on top of fine grained soil, the gradation of which will depend upon whether it is intended to act as a drainage layer as well. As a preferred alternative to inverted choke, appropriate geosynthetics performing functions of separation and drainage may be used over the prepared sub grade as directed by the Engineer. Section 700 shall be applicable for use of geosynthetics.

Spreading coarse aggregates: The coarse aggregates shall be spread uniformly and evenly upon the prepared sub grade/sub-base/ base to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 2 and 3, as specified in Clause 404.2.5. Wherever possible, approved mechanical devices such as aggregate spreader shall be used to spread the aggregates uniformly so as to minimise the need for manual rectification afterwards. Aggregates placed at locations which are inaccessible to the spreading equipment, may be spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly from vehicles. No segregation of large or fine aggregates shall be allowed and the coarse aggregate, as spread shall be of uniform gradation with no pockets of fine material.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. The

surface shall be checked frequently with a straight edge while spreading and rolling so as to ensure a finished surface as per approved drawings.
The coarse aggregates shall not normally be spread more than 3 days in advance of the subsequent construction operations.

Rolling: Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 80 to 100 kN capacity or tandem or vibratory rollers of 80 to 100 kN static weight. The type of roller to be used shall be approved by the Engineer based on trial run.

Except on super elevated portions where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward and backward. The roller shall then move inward parallel to the centre line of the road, in successive passes uniformly lapping preceding tracks by at least one half widths
Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However, where screenings are not to be applied, as in the case of crushed aggregates like brick metal, laterite and kankar, compaction shall be continued until the aggregates are thoroughly keyed. During rolling, slight sprinkling of water may be done, if necessary. Rolling shall not be done when the sub grade is soft or yielding or when it causes a wave-like motion in the sub grade or sub-base course.
The rolled surface shall be checked transversely and longitudinally, with templates and any irregularities corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to desired cross fall (camber) and grade. In no case shall the use of screenings be permitted to make up depressions.

Material, which gets crushed excessively during compaction or becomes segregated shall be removed and replaced with suitable aggregates.
It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses as per Clause 407.4.1.

Application of screenings: After the coarse aggregate has been rolled to Clause 404.3.4, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.
The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms, hand-brooms or both. In no case shall the screenings be applied as fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse

aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate.

The spreading, rolling, and brooming of screenings shall be carried' out in only such lengths of the road which could be completed within one day's operation.

Sprinkling of water and grouting: After the screenings have been applied, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into voids and to distribute them evenly. The sprinkling, sweeping and rolling operation shall be continued, with additional screenings applied as necessary until the coarse aggregate has been thoroughly keyed, well-bonded and firmly set in its full depth and a grout has been formed of screenings. Care shall be taken to see that the base or subgrade does not get damaged due to the addition of excessive quantities of water during construction.

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (Is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done, after the sub-base attains adequate strength, as directed by the Engineer.

Application of binding material: After the application of screenings in accordance with Clauses 404.3.5 and 404.3.6. the binding material where it is required to be used (Clause 404.2.7) shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

Setting & drying: After the final compaction of water bound macadam course, the pavement shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set. The Engineer shall have the discretion to stop hauling traffic from using the completed water bound macadam course, if in his opinion it would cause excessive damage to the surface.

The compacted water bound macadam course should be allowed to completely dry and set before the next pavement course is laid over it. Surface Finish and Quality Control of Work

The surface finish of construction shall conform to the requirements of Clause 902.

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

The water bound macadam work shall not be carried out when the atmospheric temperature is less than 0°C in the shade.

Reconstruction of defective macadam: The finished surface of water bound macadam shall conform to the tolerance of surface regularity as prescribed-in Clause 902. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to sub grade soil mixing with the aggregates, the course to its full thickness shall be scarified over the affected area, reshaped with added material or removed and replaced with fresh material as applicable and recompacted. In no case shall depressions be filled up with screenings or binding material.

Arrangement for Traffic

During the period of construction, the arrangement of traffic shall be done as per clause 112.

3.Measurements for payment

Water bound macadam shall be measured as finished work in position in cubic meters.

. Rate

The Contract unit rate for water bound macadam sub-base/base course shall be payable in full for carrying out the required operations including full compensation for all components listed in Clause 401.8 (i) to (v) including arrangement of water used in the work as approved by the Engineer.

EXTRACT OF SECTION - 500 OF MORTH &SPECIFICATIONS
PRIME COAT OVER GRANULAR BASE

Scope

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to a porous granular surface preparatory to the superimposition of bituminous treatment or mix.

Materials

Primer: The choice of a bituminous primer shall depend upon the porosity characteristics of the surface to be primed as classified in IRC: 16. These are:

- Surfaces of low porosity; such as wet mix macadam, water bound macadam.
- Surfaces of medium porosity; such as cement stabilised soil base.

- Surfaces of high porosity; such as a gravel base.

Primer viscosity: The type and viscosity of the primer shall comply with the requirements of IS 8887, as sampled and tested for bituminous primer in accordance with these standards. Guidance on viscosity and rate of spray is given in Table 500-1.

TABLE 500-1. VISCOSITY REQUIREMENT AND QUANTITY OF LIQUID BITUMINOUS PRIMER

Type of surface	Kinematic Viscosity of Primer at 60° Centistokes	Quantity of Liquid Bituminous Material per 10 m2/kg
Low porosity	30- 60	6 to 9
Medium porosity	70 -140	9 to 12
High porosity	250 - 500	12 to 15

4.Choice of primer: The primer shall be bitumen emulsion, complying with IS 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of medium curing cutback as per IS 217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

5.Weather and Seasonal Limitations

Bituminous primer shall not be applied to a wet surface (see 502.4.2) or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Surfaces which are 155 to receive emulsion primer should be damp, but no free or standing water shall be present.

6.Construction

Equipment: The primer distributor shall be a self-propelled or towed bitumen pressure sprayer equipped for spraying the material uniformly at specified rates and temperatures. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

Preparation of road surface: The surface to be primed shall be prepared in accordance with Clauses 501.8. and 902 as appropriate. Immediately prior to applying the primer the surface shall be carefully swept clean of dust and loose particles, care being taken not to disturb the interlocked aggregate. This is best achieved when the surface layer is slightly moist (lightly sprayed with water and the surface allowed to dry) and the surface should be kept moist until the primer is applied.

Application of bituminous primer: The viscosity and rate of application of the primer shall be as specified in the Contract, or as determined by site trials carried out as directed by the Engineer. Where a geosynthetic is proposed for use, the requirements of Clauses 703.3.2 and 703.4 shall apply. The bituminous primer shall be sprayed uniformly in accordance with Clause 501.The method for application of the primer will depend on the

type of equipment to be used, size of nozzles, pressure at the spray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Curing of primer and opening to traffic: A primed surface shall be allowed to cure for at least 24 hours or such other period as is found to be necessary to allow all the volatiles to evaporate before any subsequent surface treatment or mix is laid. Any unabsorbed primer shall first be blotted with an application of sand, using the minimum quantity possible. A primed surface shall not be opened to traffic other than that necessary to lay the next course. A very thin layer of clean sand may be applied to the surface of the primer, to prevent the primer picking up under the wheels of the paver and the trucks delivering bituminous material to the paver.

. Tack coat: Over the primed surface, a tack coat should be applied in accordance with Clause 503.

7. Quality Control of Work

For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

8.Arrangements for Traffic

During construction operations, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

9. Measurement for Payment

Prime coat shall be measured in terms of surface area of application in square meters.
Rate

The contract unit rate for prime coat with adjustments as described in Clause 502.7 shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 401.8 (i) to (v) and as applicable to the work specified in these Specifications. Payment shall be made on the basis of the provision of prime coat at an application rate of 0.6 kg per square meter, with adjustment, plus or minus, for the variation between this amount and the actual amount approved by the Engineer after the preliminary trials referred to in Clause 502.4.3.

10.TACK COAT

Scope

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the Contract or instructed by the Engineer.

11.Materials

Binder: The binder used for tack coat shall be bitumen emulsion complying with IS 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of cutback bitumen as per IS 217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

12.Weather and Seasonal Limitations

Bituminous material shall not be applied to a wet surface or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cutback bitumen, the surface shall be dry.

13.Construction

Equipment: The tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a specified rate. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

Preparation of base: The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clauses 501.8 and 902 as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.

Application of tack coat: The application of tack coat shall be at the rate specified in the Contract, and shall be applied uniformly. If rate of application of Tack Coat is not specified in the contract then it shall be at the rate specified in Table 500-2.

TABLE 500-2. RATE OF APPLICATION OF TACK COAT

Type of Surface	Quantity of liquid bituminous material (Kg/m2)
i) Normal bituminous surfaces	0.20 to 0.25
ii) Dry and hungry bituminous surfaces	0.25 to 0.30
iii) Granular surfaces treated with primer	0.25 to 0.30
iv) Non bituminous surfaces a) Granular base (not primed) b)Cement concrete pavement	 0.35 to 0.40 0.30 to 0.35

The normal range of spraying temperature for a bituminous emulsion shall be 20°C to 70°C and for a cutback, 50°C to 80°C if RC-70/MC-70 is used. Where a geosynthetic is proposed for use, the provisions of Clauses 703.3.2 and 703.4.4 shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar, and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Where the material to receive an overlay is a freshly laid bituminous layer that has not been subjected to traffic or contaminated by dust, a tack coat is not mandatory where the overlay is completed within two days.

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Curing of tack coat: The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or vehicles shall be allowed on the tack coat other than those essential for the construction.

14.Quality Control of Work

For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

15.Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112

16.Measurement for Payment

Tack coat shall be measured in terms of surface area or application in square meters.

17.Rate

The contract unit rate for tack coat shall be payment in full for carrying out the required operations including for all components listed in Clause 401.8 (i) to (v) and as applicable to the work specified in these Specifications. The rate shall cover the provision of tack coat at 0.2 kg/m2, with the provision that the variance in actual quantity of bitumen used will be assessed and the payment adjusted accordingly.

18.BITUMINOUS CONCRETE

Scope

This clause specifies the construction of Bituminous Concrete, for use in wearing and profile corrective courses. This work shall consist of construction in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface. Single layers shall be 25mm to 100mm in thickness.

. **19. Materials**

Bitumen: The bitumen shall be paving bitumen of Penetration grade complying with Indian Standard Specification for Paving Bitumen, IS: 73 and of the penetration indicated in Table 500-18, for bituminous concrete, or this bitumen as modified by one of the methods specified in Clause 521, or as-otherwise specified in the Contract. Guidance on the selection of an appropriate grade of bitumen is given in The Manual for Construction and Supervision of Bituminous Works.

Coarse aggregates: The coarse aggregates shall be generally as specified in Clause 507.2.2, except that the aggregates shall satisfy the physical requirements of Table 500-17.

Fine aggregates: The fine aggregates shall be all as specified in Clause 507.2.3.

Filler: Filler shall be generally as specified in Clause 507.2.4. . Where the aggregates fail to meet the requirements of the water sensitivity test in Table 500-17 then 2 % by total weight of aggregate, of hydrated lime shall be added without additional cost.

Aggregate grading and binder content: When tested in accordance with IS: 2386 Part 1 (Wet grading method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table 500-18 for gradings 1 or 2 as specified in the Contract.

20.Mixture Design

Requirements for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 500-19. The requirements for minimum % voids in mineral aggregate (VMA) shown in Table 500-12.

Binder content: The binder content shall be optimised to achieve the requirements of the mixture set out in Table 500-19 and the traffic volume as specified in the Contract. The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2, replacing the aggregates retained on the 26.5mm sieve and retained on the 22.4mm sieve, where approved by the Engineer.

TABLE 500-17.Physical Requirements for Coarse Aggregate for Bituminous Concrete Pavement Layers

Property	Test	Specification
Cleanliness (dust)	Grain size analysis'	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index	Max 30% (Combined)2
Strength*	Los Angeles Abrasion Value 3 Aggregate Impact Value 4	Max 30% Max 24 %
Polishing	Polished Stone Value 5	Min 55
Durability	Soundness:6 Sodium Sulphate Magnesium Sulphate	Max 12% Max 18%
Water Absorption	Water absorption 7	Max 2%

Stripping	Coating and Stripping of Bitumen Aggregate Mixtures 9	Minimum retained coating 95%
Water Sensitivity **	Retained Tensile Strength 8	Min 80%

Notes: 1. IS: 2386 Part I
2. IS: 2386 Part I
(the elongation test to be done only on non-flaky aggregates in the sample) .
3. IS: 2386 Part 4*
4. IS: 2386 Part 4*
5. BS: 812 Part 114
6. IS: 2386 Part 5
7. IS: 2386 Part 3
8. AASHTO T283**
9. IS: 6241

* Aggregate may satisfy requirements of either of these two tests.
** The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

Job mix formula: The procedure for formulating the job mix formula shall be generally as specified in Clause 507.3.3 and the results of tests enumerated in Table 500-19 as obtained by the Contractors.

Plant trials - permissible variation in job mix formula: The requirements for plant trials shall be all as specified in Clause 507.3.4 and permissible limits for variation as shown in Table 500-13.

Laying trials: The requirements for laying trials shall be all as specified in Clause 507.3.5.

21.Construction Operations

Weather and seasonal limitations: The provisions of Clause 501.5.1 shall apply.

TABLE 500-18. COMPOSITION OF BITUMINOUS CONCRETE PAVEMENT LAYERS

Grading	1	2
Nominal aggregate size	19mm	13mm
Layer Thickness	50-65 mm	30-45 mm
IS Sieve' (mm)	Cumulative % by weight of total aggregate passing	
45		
37.5		
26.5	100	
19	79-100	100
13.2	59-79	79-100
9.5	52-72	70-88
4.75	35-55	53-71
2.36	28-44	42-58
1.18	20-34	34-48
0.6	15-27	26-38
0.3	10-20	18-28

0.15 0.075	5-13 2-8	12-20 4-10
Bitumen content % by mass of total mix 2	5.0 - 6.0	5.0 - 7.0
Bitumen grade (pen)	65	65

Notes: 1. The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve. 2. Determined by the Marshall method.

TABLE 500-19. REQUIREMENTS FOR BITUMINOUS PAVEMENT LAYERS

Minimum stability (kN at 60°C)	9
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the Specimen
Per cent air voids	3-6
Per cent voids in mineral aggregate (VMA)	~~See table 500 -12~~ ~~65-75~~
Per cent voids filled with bitumen (VFB)	Min 75 percent retained strength
Loss of stability on immersion in water at 60°C (ASTM D 1075)	

Preparation of base: The surface on which the bituminous concrete is to be laid shall be prepared in accordance with Clauses 501 and 902 as appropriate, or as directed by the Engineer. The surface shall be thoroughly swept clean by mechanical broom and dust removed by compressed air. In locations where a mechanical broom cannot access, other approved methods shall be used as directed by the Engineer.

Geosynthetics: Where Geosynthetics are specified in the Contract this shall be in accordance with the requirements stated in Clause 703:

Stress absorbing layer: Where a stress absorbing layer is specified in the Contract, this shall be applied in accordance with the requirements of Clause 522.

Tack coat: Where specified in the Contract, or otherwise required by the Engineer, a tack coat shall be applied in accordance with the requirements of Clause 503.

Mixing and transportation of the mixture: The provisions as specified in Clauses 501.3 and 501.4 shall apply.

Spreading: The general provisions of clauses 501.5.3 and 501.5.4 shall apply.

. **Rolling**: The general provisions of clauses 501.6 and 501.7 shall apply, as modified by the approved laying trials.

22.Opening to Traffic

The newly laid surface shall not be open to traffic for at least 24 hours after laying and the completion of compaction, without the express approval of the Engineer in writing.

23.Surface Finish and Quality Control

The surface finish of the completed construction shall conform to the requirements of Clause 902. All materials and workmanship shall comply with the provisions set out in Section 900 of this Specification.

24.Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112

25.Measurement for Payment

The measurement shall be all as specified in Clause 507.8.

26.Rate

The contract unit rate shall be all as specified in Clause 507.9, except that the rate shall include the provision of bitumen at 5.0 per cent, by weight of total mixture. The variance in actual percentage of bitumen used will be assessed and the payment adjusted up or down, accordingly.

27.SURFACE DRESSING

Scope

This work shall consist of the application of one coat or two coats of surface dressing, each coat consisting of a layer of bituminous binder sprayed on a previously prepared base, followed by a cover of stone chips rolled in to form a wearing course to the requirements of these Specifications. For information on the Design of Surface Dressing refer to the Manual for Construction and Supervision of Bituminous Works.

28.Materials

Binder: The binder shall have a kinematic viscosity lying in the range
lxl04 to 7xl05 centistokes at the expected range of road surface temperatures at the construction site during the period of laying. The type of binder to be used will be stated in the Contract documents and shall comply with one of the following:

Paving Bitumen IS: 73
Bitumen Emulsion IS: 8887

Aggregates: The chips shall conform to the requirements of Clause 504.2.2, except that their water absorption shall be restricted to a maximum of 1% and they shall have a Polished Stone value, as measured by the method given in BS812 (Part 114), of not less than 60. The chips shall be single sized, clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter and conforming to one of the gradings given in Table 500-21.

Rates of spread of binder and chips: For the purpose of pricing the Bill of Quantities the rates of spread given in Table 500-20 shall be priced.

TABLE 500-20. NOMINAL RATES OF SPREAD FOR BINDER AND CHIPPINGS

Nominal Chipping Size mm	Binder (penetration grade bitumen) kg/m2	Chips m3/m2
19	1.2	0.015
13	1.0	0.010
10	0.9	0.008
6	0.75	0.004

Note:

1. These rates of spread are for pricing purposes (Clause 510.2.3 and Clause 51^8)
2. For emulsion, these rates of spread are for the residual bitumen and appropriate adjustment must be made to determine the total quantity.
3. Refer to Manual for Construction and Supervision of Bituminous Works for the procedure of determining the rates of spread of binder and chips.

Anti-stripping agent: Where the proposed aggregate fails to pass the stripping test then an approved adhesion agent (Appendix 5 for details) may be added to the binder in accordance with the manufacturer's instructions. The effectiveness of the proposed anti-stripping agent must be demonstrated by the Contractor, before approval by the Engineer.

Pre-coated chips: As an alternative to the use of an adhesion agent the chips may be pre-coated before they are spread except when the sprayed binder film is a bitumen emulsion. Pre-coating the chips may be carried out in any one of the two methods:

a) Mixing them with 0.75 to 1.0 per cent of paving bitumen by weight of chips in a suitable mixer, the chips being heated to 160°C and the bitumen to its application temperature. The pre-coated chips shall be allowed to cure for at least one week or until they become non sticky and can be spread easily.

b) Spraying the chips with a light application of creosote, diesel oil or kerosene at ambient temperature. This spraying can be done in a concrete mixer or on a belt conveying the chips from stockpile to gritting lorries.

29.Construction operations

Weather and seasonal limitations: Clause 501.5.1 shall apply.

TABLE 500-21. GRADING REQUIREMENTS FOR CHIPS FOR SURFACE DRESSING

IS Sieve Designation mm	Cumulative % by weight of total aggregate passing for the following nominal sizes (mm)			
	19	13	10	6
26.5	100	-	-	-
19	85-100	100	-	-
13.2	0-40	85-100	100	-
9.5	0-7	0-40	85-100	100
6.3	-	0-7	0-35	85-100
4.75	-	-	0-10	-
3.35	-	-	-	0-35
2.36	0-2	0-2	0-2	0-10
0.60	-	-	-	0-2
0.075	0-1.5	0-1.5	0-1.5	0-1.5
Minimum65% by weight of aggregate	Passing 19 mm, retained 13.2mm	Passing 13.2 mm, retained 9.5 mm	Passing 9.5mm, retained 6.3mm	Passing 6.3 mm, retained 3.35 mm

Preparation of base: The base on which the surface dressing is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross section in accordance with Clause 501 or as directed by the Engineer. Prime coat, where needed, shall be provided as per Clause 502 or as directed by the Engineer. Where the existing surface shows signs of fatting up, the excess bitumen shall be removed by burning off, or manually, as specified in the Contract or directed by the Engineer. The bituminous surface to be dressed shall be thoroughly cleaned either by using a mechanical broom and / or compressed air, or any other approved equipment / method as specified in the Contract or by the Engineer. The prepared surface shall be dust free, clean and dry, (except in the case of cationic emulsion where the surface shall be damp).

Application of binder: The equipment and general procedures shall all be in accordance with the Manual for Construction and Supervision of Bituminous Works. The application temperature for the grade of binder used shall be as given in Table 500-22 and the rate of spray as given in 510.2.3.

Application of stone chips: The equipment and general procedure shall all be in accordance with the Manual for Construction and Supervision of Bituminous Works. For relatively small areas of surface dressing, careful application of chips by hand may be acceptable if approved by the Engineer. The rate of application of chips shall be as determined by the procedure given in the Manual for Construction and Supervision of Bituminous Works. Immediately after application of the binder, clean, dry chips (in the case of emulsion binder the chippings may be damp) shall be spread uniformly on the surface so as to cover the surface completely with a single layer of chips.

TABLE 500-22. SPRAYING TEMPERATURES FOR BINDERS

Binder grades	Whirling spray jets		Slot jets	
	Min°C	Max°C	Min°C	Max°C
Penetration Grades				
400 / 500	160	170	140	150
280 / 320	165	175	150	160
180 / 200	170	190	155	165
80 /100	180	200	165	175

Rolling: Rolling of the chips should preferably be carried out by a pneumatic tyred roller in accordance with Clause 501.6 and Clause 501.7. Traditional steel wheeled rollers tend to crush the aggregates and if their use cannot be avoided their weight should be limited to 8 MT Rolling shall commence at the edges and progress towards the centre except in super-elevated and un-directional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. While rolling is in progress additional chips shall be spread by hand in necessary quantities required to make up irregularities. Rolling shall continue until all aggregate particles are firmly embedded in the binder and present a uniform closed surface.

Application of second coat of surface dressing: Where surface dressing in two coats is specified, the second coat should not be applied until the first coat has been open to traffic for 2 or 3 weeks. The surface on which the second coat is laid must be clean and free of dust. The construction operations for the second coat shall be the same as described in Clauses 510.3.3 to 510.3.5.

30.Opening to Traffic

Traffic shall not be permitted to run on any newly surface dressed area until the following day. In special circumstances, however, the Engineer may allow the road to be opened to traffic immediately after rolling, but in such cases traffic speed shall be limited to 20 km per hour until the following day.

31.Surface Finish and Quality Control of Work

The surface finish of construction shall conform to the requirements of Clause 902.
For control on the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

32.Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.
Measurement for Payment
Each coat of surface dressing shall be measured as finished work, for the area instructed to be covered, in square meters.

33.Rate

The Contract unit rate for surface dressing, based on the notional rates of spread for binder and each size of chippings given in Clause 510.2.3, which shall be adjusted, plus or minus, for the difference between the notional rates of spread and the rates of spread determined as described in the Manual for Construction and Supervision of Bituminous Works, and approved by the Engineer, multiplied by the rates entered in the Bill of Quantities for binder and each size of Chipping. The adjusted rate shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2. (i) to (xi).

34. ADVERSE WEATHER CONDITIONS

Cold Weather Concreting:

Where concrete is to be deposited at or near freezing temperature, precautions shall be taken to ensure that at the time of placing, it has a temperature of not less than 5 degrees Celsius and that the temperature of the concrete shall be maintained above 4 degrees Celsius until it has thoroughly hardened. When necessary, concrete ingredients shall be heated before mixing but cement shall not be heated artificially other than by the heat transmitted to it from other ingredients of the concrete. Stock-piled aggregate may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or on sheet metal over fire. In general, the temperature of aggregates or water shall not exceed 65 degrees Celsius. Salt or other chemicals shall not be used for the prevention of freezing. No frozen material or materials containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to freezing weather shall have entrained air and the water consent of the mix shall not exceed 30 litres per 50 kg of cement.

35.PROTECTION AND CURING

Concreting operations shall not commence until adequate arrangements for concrete curing have been made by the Contractor.
Curing and protection of concrete shall start immediately after compaction of the concrete to protect it from:

- Premature drying out particularly by solar radiation and wind
- High internal thermal gradients
- Leaching out by rain and flowing water
- Rapid cooling during the first few days after placing
- Low temperature or frost.

Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement. Where members are of considerable size and length, with high cement-content, accelerated curing methods may be applied, as approved by the Engineer.

Water Curing

Water for curing shall be as specified in Section 1000.

Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacks, canvas, Hessian or similar materials and shall be kept constantly wet for a period of not less than 14 days from the date of placing of concrete.

Curing Compounds.

Curing compounds shall only be permitted in special circumstances and will require specific approval of the Engineer. Curing compounds shall not be used on any surface which requires further finishing to be applied. All construction joints shall be moist, cured and no curing compound will be permitted in locations where concrete surfaces are required to be bonded together.

Curing compounds shall be continuously agitated during use. All concrete cured by this method shall receive two applications of the curing compound. The first coat shall be applied immediately after acceptance of concrete finish. If the surface is dry, the concrete shall be saturated with water and curing compound applied as soon as the surface film of water disappears, the second application shall be made after the first application has set. Placement in more than two coats may be required to prevent streaking.

36.FINISHING

Immediately after the removal of forms, exposed bars or bolts, if any, shall be cut inside the concrete member to a depth of at least 50 mm below the surface of the concrete and the resulting holes filled with cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners, and other defects, shall be thoroughly cleaned, saturated with water, and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces, which have been pointed, shall be kept moist for a period of twenty tour hours. Special pre-packaged proprietary mortars shall be used where appropriate or where specified in the drawing.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges. Immediately on removal of, forms, the concrete work shall be examined by the Engineer before any defects are made good.

The work that has sagged or contains honeycombing to an extent detrimental to structural safety or architectural appearance shall be rejected. Surface defect of a minor nature may be accepted. On acceptance of such work by the Engineer, the same shall be rectified as directed by the Engineer.

37.TOLERANCES

Tolerances for dimensions/shape of various components shall be as indicated in these specifications or shown on the drawings or as directed by the Engineer.

38.TESTS AND STANDARDS OF ACCEPTANCE

Concrete shall conform to the surface finish and tolerance as prescribed in these specifications for respective components.
Random sampling and lot-by-lot of acceptance inspection shall be made for the 28 days cube strength of concrete.

Concrete under acceptance shall be notionally divided into lots for me purpose of sampling, before commencement of work. The delimitation of lots shall be determined by the following:

- No individual lot shall be more than 30 Cum in volume
- At least one cube forming an item of the sample representing the lot shall be taken from concrete of the same grade and mix proportions cast on any day.
- Different grades of mixes of concrete shall be divided into separate lots
- Concrete of a lot shall be used in the same identifiable component of the bridge

Sampling and testing
Concrete for making 3 test cubes shall be taken from a batch of concrete at point of delivery into construction, according to procedure laid down in IS: 1199.
A random sampling procedure to ensure that each of the concrete batches forming the lot under acceptance inspection has equal chance of being chosen for taking cubes shall be adopted.

150 mm cubes shall be made, cured and tested at the age of 28 days for compressive strength in accordance with IS: 516. The 28-day test strength result for each cube shall form an item of the sample.

Test specimen and sample strength: Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or for any other purpose.
The test strength of the sample shall be the average of the strength of 3 cubes. The individual variation should not be more than ± 15 per cent of the average.
Frequency: The minimum frequency of sampling of concrete of each grade shall be in accordance with Table 1700-8

TABLE 1700-8

Quantity of Concrete in work, m3	No. of samples
1 - 5	1
6-15	2
16-30	3
31-50	4

51 and above	4 plus one additional sample for each additional 50 m' or part thereof

At least one sample shall be taken from each shift of work.

Acceptance criteria

Compressive Strength

When both the following conditions are met, the concrete complies with the specified compressive strength:

- The mean strength determined from any group of four consecutive samples should exceed the specified characteristic compressive strength.
- Strength of any sample is not less than the specified characteristic compressive strength (-)3 MPa.
- The quantity of concrete represented by the test results include the batches from which the first and last samples were taken, together with all intervening batches.

Chloride and Sulphate Content.

The total chloride and sulphuric anhydride (SO3) content of all the constituents of concrete as a percentage of mass of cement in the mix shall not exceed the values given in this section of the specifications.

Density of Fresh Concrete

Where minimum density of fresh concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

Density of Hardened Concrete

Where minimum density of hardened concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

Permeability Test

The concrete should pass the following test if it is properly compacted and is not considered permeable. Prepare a cylindrical test specimen 150 mm dia and 160 mm high

After 28 days of curing, the test specimen is fined in a machine such that the specimen can be placed in water under pressure up to 7 bars. A typical machine is shown in Appendix

At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for next 24 hours..

After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.

The water penetration in the broken core is to be measured with a scale and the depth of penetration assessed in mm (max. permissible limit 25 mm).

If the concrete is not able to meet any of the standards of acceptance as prescribed, the effect of such deficiency on the structure shall be investigated by the Contractor as directed by the Engineer. The Engineer may accept the concrete as sub-standard work. Any additional work required by the Engineer for such acceptance shall be carried out by the Contractor at his cost. In case the concrete is not found to be acceptable after investigation, the Contractor shall remove the rejected concrete forthwith.

39.MEASUREMENTS FOR PAYMENT

The measurement for payment shall be made in accordance with IS 1200 (ALL PARTS)

40. Specifications

The specifications given above are for information purposes. However the specifications for all civil items will be as laid down in CPWD Book of specifications (latest edition) and MORTH 5th Edition (for road work) . Wherever there is discrepancy in the specifications given above and in CPWD Book of specifications or MORTH 5TH Edition, the superior specifications provided in any of the above will prevail.

7.1.2 ELECTROMECHANICAL WORKS

7.1.2.1 MECHANICAL WORKS

Specifications for Pumping Station

7.1.2.1.1 General

The technical specifications for the Mechanical and Electrical material and equipment(s) are detailed below.

All valves, MS pipe specials, Pumps, Valves, Transformers, Panels and DI specials used in the pumping stations shall conform to the specifications specified hereafter in this document.

7.1.2.1.2 Standards

Except as otherwise specified in these technical specification, the Indian Standards and Codes of Practice shall be adhered to for the design, manufacturing, inspection and factory testing, handling, installation and site testing of all material and equipment used for the work, or where a IS standard does not exist, to an approved national or international standard. Only equipment supplied by reputed manufacturers and approved by the Engineer in Charge will be accepted.

7.1.2.1.3 MECHANICAL PLANT & EQUIPMENT

General

It is not the intent to specify herein all the details pertaining to the design, drawing, selection of equipment/materials, procurement, manufacture, installation, testing & commissioning, however, the same shall be of high engineering standard and shall comply with all currently applicable standards, regulations & safety codes.

The successful bidder shall furnish system head curves, technical literature and data etc.

7.1.2.1.4 Pumps

System Head Curves

The successful bidder shall submit system head curves after detailed survey and layout planning of the entire system for the approval of the Engineer-in-Charge. The selected pumps shall be suitable for operation in different combination/speed with the range defined by the upper and lower system head curves.

7.1.2.1.5 Design requirements

The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The Bidder shall match his pumps to the System - Head Curve, referred to above, and the pumps shall operate satisfactorily within the operating range. The pump shall have a stable head curve, i.e. the total head-capacity curve shall be continuously rising towards the shut off. The shut off head shall be at least 10% more than pump head at intersecting point of the pump curve with the upper range system head curve. The operation efficiency shall be as close to maximum efficiency as possible during entire range of operation.

The bidder shall guarantee a minimum overall efficiency for pumps as per reference given in CPHEED manual or offered by manufacturer, whichever is high, corresponding to delivery of design discharge at duty point. The bidder shall specify the pump performance.

The power characteristic shall be non-overloading and preferably flat for flows higher than the best efficiency flow (BEF).

The required pump NPSH at duty point shall be at least 0.5 meters less than the minimum available NPSH.

Pumps must be suitable for operating alone or in parallel over the entire operating range. The pumps shall operate satisfactorily at any point between the maximum and minimum system resistance or at the end of pump performance curve with respect to the NPSH available at the lowest permissible sump water level.

The pumps shall be capable of reverse rotation up to 125% rated full speed of the drive motor, due to backflow of water, without damage or loosening of threaded components.

The first critical speed shall be away from the operating speed and in no case less than 130% of the rated speed.

The specifications for flanges shall be as mentioned in the upcoming chapters.

Spare parts considered, with the pump shall be identical to respective pump components and shall be from original manufacturer.

Pumps shall run smooth without undue noise or vibration. Noise levels and velocity of vibrations shall be within acceptable limits. Noise level shall be limited to 85 dba at a distance of 2 m. Velocity of vibrations in shaft shall be within 4.5 mm/s or as per relevant Hydraulic Institutes Standards and IS.

Unless otherwise specified drive unit power rating shall be the maximum of the following requirements:

20 % margin over the pump shaft input power required for the flow and head as considered.

15 % margin over the maximum shaft input power required within the “Range of Operation” as per the upper and lower system resistance curves.

The bidder shall confirm that the pumps shall not be of a new design and a pump of at least the same size and same type should be in operation for more than 10000 hours satisfactorily in at least Five locations.

7.1.2.1.6. General Features of Pumps
TYPE OF RAW WATER PUMPS:
Centrifugal submersible pumps of with suitable drive. Pump drive shall be of 415V rating.

NPSH

The NPSH provided for the pumps shall be at least 0.5 m more than that required for the pump under all conditions of operation.

Design, manufacture and performance of all pumps specified in scope of work shall comply with the requirements of the latest edition (as on date of submission of bids) of the applicable, Codes and Standards:

7.1.2.1.7. Pump Duty Points
Based on the detailed survey and the water demand, the duty point required for the pumps is specified herein after. However, due to minor change in alignment, the levels of inlet and outlet at the terminal point's etc. minor changes are expected which shall only be finalized after detailed layout plan of head works and the L-section of the mains is finalized. Thus the final selected pumps may therefore require suitable changes for operation in different combination/speed which the Contractor has to make in his final designs submitted for approval on the basis of final L-section of mains and levels of reservoirs.
As it is the responsibility of the contractor to provide the designed flow, thus the contractor on his own cost must do the required surveys to verify the department data and the designs. However, to fulfill the contractors obligation the duty conditions asked herein after can be changed to suit the system requirement as per the prevailing site conditions. No additional costs will be given for variance in specification up to 10% specified in bid documents.

7.1.2.1.8. Specifications for Submersible Pumps
7.1.2.1.9. Codes and standards
The submersible pumps shall confirm to IS: 8034 (Latest amended)
The design, manufacture and performance of the pumps specified herein shall comply with the requirements of the latest applicable Codes and Standards.
The pump set shall be of Compact Unitary construction. The pump casing shall be of high efficiency, Volute Casing type with the Impeller mounted directly onto the Extended Solid Motor Shaft (without any couplings). Nos. of stages shall be decided as per maximum efficiency as per Hydraulic Institute Standards.
The pump maybe mounted directly into the water body (Canal / Sump/ River or unscreened Jack well), so it may suck up lot of silt, clay, pebbles & vegetation. Hence it should be reliable & robust.
7.1.2.1.10. Pump Design
Speed: Speed is required to be decided on achievable efficiency of pump.
The pump shall be capable of developing the required total head at rated capacity for its continuous operation. Pumps of particular category shall be identical and shall be suitable for parallel operation.
The head capacity curve shall be continuously rising towards shut off with the highest at shut off. The shut off head shall be at least 120% of the specified duty point head. The Impeller shall be of high efficiency Multi Channel Enclosed type (except for Specific Speeds > 90 where Semi Open Impellers shall be allowable). Impellers and casing should be able to handle solids up to 80 mm size

The pump set shall be suitable for starting with delivery valve open as well as closed at any operating point. The motor should also start accordingly. The pump set shall be capable of withstanding the accidental rotation in reverse direction.

7.1.2.1.11. Submerged Induction Motor

The motor shall be of Squirrel Cage, Induction type, Air Filled yet capable of Water Immersion up to 20mwc for S1 duty – Motors with Oil or Water filled windings shall not be allowed.

It is rated for 415 V, + 10% V, 3 phase 50 Hz+ 5% A.C. Its winding should be of Class "H" insulation while the nominal temperature rise of winding hotspot should not exceed that of class "B".

It should be wound using Dual Coated, Super Enameled Copper wire with high temperature index as per I.S. 4800 Part-13. PVC / Poly propylene – poly ethylene insulation for winding wires shall not be allowed. Motor's Insulation should be Vacuum Varnish Impregnated & Oven Baked to ensure a Moisture Impervious & Mechanically Robust insulation. Dip or Pour type Air Dry Varnishing shall not be allowed.

The Motor Rating should be higher of the two criteria:

Maximum power consumption throughout the range of performance at 50Hz. and 20% more power consumed at duty point at 50Hz.

The Motor's Rotor shall be of Dual Cage Copper Bar Brazed type to assure:

Long Corrosion Free Service life (in presence of high moisture inevitable in submerged motors Aluminum corrodes much faster than Copper),

Ease of Onsite Repairing & beneficial Fly Wheel type inertial effect (as compared to Aluminum rotor, copper rotor is heavy) which reduces detrimental effects of water hammer, betters Motor Efficiency & Cooler Operating Temperature.

7.1.2.1.12. Motor Cooling

To restrict the Dead Water Level in the Sump to 1m, Medium sized pumps (> 55KW) should have a Cooling Jacket – i.e. motor cooling is accomplished by circulation of pumped water between the motor casing & the jacket shell – this jacket shell is fed by cold water from the pump casing & discharges its heated water back into the sump (in case of Wet Installation) or Pump casing (in case of Dry Installation) by integrally cast ducts. There should not be any pipes, hoses, etc. for this circulation.

7.1.2.1.13. Motor Protection

Thermal Overload Protectors (Bi Metallic Over Load Relays) should be embedded in each phase of the stator winding to detect overheating & trip the motor from the control panel in the event of the temperature exceeding the safe operating limit (above 1300C).

To detect primary Mechanical Seal's Leakage a Moisture Sensor shall be provided in intermediately Oil Chamber (& not in the Motor casing or elsewhere) – this shall detect water mixing in oil by mode of increased leakage current from the moisture sensor.

7.1.2.1.14. Cables

A watertight Cable Junction Box sealed from the motor shall be provided for the motor power and signalling cables. The cable shall be brought directly out of the submerged motor without joints,

and shall be of sufficient length, with minimum 30 m, to be terminated in an IP 67 junction box outside adjacent to the wet well & above the HFL. They shall be sized in accordance with the electricity utility regulations and BS 7671.
It should have Power as well as Control Cables of Dual Sheathed EPRS / PVC insulated water resistant unarmored type with Copper Core of required size. However the Cross Section of the cable shall ample enough to ensure a Voltage Drop of not more than 5% at actual site conditions.

7.1.2.1.15. Shaft & Bearings
The Solid Shaft shall be supported by heavy duty Ball or Roller bearing with a minimum life of 75000 hours in accordance with BS 5512. The bearings should be permanently greased with premium quality, high temperature, Long life Grease thereby obviating the need of re-lubrication for up to 75000 hours life of bearings. The bearing should be of Metric Series & not Imperial ones.
Oil Lubricated bearing shall not be allowed.
In case the motor is to be driven via. VFD, at least one of the bearing (DE or NDE) should be Current Insulated to prevent "electric fluting damage" caused by Harmonics.

7.1.2.1.16. Stuffing Box / Oil Chamber
The pressurized entry of water into the motor (from the pump's volute casing) should be prevented by two separate mechanical seals in mounted in a Tandem mode within an oil chamber.
The Primary (Inboard) seal should always be of Silicon Carbide or Tungsten Carbide faces to withstand erosive wear due to any silt particles.
The Secondary (Outboard) seal should be of Carbon v/s Cast Chrome Molybdenum Steel or Silicon Carbide or Tungsten Carbide – i.e. Thermally Unstable materials like Alumina/Aluminium Oxide shall not be allowed.

7.1.2.1.17. Testing
The pump sets shall be tested at the in accordance of ISO 9906, IS 10981, IS 5120 (Tolerance Class 2);. As these pumps may be installed on specialized Auto Coupling Device, where no external bolting between the pump and the delivery piping is possible – so it is essential that this joint is leak free or else there may be a substantial Pressure/Leakage Loss between the Pump and the Auto Coupling system (as they are not clamped together like conventional (Gasketed & Bolted Flanged Joints). So it is compulsory that the pump should be tested on an Auto Coupling system only- i.e. testing the pump with flange, gasket bolted delivery piping is not allowed.
The Flow shall be measure by full Bore Electro-Magnetic Flow Meters (of 0.5% or less accuracy class).
In case of pump manufacturer not having adequate testing facility within reasonable distance (i.e. decided by the area of operation of the TPI); the pumps should be tested at the Alternative Test Bed or at Field within 30 days of installation which the contractor/manufacturer is bound to offer at no extra cost. The Field Testing shall include the following:

Motor Routing Test:
IR
HV
No Load Amperes, Vibration, etc.
4. Pump Performance Testing (in accordance with IS 5120 / IS ISO 9906)

5. Measurement of Head, Discharge, Motor Input at least 6 different points to plot the Actual Performance Curves.

All the Extra Charges for such Field Testing / TPI charges shall be borne by the Contractor. It is clarified that, in case of Field Testing Failure; JTFRP reserves the right to detain the pumps in their custody until the contractor replaces the failed pumps with new pumps which shall again be subjected to Re-Testing. No extra charges shall be allowed by JTFRP to the contractor.

Table: Materials of Construction				
Motor Casing, Oil Chamber & Other Parts		Cast Iron (FG 260 as per IS 210 or GG25 or EN-JL1040)		
Motor's (Squirrel Cage) Rotor		Motor < 30kW	Aluminum Die Cast or Dual Cage Copper Bar	
		Motor > 30kW	Dual Cage Copper Bar only	
Motor Cooling Jacket (if applicable)		SS 201		
Mechanical Seals		Double mechanical seal should be fitted.		
		Primary (Inboard): Silicon Carbide v/s Silicon Carbide		
		Secondary (Outboard): Carbon v/s Cast Chrome Molybdenum Steel		
		Elastomers: All "O" rings of Viton only & Bellows of either Viton OR Nitrile		
Fasteners		Stainless Steel or Hot Dip Galvanized BHT Alloy Steel		
Auto Coupling System (If applicable)	Pedestal cum Delivery Bend	Cast Iron (FG 260 as per IS 210 or GG25 orEN-JL1040		
	Slider Bracket	Ductile Cast Iron or Cast Steel (SG 400/12 or EN-JS-1050 or GGG 40) or WCB		
	Guide Rail Pipes/ Wires & Foundation Bolts	SS 304 Higher grade		
Pump (Volute) Casting		Pumps with Duty Point Head rating ≤ 80m & Delivery Size ≤ DN100mm Pumps with Duty Point Head rating ≤ 60m & Delivery Size ≤ DN 125mm		Cast Iron (FG 260 as per IS 210 or GG25 or EN-JL1040) with 2% Ni

	Pumps with Duty Point Head rating >80m & Delivery Size > DN100mm Pumps with Duty Point Head rating > 60m & Delivery Size > DN 125mm	Ductile Cast Iron or Cast Steel (SG 400/12 or EN-JS1050 or GGG40 or ASTM 80-55-06 or WCB) with 2% Ni
Suction Bell mouth & miscellaneous pump parts	Cast Iron (FG 260 as per IS 210 or GG25 or EN-JL1040)	
Impeller	Cast Austenitic Stainless Steel (SS 316 or CF 8M or 1.4406) shall be able to handle solids up to 100 mm size.	
Wearing Rings (Suction Head Casing & Impeller)	Cast Austenitic Stainless Steel (SS 316 or CF 8M or 1.4406) or Bronze	
Pump-Motor Shaft	Stainless Steel (SS410 or SS430 or 1.4021 or 1.4460) * *Larger Motors (i.e.>200kW) may be supplied with High Carbon Alloy Steel Shaft (EN 8 or DIN 1.7225 or others) protected with SS316 Shaft Sleeves	
Suction Strainer (if applicable)	MS (C15) Fabricated with Epoxy Coating	
Portable Stand (if applicable)	MS (C15) Fabricated with Epoxy Coating	

Data Sheet for Dry Motor, Wet Installed Submerged Centrifugal Pump sets	
Application	Submerged Centrifugal pump is used for Water Intake/ Transfer/ Lift & maybe mounted in Canal, Sump, Lake or Jack well either Vertically or Horizontally depending upon the site conditions
Type of motor	Squirrel cage induction type with IP68 enclosure
Rated Flow	As per scope
Rated Head	As per scope
Supply system fault	20 MVA
Supply neutral	Solidly earthed
Rated voltage/ Rated KW	415 V/Suitable for pump as per previously outlined margin norms
No. of Phases & frequency	3 Phase & 50 Hz
Supply condition	±10% voltage variation ± 5% frequency variation ± 10% combined voltage and frequency variation
Speed	As per pump manufacturer’s requirement

Duty condition as per IS 325 or equivalent	S1 suitable for constant operation
Method of starting	DOL up to 5.5kW Star Delta up to 20 kW Soft Starter for above 20 kW larger pump set according to site requirements.
Starting torque & Pull Out torque	Sufficient enough to start the pump with delivery valve open and when other pumps are running. Sufficient to bring the motor to normal speed in minimum time
Class of Insulation & temp, rise by thermometer	Minimum Class "F" but Temperature rise restricted to that of class "B" i.e. 75oC
Ambient Temperature	35oC
Type Of Cooling	Surface cooled by circulation of water through jacket shell
	≥ IP 68 (should withstand up to 20m of Water Immersion)
Degree of protection	on S1 basis
Cable details	Four Cores (minimum 1/8 cores required as Earth)
Shaft orientation	Pump-set should be suitable for Any position - i.e. Vertical or Horizontal or Inclined
Type of bearings	Ball/ Roller/ Thrust life time lubricated Anti Friction type
Bi Metallic Thermal Over Load Relay for Winding required?	Yes, one in each phase; for trip, alarming and indicating set to trip @ 130oC
Bearing Over temperature Detectors	Required for motors > 113kW By Bi Metallic Overload Thermal Switches set to trip @ 95oC
Winding connections	6 Terminals
Standards to be followed	IS 325, 8225, 4889, 4772, 4029, 4691 and other relevant Indian Standard or equivalent BSS. Testing as per ISO 9906 or IS 9137 or IS 5120

7.1.2.1.18. Drawings and information to be provided

During detailed engineering, the successful Bidder shall submit the following:

General arrangement, cross-sectional and dimensional drawing/data pertaining to selected model.

Complete performance curve with

H – Q curves for complete range of impellers between minimum and maximum size of impellers and efficiency curves super imposed on them, highlighting selected impeller diameter.

Instruction Manuals:

Instruction manual for Erection

Instruction for pre-commissioning check-up, operation abnormal conditions, maintenance and repair

Write up on Controls and interlocks provided

Recommended inspection points and periods of inspection
Schedule of preventive maintenance
Ordering information for all replaceable parts
Recommendations for types for lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.

7.1.2.1.19. Erection of Pumps
Installation of Submersible Pumps
The installation of a pump should proceed through five stages in the following order:
Preparing the foundation and fixing the foundation bolts in it.
Fixing the pump on the foundation bolts, however resting on levelling wedges, which permit not only easy levelling but also space for filling in the grout later on
Levelling
Grouting
Alignment
The foundation should be sufficiently substantial to absorb vibrations and to form a permanent, rigid support for the base plate.
The capacity of the soil or of the supporting structure should be adequate to withstand the entire load of the foundation and the dynamic load of the machinery. As mentioned in clause 6.2.2 and 6.2.3 of IS: 2974 (Part IV), the total load for the pump set and foundation shall include the following:
a) Constructional loads
b) Three times the total weight of the pumping unit
d) Weight of the water in the column pipe
e) Half of the weight of the unsupported pipe, connected to the pump- flanges
If the pumps are mounted on steel structures, the location of the pump should be as nearest as possible to the main members (i.e., beams or walls). The sections for structural should have allowance for corrosion also. A curb-ring or a sole-plate with machined top should be used as a bearing surface for the support flange of a vertical wet-pit pump. The mounting face should be machined, because the curb-ring or sole-plate is used to align the pump. Pumps kept in storage for a long time should be thoroughly cleaned before installation.
Alignment of the pump sets should be checked, even if they are received aligned by the manufacturer. The alignment should be proper, both for parallelism (by filler gauge) and for coaxiality (by straight edge or by dial gauge). During all alignment-checks, both the shafts should be pressed hard, over to one side, while taking readings. Alignment should be also checked after fastening the piping and thereafter, periodically during operation.
Name Plates
Each main and auxiliary item to the Plant shall have permanently attached to it, in a conspicuous position, a name plate and rating plate, each of weather-resistance and fire-resistance material. Upon these shall be engraved or stamped the manufacturer's name, type and serial number of Plant, details of the loading and duty at which designed to operate.
Details of proposed inscriptions shall be submitted to the Engineer in Charge for approval before any labels are manufactured.

7.1.2.1.20. EOT Crane / JIB Crane
EOT Cranes/ Jib crane shall be provided over floor area and loading unloading bay of pump house. The EOT Cranes/ Jib crane shall be of adequate capacity as per requirement. Design, testing and

commissioning of the related parts shall conform to the latest revision of IS 3177 Class 2, medium duty for mechanical and Class 4 for electrical and IS 807. For welded construction, such as for the bridge girders/ jib arm and carriages, rope drums, gear boxes etc., steel shall conform to IS 2062 quality. For welding these members low hydrogen electrodes shall be used.The job shall include complete supporting structure required for installation.

General

Cranes will be of welded box girder / beam section construction and the design testing and commissioning shall conform to the latest revision of IS 3177, class 4 for electrical and IS 807. For welded construction, such as for the bridge girders and carriages, rope drums, gear boxes etc.., steel shall conform to IS 226 quality for thickness up to 20mm; steel above 20mm thickness shall conform to IS 2062 quality. For welding these members low Hydrogen electrodes shall be used. Guards of an approved pattern and design shall be attached to each end of the end carriages, which shall push forward and off the track any object placed across it.

7.1.2.1.21. Constructional details

The beam / box section construction crane bridge girders shall be in one piece or in pieces suitable for transportation if in pieces the design of multi piece construction shall require the approval of the Engineer in Charge. Cross travel rails shall be fixed to the bridge girders by clamping only and not welding. Plates, bars, angle sections and where practicable other rolled sections, used in the load bearing members of structures shall be not less than 6 mm thickness. The end carriages shall be of double web plate box construction or I section connected to the girders by welding at top or by large gusset plates and fitted bolts to ensure maximum rigidity. Drop stops and jacking pads shall be built-in features. Full length plate form of checker plate of minimum thickness 6 mm shall be provided along both sides of the crane to ensure easy, safe excess to the crane crab, travel gears and other parts. Safety railing shall be provided on crane bridges and crab frame. Foot-walk shall have sufficient width to give 500 mm minimum clear passage at all points, except between railing and bridge drive where this clearance may be reduced to not less than 400mm.

7.1.2.1.22. Rope Drums

Rope drums shall be of cast steel or fabricated from seamless tubes, conforming to the relevant Indian Standards. Fabricated rope drums shall be stress relieved before any machining takes place. The sizing of drum shall conform to IS 3177 Clause 5.

7.1.2.1.23. Rope Sheaves

Rope sheaves shall be of cast steel or fabricated from rolled steel plates, conforming to Clause 6 of IS 3177.

7.1.2.1.24. Wire Ropes

The wires shall be hemp cored for all cranes. Ropes shall be of regular right hand lay as per IS 2266. The rope construction shall be 6 x 37 up to 16 mm diameter and 6 x 36 above 16 mm diameter, with a factor of safety specified as per Clause 5.6.1 of IS 3177.

7.1.2.1.25. Hook Block

The sheaves shall be fully encased in close fitting guards fabricated from steel plate. Smooth opening shall be provided in the guards to allow for free movement of the rope. Holes shall be provided for oil drainage.

7.1.2.1.26. Lifting Hooks

The lifting hook shall be one that will best suit this type of crane and as per IS 3177. Hooks shall be quality tested by a third party agency.

7.1.2.1.27 Gears and Gear Boxes

Straight and helical spur gearing shall be used for all motions. All first reduction gears shall have helical teeth. All pinions shall be integral with the shaft. All gears shall be hardened and shall be of tempered alloy steel having metric module. Overhung gears shall not be used. The design and general arrangement of gear boxes shall be as per Clause 10 of IS 3177. All gearing shall be totally enclosed/immersed in oil.

7.1.2.1.28. Track Wheels

Crab/Crane wheels shall be double flanged. Wheels shall be mounted in anti-friction roller bearings housed in "L" shaped bearing brackets for ease of removal during routine maintenance. Flangeless wheels with guide rollers would also be acceptable. Solid wheels shall be of forged/rolled steel or cast steel. In general, the track wheels shall conform to Clause 11 of IS 3177.

7.1.2.1.29. Rails

The rails shall be specified as being suitable for the crane duty used no square bars will be acceptable. The rails shall be complete with end stops, holding down bolts and taper washers and shall be suitable for connection to the station earth. Access to the crane for maintenance purposes from the walking plate form by means of a steel ladder with cage shall be provided. The crane shall be provided with full length walkway on drive side girder and small walkway on another girder. Walkway shall be at least 500 mm clear inside.

7.1.2.1.30. Couplings

All couplings shall be of steel or cast iron of grade 260 conforming to IS 210 and shall be designed to suit the maximum torque that may be developed. The manual drive shaft and hoist drum shall be connected to the gear box input shaft through a flexible shock absorbing coupling as per Clause 8 of IS 3177.

7.1.2.1.31. Bearing and Bearing Housing

Anti-friction bearing housings shall be used throughout, except where required otherwise for technical reasons, conforming to Clause 7 of IS 3177.

7.1.2.1.32. Shafts

All shafts shall be made of steel as per Clause 9 of IS 3177.

7.1.2.1.33. Electrical details

The general technical details for the electrical systems specified elsewhere in the document will apply to the electrical equipment for the gantry crane also. The following points deal with the special requirements for the crane. In case of any contradiction with the electrical specifications described elsewhere in this document, the special requirements detailed hereafter shall have precedence.

415 V, 3 Phase, 4 wire electric power supply will be available at one point for the crane bus. The Bidder shall provide a metal enclosed switch box housing a 32 A TPN switch, CT operated

ammeter and voltmeter, with selector switch. This switch box shall be located approx. 1.2 meters above the floor level. The incoming cable must be of suitable size aluminium conductor, PVC insulated, PVC sheathed, strip armoured. From this switch onwards, the Bidder shall arrange and terminate the supply at the crane bus. All the electrical accessories including motors must be for outdoor arrangement.

7.1.2.1.34. Crane Power Supply
415 Volts +/- 10%, 3 Phase, 4 Wire, 50 Hz +/- 5%, AC through trolley lines.

7.1.2.1.35. Current Collector
Two No. per trolley line shall be provided; each rated for 100% of total crane rating. Double collectors on each earth trolley shall be provided and these shall be different from those on the power trolley line. Collector rollers and shoes shall be designed to reduce sparking to the minimum level possible Power Distribution on Crane. An off/load manual isolator, with a locking facility shall be provided immediately after the current collectors on the incoming line on the crane.
Power from the isolator shall be taken to the circuit breaker located in protective panel of the crane. The breaker shall be provided with under voltage, overload and short circuit release or relays. The breaker can only be closed when:
All controllers are in neutral position;
None of the stator or directional contactors are in closed position;
Door/gate switches are not actuated;
Rotary and gravity limit switches for hoist motion not operated.

7.1.2.1.36. Power Supply for Lighting and Magnet Circuits
Power for lighting and magnet circuits shall be tapped from the incoming side of isolator near current collectors.

7.1.2.1.37. Panels
All panels shall be of free-standing floor mounted construction, suitable to withstand any vibrations emanating from the crane. The panel and its components shall conform to standards of Electrical Technical Specifications for LT Switchgear/Panel, described elsewhere in this document.

7.1.2.1.38. Motors
Heavy duty motors suitable for crane operation, shall be reversible, suitable for frequent acceleration and mechanical breaking, totally enclosed, fan cooled, wound rotor type. The duty of the motor shall be S5, as per IS 325. Class of insulation shall be “B”. The pull-out torque is to be not less than 225% of full load torque, corresponding to 40% CDF (Cycle Duration Factor of the motor).The main motor shall have the speed ranges suitable for gearbox and operating speed for a Class 2 crane. Motor should be in the enclosed housing to prevent from dust, rain and snow for its use in outdoor location.

7.1.2.1.39. Brakes
Brakes shall be provided for hoisting motions. Brakes shall be thrust type. Brakes shall be designed to be fail-safe whenever there is a current interruption, either intentionally or by main power supply failure. The capacity of brakes, brake drums, shoes and brake adjustment shall be as per Clause 14.4 of IS 3177.

7.1.2.1.40. Limit Switches

Only drum limit switches are acceptable. Roller operated, resetting limit switches shall be provided for all motors. For each hoist motion, a rotary type over-winding self-resetting limit switch shall be provided. An indication shall be provided to the operator whenever this limit switch has been operated. Limit switches shall be fitted to prevent over travelling and over traversing and any other special requirements.

7.1.2.1.41. Resistance

Resistance's shall be air-cooled, robust, heavy duty, corrosion resistant, punched stainless steel grid type/cast iron grid resistor. Suitable tapping points shall be provided. Resistance boxes shall be mounted in racks that permit independent travel of any selected box.

7.1.2.1.42 Pendent Controller

1. Pendent push button station shall comprise of the following and be suitable for 110 V AC:
2. Key operated ON push button-standard green button.
3. on signal lamp-green lens.
4. Emergency OFF push button-standard red button.
5. Hoisting push button- standard black button.
6. Lowering push button-standard yellow button.
7. Micro Hoisting push button- standard black button.
8. Micro Lowering push button- standard black button.
9. Cross traverse forward push button- standard black button.
10. Cross traverse reverse push button- standard black button.
11. Micro Cross traverse forward push button- standard black button.
12. Micro Cross traverse reverse push button- standard black button.
13. Crane light ON/OFF push button.
14. Bell ON/OFF push button.
15. Class of Duty: Outdoor

7.1.2.43.Technical Particulars

Capacity and size Required – Pump-houses

1	Capacity	Of adequate capacity to handle heaviest load
2	Span	To suit actual pump house plan, approved by Engineer in Charge
3	Rated Speed	Main Hoist – 2 m/min. Macro Hoist – 0.2 m/min. Cross Travel – 20 m/min. Micro Cross travel – 2 m/min. ± 10% of rated speed while operating in full load condition for lowering or hoisting.
4	Gantry Length	As per building plan approved by Engineer in Charge.
5	Class of duty	Outdoor

7.1.2.1.44. Drawings and information to be provided
The successful Bidder shall submit the following:
Vendor Catalogue with Credentials and complete technical data of material used for all items.
During detailed engineering the Bidder shall submit the following:
Drawings showing general arrangement, clearance requirement, assembly, cross sectional data and materials of construction for:
EOT Crane unit.
Bridge assembly and components.
Bridge end trucks and Wheel assembly
Trolley.
Trolley wheel assembly.
Drive and transmission unit for bridge travel, trolley travel, main hoist and auxiliary hoist.
Suspension unit for main hook block and auxiliary hook block.
Main hook block.
Drawings showing layout of controllers and protective panels inside the operator's cabin/pendant station.
Leaflets on proprietary items such as motors, brakes, gearbox and coupling etc.
Design calculations for the following:
Bridge girder, rope drum, machinery shafts, gear box, motor rating, brake capacity, bearing life, wheel loading etc.
Drawings, characteristics and other data for each drive motor.
Drawings on runway rails and their end stops, showing fixtures.
Material test certificates for all items, including hooks and wire rope.
Reports on various tests at shop and at site.
Control and protection scheme along with crane wiring drawing as well as a schematic drawing of control wiring indicating ratings and specifications for motors, resistors, fuses etc.

7.1.2.1.45 Instruction Manuals:
Installation manual for erection
Instruction for pre-commissioning check-up, operation, abnormal conditions, maintenance and repair
Recommended inspection points and periods of inspection
Schedule of preventive maintenance
Ordering information for all replaceable parts

Recommendations for types of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.

7.1.2.1.46 Electric hoists
General
Electric driven, short headroom, wire rope hoists with motor driven traveling trolley and I-beams for suspension shall be provided as specified.
The successful Bidder shall furnish all technical data with catalogue and drawings .
The construction of the hoists, its components, the design, testing and commissioning shall conform to IS 3938, Class II duty. All parts needing inspection and/or replacement shall be easily accessible with the minimum need to dismantle other equipment, accessories or structures. All lubrication points shall also be easily accessible without the need for any dismantling of other equipment or

accessories. The hoist must be equipped with adequate safety devices. The beam on which the hoist shall travel, shall be designed, supplied, installed and tested in conforming to the relevant Indian Standards.

7.1.2.1.47 Mechanical details
The specifications of the hoists are as follows:

Specifications of the hoists

Rope Drums	Rope drums shall be of cast steel or fabricated from rolled steel plates, conforming to the relevant Indian Standards. Fabricated rope drums shall be stress relieved before any machining takes place. The drum grooves shall be smooth finished and the rope drum shall be flanged at both ends. The drum shall be designed for a single layer of ropes. A precision machined rope guide to suit the drum grooves shall move over the drum like a nut, guiding the rope into the grooves and preventing an overlapping of the rope.
Brakes	Brakes shall be D.C. electromagnetic type/thrust type. Brakes shall be designed to hold the load at any position whenever there is a current interruption, either intentionally or by main power supply failure.
Wire ropes	The wires shall be hemp cored and galvanized. Ropes shall be of regular right hand lay as per IS 2266. The rope construction shall be 6 x 37 with a factor of safety specified as per IS.
Hook block	The sheaves shall be fully encased in close fitting guards fabricated from steel plate. Smooth opening shall be provided in the guards to allow for free movement of the rope. Holes shall be provided for oil drainage. The lifting hook shall be supported on a bearing for 360 ° swivel under load.
Gears and gear box	Straight and helical spur gearing shall be used for all motions. All first reduction gears shall have helical teeth. All pinions shall be integral with the shaft. All gears shall be hardened and shall be of tempered alloy steel having metric module. Overhung gears shall not be used. All gearing shall be totally enclosed and grease lubricated.
Trolley wheels	Single flanged wheels shall be mounted in anti-friction roller bearings housed in “L” shaped bearing brackets for ease of removal during routine maintenance. Solid wheels shall be of forged/rolled steel or cast steel.
Motor for hoist and trolley	415 V, 50 Hz, heavy duty motors suitable for hoist and trolley operation, suitable for reversible motion, frequent acceleration and mechanical breaking, totally enclosed, fan cooled, wound rotor motor shall be used. Class of insulation shall be “F”, with temperature rise limited that for “B”. The pullout torque shall not be less than 225% of full load torque, corresponding to 40% CDF (Cycle Duration Factor of the motor). 200 switching per hour shall be considered for the selection of motors. The motors shall have the following speed ranges: a) trolley travel: 10 m/min; micro travel: 2 m/min b) hoist: 2 m/min Roller operated, resetting limit switches shall be provided for all motions.

	Limit switches shall be fitted to prevent over travelling and over hoisting.
Power supply	A flexible travelling cable system mounted on a retracting support system, shall be used. The conductor shall consist of insulated multi conductor cable with permanent termination on the connection box and on the trolley. The flexible trailing cable shall have ample length and shall be supported by means of properly designed movable clamps. These clamps shall be fitted with rollers and shall run freely on a guide rail along the beam. The flexible copper cable shall be butyl rubber or EPR insulated CSP sheathed type 650/1100 V Grade.
Control	From fixed control panel from where the entire operation area can be overlooked or from a pendant push button control block hanging on a cable from the hoist. Control voltage is 110 V from a single phase step-down transformer. The following control is possible: a) Key operated ON push button - standard green button. b) ON signal lamp - green lens. c) Emergency OFF push button - standard red button. d) Hoisting push button - standard black button. e) Lowering push button - standard yellow button. f) Micro hoisting push button - standard black button. g) Micro lowering push button - standard black button. h) Cross traverse forward push button - standard black button. I) Cross traverse reverse push button - standard black button. j) Micro cross traverse forward push button – standard black button. k) Micro cross traverse reverse push button – standard black button. l) Class of duty: Outdoor
Beam	The beam shall be suitable for the trolley, complete with end stops, holding down bolts and taper washers and shall be suitable for connection to the station earth. It shall be designed according to the capacity of the hoist, the beam fixation/support points, length and alignment. It shall be of galvanized mild steel. All fixation elements shall be of galvanized steel.

7.1.2.1.48 MONORAIL WITH CHAIN PULLEY BLOCK

The chain pulley block shall be operated on the Monorail.

The load chain shall be made of alloy steel as per IS: 3109. It shall be heat treated to give ductility and toughness so that it will stretch before breaking. It shall be of welded construction with a factor of safety not less than 5.

The hand chains, SS 316, for the hoisting and traverse mechanism shall hang well clear of the hook and both the chains shall be on the same side. The hand chain wheel shall be made from pressed sheet steel and shall be provided with roller type guarding to prevent snagging and fouling of the chain.

All the gearing shall be totally encased. Proper lubricating arrangements shall be provided for bearings and pinions. Gears shall be cut from forged steel blanks. Pinions shall be of heat treated alloy steel. Gears shall be as per BS 436/IS: 4460.

The trolley track wheels shall be rim toughened, heat treated carbon steel or low alloy steel or C.I. and shall be single flanged and shall have antifriction ball bearings. The wheels shall be machined on their treads to match the flanges of the track joints.

The travelling trolley frame shall be made of rolled steel conforming to IS: 2062. The side plates of trolley frame shall extend beyond wheel flanges, thus providing bumper protection for the wheels. The two side plates shall be connected by means of an equalizing pin. Travelling trolley shall be push pull or manual geared type. The job shall include complete supporting structure required for installation.
Axles and shafts shall be made of carbon steel and shall be accurately machined and properly supported.
The lifting hooks shall be forged, heat treated alloy or carbon steel of rugged construction. They shall be of single hook type provided with a standard depress type safety latch. They shall swivel and operate on antifriction bearings with hardened races. Locks to prevent hooks from swiveling shall be provided. Hook shall be as per BS:2903/IS:3815/IS:15560
The brake for the lifting gear shall be automatic and always in action. It shall be of screw and friction disc type self-actuating load pressure brake. Brakes shall offer no resistance during hoisting.

7.1.2.1.49 JIB Crane

The Crane will consist of the following:

1. One Mild steel fabricated Jib arm complete with bearing housings and suitable anti friction bearings with a provision of swivelling.

2. One Mild steel fabricated Independent column suitably stiffened and with suitable base plate.

3. One Electric wire rope hoist running on the bottom flange of Jib arm.

4. One control Pendent

The self standing motorized jib crane should have motorized swivelling, motorized cross travel & motorised hoisting with a self hanging pendent control. To minimize the over all height of jib crane and in order to provide maximum clearance below the hook, a low height hoist is to be provided. The height of structure above the boom should be kept minimum. All structural elements are to be suitably stiffened to minimize deflection, even under extreme loading conditions. The swivelling motion is to be from 0 to 270° by means of a suitable bull gear, pinion & geared motor. Anti collision limit switches are to be provided for preventing damage to the crane from other jib cranes in its proximity. Suitable heavy-duty limit switches with back up position stopper are to be provided for limit at extreme ends in all the three axes. The system should be self-locking type, so that when not in use it remains locked at one position. Also soft starting should be provided. Hook swivelling should be only on thrust bearing. All the bearings should be SKF / NBC / ZKL / TIMKEN make only.
Easy maintainability of the system should be ensured. Also suitable cable travel arrangement is to be provided at necessary locations. The space available for the foundation of the crane is 3000 mm X 3000 mm.

SL.No	DESCRIPTION	REQUIREMENT
1.	Type	Floor mounted swivelling type Jib Crane

2.	Jib radius	5000 mm
3.	Angle of rotation	270°
4.	Height of lift For crane	6000 mm
5.	Hoist head room height	as per site condition
6.	Over all Height of crane	as per site condition
7.	Capacity (SWL)	as per requirement
8.	Hoist make (IS: 3938)	Indef / AVON / Swift
9.	Hoisting speed	4 m/min.
10.	Duty Class II,	Outdoor
11.	No. Of falls	4
12.	Wire rope diameter	10 mm
13.	Hoisting motor (IS: 325)	as per design
14.	Hoisting brake	Double shoe single coil DC EM type
15.	Cross traverse motor	as per design
16.	Cross traverse speed	10 - 12 m/min
17.	Swivel motor	1 HP
18.	Swivel speed	0.1 to 1 rpm
19.	Deflection of boom	Not to exceed the ratio of Boom length / 150.
20.	Operation Control	Pendent type – Push button operated
21.	Power source	AC 415 V, 50 HZ, 3 Phase 3 wire system.

7.1.2.1.50.Control panel:

Electrical control panel should be complete with required electrical elements such as contactors, MCB s, fuses, rectifiers, isolators etc. of reputed make. All necessary cables, lugs, number ferrules for wiring identification on control and power side should be provided.

7.1.2.1.51.Electrical:

1. Use of Solid-state relays would be preferred.
2. Wiring routing in panel/pendent & ferruling to be as per IS Norms.
3. All control elements to be mounted on DIN channels.
4. Nomenclature of each control element to be tagged at appropriate place in panel.
5. Appropriate gasketing of control panel/ pendant to be done so that panel generally conforms to IP54.
6. Proper channelizing of the loose wiring inside the panel.
7. Separate color for each of power phase (R,Y,B) & for control wiring (Phase & neutral)
8. Double earthing of the equipment / panel is to be done. Gourmets to be provided for any loose wire coming out of the panel.
9. All wiring outside the panel/pendant to be routed through steel reinforced PVC conduits properly glanded at both the ends.
10. ICTP/ MCB Box on side of panel.
11.Control Panel is to be mounted on the Column.
12. Appropriate labels are to be provided for each indication/switch/push button/ MCB’s.
13. Proper guide, cables, cable routing for CT festoon cable to be provided.

7.1.2.1.52.Details to be furnished:

1. Full technical details / specifications, general arrangement drawing, electrical schematics,, control diagrams illustrating construction of the system/ equipment.
2. Specification of Materials used in manufacturing the equipment.
3. Schematic diagram of the foundation required for the equipment.

7.1.2.1.53.Material & Heat treatment:

All wear components (in motion) shall be properly heat treated and have min 300 to 350 BHN. All cast and fabricated items are to be stress relieved.

7.1.2.1.54.Safety:

1. The equipment should confirm to relevant standards like IS 3938, IS 325, IS 800 & 807. The structure should be stable and should not fall / collapse / bulge causing any harm to the surroundings. Where ever desirable edges should be strengthened and rounded to remove sharpness.
2. Buzzer should be working properly while the Crane is working.
3. Proper interlocks are to be incorporated and their working to be fully functional at the time of trials.

7.1.2.1.55.Performance Testing:

1. The Jib Crane would be tested at 125% rated load & the deflection of the Jib arm should not be more than L/150, where L is Boom length. Other tests would be carried out in conformance with IS 807 & IS 14474.
2. With load, the system will be checked for vertical travel, cross travel & swiveling motion. All motions in the three directions are to be smooth & jerk free.
3. There should be immediate stopping of the jib crane (of all the three motions) in case of a sudden power failure.

7.1.2.1.56.Painting:

The Jib Crane is to be painted with deep orange color, after one coat of red oxide primer.

The final design of the EOT / Monorail / Jib crane to be installed will depend on site conditions and shall be approved by the Engineer incharge after due submission of QAP by successful bidder.

7.1.2.1.57 Specifications of Valves
7.1.2.1.58 Pressure Rating

The pressure rating of valves must at least be equal to the maximum expected pressure at the point of installation.

7.1.2.1.59. Size

Unless otherwise mentioned, the size of valves must not be less than the size of the respective main (suction, delivery) pipes.
Valves shall be flanged and the flange face at right angles to the valve center line. Backside of valve flanges shall be machined or spot faced for proper seating of the head and nut.
Flanges shall be machined on faces and edges to IS 6392 or BS 4504 for PN 10 nominal pressure rating unless otherwise required. Flange drilling shall conform to IS 1538.
Depending on location the valves shall be electrically operated, or by manual hand wheel or key operation, clockwise closing unless specified otherwise by the Engineer. For valves greater than 300 mm diameter gear operators shall be used. The direction of closing shall be clearly indicated on the hand wheel or body as appropriate.
Manual operation of valves shall be such that the torque effort required to operate the hand wheel manually, lever or chain shall not exceed 20 kg-m applied by an operator.
Valves shall be provided with operating hand wheels, caps, extension spindles and valve boxes as required. Extended valve spindles shall have spindle guides and operating caps.
For sluice valves up to 600mm diameter installed in underground chamber or otherwise not easily accessible, the Contractor shall furnish extension spindles and/or keys, or chains with extension oil cups or such similar fittings or appliances as may be required to permit easy access for proper operation, lubrication etc. Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.
All hand wheels shall be of a solid cast type.
The valve stem, thrust washers, screws, nuts and all other components exposed to the water shall be of a corrosion resistant grade of stainless steel. Valves shall be free from sharp projections.
Sluice valves on pumping main (except scour valves on pumping main and the isolation valves for air valves) shall be electrically operated. The valves shall have arrangement for manual operation also, operated through a suitable gearbox, by hand wheel. Operation must be possible by one man against maximum design working pressure. A locking facility shall be provided for the valve in either the fully open, fully closed or intermediate position. Gate valves shall be provided with position indicators, to show whether the valve is in the open or close position.
Scour valves shall be provided with extension spindle with supports for operation from operating level / ground level.
All valves shall be protected against corrosion. Minimum required application shall be factory applied epoxy system 250 microns thick.
Provision for indicator tags shall be made for identification / location of valves. Marking shall be either cast on the bonnet or the body and shall show the following:
Manufacturer's name or mark
Year of valve casting
Size of valve
Designation of working pressure
Number of turns to open, with the direction of closing clearly indicated on the hand wheel or body as appropriate.
Gaskets shall be of Nitrile rubber and readymade matching with respective flanges. Gaskets cut out from rubber sheets are not acceptable.
Nuts and bolts shall be of the best quality bright steel, machined on the shank and under the head and nut. Nuts and bolts shall conform to IS 1363 and IS 1367, unless otherwise specified. Nuts and bolts shall be hot dip galvanized or shall be chromium plated.

7.1.2.1.60.Motorised Butterfly valves

Butterfly valve shall generally conform to IS:13095 (Latest ammended)/BS:5155/BSEN:593 . Valves shall be motorized compatible for underground installation with or without valve chamber and provision for manual operation.The valves shall be robust enough to operate in burried conditions with sealed gear box and life time lubrication for minimum 30 years.The motorised mechanism should have sufficient IP rating to sustain water submergence.
Material of construction shall comply with the requirements given below:

Pressure Rating	10 Bar
Body, Dome	Ductile Iron DIN 1693-GGG40 / GGG50 Spheroidal Graphite Iron IS 1865 Gr 400/12 orGr500/7
Wedge	Ductile Iron DIN 1693-GGG40 / GGG50 Spheroidal Graphite Iron IS 1865 Gr 400/12 or Gr500/7 Rubber lined with EPDM
Spindle / Stem	SS: IS 6603 04 Cr17 Ni 12 M0 2 / AISI 316
Bonnet Gasket	EPDM
Internal Fasteners	Stainless steel SS316
Nuts, bolts & washers for pipe flanges	High tensile steel Hot dip galvanized for valves in chambers. Stainless steel SS316 for buried valves
Coating	Internal and external with powder or liquid epoxy coating with minimum dry film thickness of 250 microns.

The Butterfly valves shall be electrically operated installed with gearing,actuator enclosure and hand wheel for optional manual operation.Valves shall be provided with mechanical position indicator to show position of disc .Valves shall be capable of closing against maximum flow that can occur.The valves shall be suitable for bi-directional pressure testing with dead tight shutt off even after long period of operation.The disc shall be designed to withstand maximum pressure differential across valve in either direction.
The testing of Butterfly valves shall be as per relevant codes.

7.1.2.1.61. NRV/ Check Valve

General
The valve shall be Ductile Iron flanged type suitable for mounting on a horizontal pipeline.
Valves shall possess high speed closing characteristics and be designed for minimum slam condition when closing.
The minimum body-wall thickness shall confirm to those given in Table 1B of API Standard 594.
Slant seated check valve shall conform to API 594 and API 598. They shall have resilient sealing. The plate shall not drag on to the seat while opening. The plate shall not vibrate under full and partial flow condition.
The face-to-face dimensions of valves (including valves with ring joint facings) shall conform to those mentioned in Table 2B of API Standard 594.
The valve body shall be furnished with a clearly visible cat, forged, machined-in, or die-stamped arrow to indicate the direction of flow through the valve.

7.1.2.1.62.Constructional Features

Double Flanged quick closing non slam, slant seated check valve generally conforming to API 594 for pressure rating as per requirement at particular section, of size equivalent to the delivery pipe, shall be provided with following material of construction:
Materials of Construction

Body	SG Iron 1865 Gr 400/12 or 500-7, Grade GGG 40/ GGG50
Plate	CS : A 216 Gr WCB
Stop Pin	SS. AISI 431
Hinge Pin	SS. AISI 431
Retainer	Carbon Steel
Body Bearing	BRG AISI SS 316
Plate Bearing	BRG AISI SS 316
Seal	EPDM
Seat Plate	Integral (NO overlay)
Rating	PN 16 / PN 10 based on Design
Body & Plate Seat	13% Chromium Overlay

7.1.2.1.63. Flow Meter:-

i.	Quantity	As per BOQ
ii.	Size	Required for 250mm and 400 mm dia common header pipeline
iii.	Type	Electromagnetic with separate Digital Signal convertors compatible with SCADA
iv.	Discharge	20 - 500 LPS
v.	Pressure Rating	PN 10
vi.	Accuracy	± 0.25% of measured value
vii.	Display Language	English
viii.	Display Functions	Instantaneous flow rate, status, forward/reverse sum totalizer (8 digits)/16 character bar with present display.
ix.	Display Units	Instantaneous flow rate in m^3/h or LPS
x.	Special condition	Must provide the flow rate & flow velocity in partial flow condition also

7.1.2.1.64. Ultra Sonic Level Gauge:-

Ultra sonic level indicators shall be installed inside of the sump. The height of water in the sump is 7.5 M (max).
100 mm dia. G.I. pipe shall be casted inside the sump for fixing the level gauge.
The signal output shall be connected to SCADA for the purpose of not only ascertaining the level and quantity of water in sump, but to ensure that pumps don’t run dry at any spell of time.

Technical data:

Materials Wetted parts	
Process fitting Transducer Seal/transducer/process fittings	PVDF PVDF EPDM
Materials Non-Wetted parts	
Housing Seal ring between housing and housing cover Inspection window in housing cover for indicating/adjustment module Ground Terminal	Stainless steel NBR Poly carbonate Stainless steel
Output variable	
Output signal Resolution Fault signal Integration time(63% of input variable Rise time	4-20mA 1.6µA Current output unchanged 20.5mA, 22mA, <3.6mA (adjustable). 0-999s adjustable 500 mS (ti: OS 0-100%)
Ultra sonic frequency	As per manufacturers design
Accuracy (similar to DIN EN 60770-1)	Better than 0.2% or ±4mm
Temperature	-10 ˚C to 40˚C
AMSL	1600M

7.1.2.1.65. Inspection and Tests

The following Inspection and Testing procedures shall be carried out for all the equipment as applicable:

Visual Inspection.

Material Certificates for all the specified material shall be furnished.

Welding Qualifications.

Dimension Checking.

Stage Inspections (in process inspection).

Hydrostatic / Leak testing for all pressure parts, Pneumatic Leak Test wherever applicable.

Operation check.

Liquid penetrating tests or magnetic particle tests for all machined surfaces of pressure parts.

Ultrasonic test for forging materials viz.,

Plates of thickness 20mm and above for pressed / formed parts such as heads, etc.

Plates, flanges and bars of thickness / diameter 40mm and above used for fabrication of pressure and load bearing members and rotating parts.
Radiographic testing for all but welded parts, as per applicable codes.
Hardness tests for all Hardened surfaces.
The Supplier shall maintain proper identification of all materials used, along with reports for all internal / stage inspection work carried out, based on the specific job requirement and or based on the datasheets / drawings / specifications.
Requirement of shop tests for Valves are listed below:
During testing, there shall be no visible evidence of structural damage to any of the valve components.
Each valve operated actuator shall be shop-operated at least three times from the fully closed to the fully opened position, and the reverse, under no-flow condition, to demonstrate that complete assembly is workable.
The tests mentioned below shall be hold points and to be witnessed by a duty authorized representative of the Employer:
The following tests shall be carried out for sluice valves in line with IS 13095:
Seat leakage test. Seat test shall be carried out in each direction and the valve shall be drop tight.
Body hydrostatic test
Disc strength test at body test pressure in each direction.
Valve operation with and without actuator
The material certificates, physical properties, heat treatments and shop test certificates of valve body, disc, wedge and shaft shall be duly approved and certified by the manufacturer and these shall be subject to review & approval by the Engineer.
Notwithstanding the above requirement for inspection and quality control, the following inspection and quality control measures shall be carried out by manufacturer:
Magnetic particle tests on body and disc/door.
Dye penetration tests on metal seats.
Ultrasonic tests on shafts.
Overload Torque Test shall be carried out on the gear boxes of the valves. The test shall be carried out by applying 1.5 times the rated torque.

7.1.2.1.66. Painting
The supplier shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting of all parts at the place of manufacture prior to packing.
Parts may be cleaned but surface defects may not be filled in before testing at the manufacturer's works. Parts subject to hydraulic test shall be tested before any surface treatment. After test, all surfaces shall be thoroughly cleaned and dried out if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the Specification provides to the contrary all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.
Protective coatings and painting shall be in line with the Standards for the particular type of valve.

7.1.2.1.67 Electric Actuators
The actuator shall be suitable for operation in hot, humid, dusty and tropical atmosphere. Type of actuator offered should be in satisfactory operation under similar conditions. For isolating service, the actuator shall be rated for three successive open-close operation of the valve or 15 minutes,

whichever is longer. For regulating service, the actuator shall be suitably time rated for the duty cycle involved with necessary number of starts per hour.
The actuator shall open and close the valve completely and make leak tight valve closure without jamming. The actuator shall attain full speed operation before valve load is encountered and impact an unseating blow to start the valve in motion (hammer blow effect). The actuator shall operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
The actuator motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure. The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.
Actuators shall be suitable for the medium, climatic, environmental and pressure conditions of the system in which they are to be fitted.
Actuators shall be provided with:
AC Electric Motor.
Reduction gear unit.
Torque switch mechanism.
Limit switch mechanism complete with set of limit switches and additional 4 spare sets for suitable position.
Hand wheel, for manual operation.
Valve position indicator.
Hand-auto lever with suitable locking arrangement.
10 W single phase space heater in the switch compartment.
Blinking light throughout the valve operation.
Junction box for terminating power and control cables.
Integral Starter
The actuator shall be suitable for operation on 415V, 3 phase, and 50 Hz power supply. The motor winding insulation shall conform to class B as per relevant BS and motor shall be protected by suitable thermal overload relays. The actuator shall be capable of producing not less than 1 ½ times the required operator torque at the required time cycle of valve operation. The transmission shaft connecting the actuator to the valve shall be provided with 2 bearings one at actuator end and one at valve end with universal couplings at suitable places.
Each actuator shall be provided with following limit switches.
2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
4 end-of-travel limit switches, two for each direction of travel.
2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve.
Each limit switch shall have 1 NO + 1 NC potential free contacts. Contact rating shall be 5A at 240.
The torque switch shall have a minimum accuracy of 3% of set value. The torque switch shall be provided with calibrated knobs for setting desired torque and separate knobs shall be provided for open and close torque switches.
The torque and limit switches shall be housed in a separate enclosure with protection class as that of actuators.
Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall de-clutch automatically when the motor is energised.
The actuator shall have:
One (1) built-in local position indicator for 0-100% travel.

Two (2) position transmitters, potentiometer type of 100 ohm rating for remote indication.
All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 mm2 copper. All wiring shall be identified at both ends with ferrules.
The terminal box shall be weather proof with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 mm2 copper conductor.
The terminals, terminal boards, terminal boxes, winding tails and associated equipment shall be suitable for connection to supply system having 'adequate short-circuit capacity and clearance time determined by associated fuses'. The terminal boxes shall be totally enclosed.
All terminals of limit and torque switches, space heater, position transmitters, shall be brought to a common terminal box. There shall be at least five (5) terminals spare to terminate spare cores of cable.
The actuator shall be painted with epoxy based paint. The colour shall be got approved from Engineer-in-Charge.
The name plate shall be provided on the actuators as per relevant IS. In addition, the following shall also be marked:
a) Tag number
b) Torque rating
Full travel time
The electric motors shall be three phase, squirrel cage type as per IS 325, induction motor with insulation to IS 1271 class B and IP 68 protection, designed for high torque and reversing service. The windings shall be impregnated to render them non-hygroscopic and oil resistant. All internal metal parts shall be painted. The motor shall be rated for 15 minutes. They shall also be suitable for operating on the specified electric supply and shall satisfactorily open and close the valve under variations of electric supply specified. (Voltage – 415V±10%, Frequency – 50 Hz ± 3%, combined variation – 10% absolute). The motor shall be designed for full voltage direct on-line start with starting current limited to 6 times full-load current. The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each. Earthing terminals shall be provided on either side of the motor.
Motor shall be protected by suitable overload protection device.
The reversing contactor starter and local controls shall be integral with the valve actuator. The starter shall comprise mechanically and electrically interlocked reversing contactors of appropriate rating fed from a 110 Volt control transformer. The common connection of the contactor coils at the transformer shall be grounded. HRC cartridge type primary and secondary fuses shall be provided.
Local control shall comprise pushbuttons for open, close and stop operations and a Lockable Local/Remote/off selector switch. The control schematics shall be subject to approval.
Internal wiring shall be of 650/1100 volt grade PVC insulated stranded copper conductor of minimum 1.5 sq. mm for control circuits and of minimum 4 sq.mm copper for the power circuit. Each wire shall be number identified at each end. The terminals shall be of stud type. Cable entries shall be suitable for PVC insulated/ sheathed, armoured cables. A separate terminal box be provided for the heater. A separate terminal box shall be provided for cabling to power and control circuits.
The actuator enclosure shall be fully weatherproof and hose proof to IP 67 and shall be fitted with an anti-condensation heater, which shall be switched off when the motor is running.
The torque switch mechanism shall function as follows to stop the motor on closing or opening of the valve, or upon actuation by the torque when the valve disc is restricted in its attempt to open or close.

The torque switch in the closing direction shall interrupt the control circuit if mechanical overload occurs during the closing cycle or when the valve is fully closed.
The torque switch in the opening direction shall interrupt the control circuit if mechanical overload occurs during the opening cycle or when the valve is fully open.
The mechanism shall facilitate adjustment of the torque at which the switches are required to operate.
Non-adjustable limit switches shall stop the motor and give indication when the disc has attained the fully open or closed position.
The adjustable limit switches shall have control rated Ampere & AC/DC Voltage for specified system interlock, at the desired value position in both the opening and closing directions.
Motor operators shall be provided with clearly visible local valve position indicators mounted on the operator assembly to give an indication whether the valve is fully open, fully closed or in an intermediate position.
Settings and emergency operation shall be possible with the use of a hand wheel. The Hand wheel shall be of stainless steel and the drive mechanically independent of the motor drive and any gearing should limit the operating torque at the hand wheel to less than 15 kg and be such as to permit emergency manual operation in a reasonable time. During electric operation, the hand wheel shall not rotate.
Actuators shall be adjusted at the manufacturer's works to ensure that they provide the correct, fully, open position and fully closed position. Mechanical adjustable stops shall be provided to prevent over-travel of the valve in the open and closed positions, so as to save the breakdown of gear box mechanism.
Actuators shall be provided with RS – 485 Communication terminal/contact for communicating the status of the actuator on PLC/SCADA system and in case of emergency the actuator can be operated through PLC/SCADA System.
7.1.2.1.68 Gaskets & Packings
Gaskets shall be of Nitrile rubber and readymade matching with respective flanges. Gaskets cut-out from rubber sheets are not acceptable.

7.1.2.69 Flanges
The nominal size and thickness of the flanges shall be as defined for pressure rating 1.0, 1.6 and 2.5 N/mm2 conforming to IS 6392 as per design. The pressure rating of the flanges shall be equivalent to the valve with which they are being installed. The selection of the flange out of these three ratings shall be based on the design pressure at the place of installation.
Valves shall be flanged and the flange face at right angles to the valve centerline. Backside of valve flanges shall be machined or spot faced for proper seating of the head and nut.
Flanges shall be machined on faces and edges to IS 6392 or BS4504. Flange drilling shall conform to IS 1538.
No new or additional holes shall be drilled on site. Tapped holes are not acceptable in flanges.

7.1.2.1.70 Nuts, Bolts, Washers
The jointing material such as nuts, bolts, washers, pig lead, rubber packing, etc. shall be provided by the Contractor. Nuts and bolts shall be of the best quality bright steel, machined on the shank and under the head and nut. Studs, bolts and nuts shall be galvanized. Bolts shall be of accurate length so that only one thread shall show through the nut in the fully tightened conditions. Nuts and bolts shall conform to IS 1363 and IS 1367. Washers, locking devices and anti-vibration arrangements shall be provided where necessary. Where there is a risk of corrosion, bolts, nuts and

studs shall be designed so that the maximum stress does not exceed half the yield stress of the material under any conditions. All bolts, nuts and screws which are subject to frequent adjustment or removal during maintenance and repair shall be made of nickel bearing stainless steel. The Contractor shall supply all holding down, alignment levelling bolts complete with anchorages, nuts washers and packing required to fix the plant to its foundations, bed plates, frames and other structural parts.
The Contractor shall procure and keep at site, reasonable excess quantities to cover wastage of those materials which will be normally subject to waste during erection, commissioning and setting to work. Throughout erection, the valves shall be supported properly on wooden sleepers, etc. and shall be concreted immediately thereafter, as directed. Before the valves are fixed, they shall be cleaned and greased and it should be seen that all parts are in perfect working condition. In the case of air valves, the Contractor shall take special care of the dexine joints and the ebonite and /or vulcanite balls until they are fixed in position. They shall be kept immersed in water in suitable containers.

7.1.2.1.71 Gear Box for Valves
Gear box must be self-locking type, with a continuous indicator. Travelling nut and screw type of gear boxes are not acceptable. The gear box of quadrant type or traveling nut type must conform to the provisions of AWWA C-504. The rated torque capability of each operator shall be sufficient to seat, unseat and rigidly hold in any intermediate position the valve disc it controls under the operating conditions specified. The operator must essentially be of self-locking type with or without additional spur gear arrangement to ensure that the effort on hand wheel is limited to the pull specified. All valve operators shall be equipped with adjustable mechanical stop limiting devices to prevent over-travel of the valve disc in the open and closed positions. Either end of the worm shaft must be provided with needle roller bearing to take on the lateral thrust.

The housing for the gearing must be enclosed and sealed in such a way that there is no leakage of oil / grease even after long period of un-use and there is no ingress of rain water. Operator for valves, which are likely to be submerged in water for long period during the rainy season, must be water tight. The hand wheels may be provided with extension for easy grip. The hand wheels must have a provision for locking with a chain and pad lock. All operators when fitted to the valve shaft must ensure clock wise closing and this must be indicated on the housing. A mechanical indicator is to be provided to show disc travel and end of travel.
Material of Construction:

Housing and Cover	SG Gr 500-7/CS Gr WCB
Quadrant	SG Gr 500-7
Spur Gears	EN-8 with hardened pinions of EN-19
Worm	EN-19, hardened
Bearings	FAG/SKF/Equivalent
“O” rings	Nitrile rubber
Hand wheel	Steel / SG Iron

7.1.2.1.72 Sluice Gates
General Specifications

Sluice gates according to IS 13349/IS 3042 (Latest Reaffirmed) shall be provided in open channels for outlets to pipes, other channels etc. All sluice gates shall have proper arrangement for electrical operation for opening/closing and position indicator. They shall be suitably linked to the switchgears and instrumentation control panel. They shall be square or circular, in standard sizes, according to the outlet conditions. The gates shall generally be mounted on the side from where the higher pressure shall generally be expected (seating). The gates shall be mounted on frames and provided with a non-rising spindle with headstock or electrical drive according to the site of installation.

In case of alternative load from either side, the sluice gate shall be designed to tightly close against a maximum unbalanced head (forcing the door away from the seat/frame) corresponding to 150 % of the maximum difference in the water levels or the difference plus 1 m, whichever is higher. The frame shall be with gunmetal seating faces, machined to match with the faces of the door. The frame shall have a sufficiently broad flange of adequate section with drilled holes to fix it with anchor bolts. It shall have an integrally cast in spigot of the nominal size of the opening to be cast into the concrete. It shall have a side guide strip with a machined face up to the maximum open position of the door. The upper part of the frame shall have machined face to support a thrust plate. All anchor bolts and nuts of galvanized mild steel, joints and fixing elements shall be provided. The door shall have reinforcement ribs depending on the size of the door and the unbalanced head. The adjustable sealing faces on the sides, bottom and top are of gunmetal and machined to match the seat on the frame. Sufficient margin should be there for wear and tear in course of use. On the back, tapered snugs shall be provided to match the tapered side guide strips of the frame. There shall be an integrally cast pocket in the upper part for the gunmetal nut threaded to suit the non-rising spindle.

The spindle shall be rolled on trapezoidal thread. It shall be provided with torsional couplings, cast iron guide brackets, and mild steel extension rod up to the headstock/drive. Ball thrust bearing arrangements shall be provided for long spindle. The headstock shall be a cast iron pillar with an operating rod operated by a hand wheel on top, fitted with gunmetal index and pointer. The hand wheel shall be designed for operation by one man against the full unbalanced head (not more than 10 kgf). The maximum time for opening and closing of gate shall be 15 minutes with electrical actuation. The Leakage in Sluice gates must be as per IS 13349.

Materials of Construction

Frame	CI ASTM A126 Class B with 2% NI
Door	CI ASTM A126 Class B with 2% NI
Sealing faces	Gun Metal
Spindle	SS. IS 410
Head stock	CI
Hand wheel	CI ASTM A126
Flush Bottom seal	ASTM D2000 50-60 Durometer Neoprene
Flush bottom retainer	ASTM A276 Type 304(L) or 316 (L) SS
Stem coupling	316 Stainless steel

7.1.2.1.73 Tests:

The Sluice gates will be tested for closed end tests as per the IS.
The Sluice gates shall be tested for Material Testing, Dimensional verification, Seat Clearance Check, Movement, Shop Leakage and Hydrostatic Tests as per IS: 13349.

7.1.2.1.74 Specifications for Pipes and Fittings

General Standards

Except as otherwise specified in this technical specification, the Indian/International Standards and Codes of Practice in their latest version shall be adhered to for the design, manufacturing, inspection, factory testing, packing, handling and transportation of product. The work of laying; jointing; testing and commissioning shall also be as per the relevant Indian standards. Should any product be offered conforming to other standards, the equipment or products shall be equal to or superior to those specified and the documentary confirmation shall be submitted for the prior approval of the Engineer-in-Charge.
If any provision is prescribed in more than one Indian Standards, the specification more stringent shall be used for the work.

7.1.2.1.75 Ductile Iron pipes and Specials

Ductile iron pipes shall be of K9 class & DI fittings shall be of K12 class.
Ductile pipes to be used shall be centrifugally cast (spun) Ductile Iron Lined pipes suitable for Water and Sewage & conforming to IS 8329: Latest Revision with internal cement mortar lining.
Ductile Iron Specials such as bends, Tees, Tapers, tail pieces etc., shall be confirming to the IS 9523: Latest Revision.
The fittings should preferably be manufactured by a manufacturer of the pipes. In case they are not, it will be the responsibility of the manufacturer of the fitting to provide fitting which commensurate with the supplied DI pipes. The special manufacturer will however be responsible for the compatibility and quality of the products.
For all purposes, the lengths of the pipes provided shall be the length as defined in IS 8329. The pipes will be supplied in standard lengths as per the provisions in the standards (IS 8329), to which the manufacturing confirms (IS 8329). The ends shall be suitably rounded and/or chamfered ends. Any tolerance in the stipulated lengths will be as per the provision of the standards to which it has been manufactured.
The tolerance in diameter, thickness, ovality & permissible deviation from straight line shall be as per the standards to which the pipe is manufactured (IS 8329).
Supplies of rubber gaskets shall be done by the contractor confirming to the relevant specifications. Contractor shall preferably take them from the approved vendor of the manufacturer of the pipe.

7.1.2.1.76 Standards for Rubber Gasket

Each pipe of the push on joint variety will also be supplied with a rubber EPDM gasket. The gaskets will confirm to the provisions of IS 5382:1985. Material of rubber gaskets for push-on mechanical or flanged joints shall be compatible with working pressure and temperature at which the water is to be conveyed. Rubber gaskets for use with flanged joints shall conform to IS: 638. The flanged joints shall confirm to the provisions of IS 8329. The pipe supply will also include one rubber gaskets for each flange.
Gaskets shall be of Nitrile rubber and readymade machined cut gaskets for respective flange shall be used. Gaskets cut out from rubber sheet are not acceptable.

7.1.2.1.77 Inspection and Testing:

The DI Double Flanged pipes supplied by the contractor will be subjected to following tests as per IS 8329 for acceptance:
Visual and dimensional check as per IS 8329
Mechanical Tests as per IS 8329
Review of online record of Hydrostatic Test as per IS 8329 of all pipes to be supplied.
Any other tests required as per the provisions to which the supplied pipe confirms i.e. (IS 8329).
The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5382.
The sampling method for testing shall be as per the provisions of the standards to which they are manufactured.
7.1.2.1.78 Marking
All pipes will be marked as per provisions of IS 8329 and subjected to the following minimum requirements:
Manufacturer name/ stamp with last two digits of year of manufacturing
Nominal diameter
Class reference
Manufacturing standards to which the pipe confirms (IS 8329), and BIS certification mark.
Mark of the pre-dispatch inspecting authority.
Acceptance tests
They shall be conducted in line with the provisions of the IS 9523.

7.1.2.1.79. DI Pipe handling, Laying, jointing, testing and commissioning

Laying of DI pipes shall conform to IS: 12288. All pipes, fittings and material shall be tested and approved by the Engineer- in -Charge before being laid. Polyethylene sleeves wound pipes shall be used for water logged areas as directed by the Engineer- in -Charge.
The transportation and handling of pipes shall be made as per IS 12288. Cranes or chain pulley block or other suitable handling and lifting equipment shall be used for loading and un-loading of heavy pipes. However, for pipes up to 400 mm nominal bore, skid timbers and ropes may be used. When using crane hooks at sockets and spigot ends; hooks shall be broad and protected by rubber or similar material, in order to avoid damage to pipe ends and lining. Damage to lining must be repaired before pipe laying according to the instructions of the pipe manufacturer. The trench must not be refilled before laying of the pipes.
All specials like bends, tees etc. and appurtenances like sluice or butterfly valves etc. shall be laid in synchronization with the pipes. No pipe shall be laid in wet trench conditions. On gradients of 1:15 or steeper, precautions should be taken to ensure that the spigot of the pipe laid does not move into or out of the socket of the laid pipe during the jointing operations. The designed anchorage shall be provided to resist the thrusts developed by internal pressure at bends, tees, etc. Where a pipeline crosses a watercourse, the design and method of construction should take into account the characteristics of the watercourse to ascertain the nature of bed, scour levels, maximum velocities, high flood levels, seasonal variation, etc. which affect the design and laying of pipeline. The assembly of the pipes shall be made as recommended by the pipe manufacturer using suitable tools.

7.1.2.1.80. Pipe testing and commissioning

The pipeline shall be tested for tightness of barrels and joints, and stability of thrust blocks in sections. Preferably the pipeline stretches to be tested shall be between two chambers (air valve, scour valve, bifurcation, other chamber).
The water required for testing shall be arranged by the contractor himself. The Contractor shall fill the pipe and compensate the leakage during testing. Complete setting of the thrust blocks. Water used for testing should not be carelessly disposed off on land which would ultimately find its way to trenches. The testing conditions for the pipelines shall be as per the test pressures and condition laid out in IS 8329 for DI pipes.

The testing conditions for the pipelines are summarized as follows:

Maximum hydrostatic test pressure for DIK9 pipes shall be 2.0 times of maximum design pressure in the pipeline.
Pre- test and saturation period with addition of make-up water.
Pressure: Test pressure.
Duration: 3 hrs for DI pipes without cement mortar lining / 24 hrs for DI pipes with cement mortar lining.
Pressure test with addition of make-up water.
Pressure: Test pressure.
Duration: 3 hrs.
Test criteria for DI pipes: Q=1 litre / km per 10mm of pipe per 30 m test pressure per 24 hrs.
All pressure testing at site should be carried out hydrostatically. The pipes shall be accepted to have passed the pressure test satisfactorily, if the quantity of water required to restore the test pressure does not exceed the amount „Q", calculated by the above formula. All pipes or joints which are proved to be in any way defective shall be replaced or remade and re-tested as often as may be necessary until a satisfactory test have been obtained.

7.1.2.1.81 Specifications for MS Pipes

7.1.2.1.80.1 Manufacturing of MS Pipeline
Manufacturing of MS pipes shall be done in conformity with IS: 3589 subject to following modifications. The diameter of MS pipes mentioned anywhere in the tender documents shall mean the finished internal diameter of the pipe as per specifications. In general MS pipes shall be manufactured as per relevant IS: 1239 & IS: 3589, as the case may be. However, following specifications are to be strictly followed:
The pipe shall be fabricated out of steel plates or strips of fresh mild steel coils (HR coils) conforming to IS-2062, and having minimum specified tensile strength of 410 MPa. MS pipelines shall be of grade 410.
MS PIPES shall be essentially spirally welded only (longitudinally welded pipes not permissible)
For MS pipe line to be laid above ground, Zinc rich epoxy primer confirming to IS: 14589 and Epoxy based Paint conforming to IS: 14209 and as per the approved make shall be used for painting.
For MS Pipes to be laid below ground level pipes shall be provided with outer tape coating as per IS 10221.

Inner surface of MS Pipes, without internal cement mortar lining shall be provided with internal coating of red oxide and epoxy paint.
Helical seams, butt-welded having joints with beveled ends as per IS 3589.
The electrode shall be conforming to IS 814.
The random length of MS pipes shall be 6 meters or more without circumferential welding.
The end of MS pipes, short pipes shall have beveled end for welding.
MANUFACTURING PROCESS SHALL ENSURE THAT –
Base material i.e. HR coils shall be of required quality.
Production equipment is well designed.
Quality control is comprehensive.
7.1.2.1.80.2 Testing
The pipes shall be tested to the following requirements in presence of Engineer-in-Charge or his representative or a third party.
Continuous monitoring of diameter and forming.
Visual inspection of all pipes from inside and outside for permissible tolerances as per IS: 3589.
Offline ultrasonic testing of weld as per IS: 4260 during welding.
Radiographic testing as per IS: 4853 for 20cm length from both the ends.
Each pipe shall be hydraulically tested to at the manufacturer's works to a test pressure as mentioned in IS: 3589.
Mechanical tests of finished pipes as per IS 3589.

7.1.2.1.80.2 Quality Assurance
During the whole process of manufacturing, department's representative or third party shall be present to supervise the Quality Assurance process and witness the test performed.

7.1.2.1.80.3 Fabrication of MS Specials & Fittings

General
Unless and otherwise mentioned in the para below, the dimensions of all MS specials and fittings (bends, tees, scour tee, reducers, enlargers, etc.) shall in general confirm to the principals of IS: 7322, using MS plate/sheet conforming to IS:2062. The thickness shall be adequate to sustain field test pressure but shall not be less than the thickness of the pipe at that point.
The Contractor shall submit the detailed drawing for each special to be used in the pipeline. On approval of the same by the Engineer-in-Charge, the Contractor will take up the manufacturing. All specials shall be manufactured and coated at the manufacturer's premises. In exceptional circumstances when welding in trench is unavoidable as advised by the Engineer-in-Charge, a flanged opening shall be provided for access inside the special for welding. The Contractor has to ensure the timely manufacturing of the MS specials so that they can be laid in synchronization with the pipe laying. The joints of adjacent pipe stretches have to be made with gap-pieces approved by the Engineer-in-Charge.
On completion of the manufacturing, the material shall be inspected by the Engineer-in-Charge or his representative at the manufacturer works. On approval of the latter, the coating and lining for the special will be done by the Contractor as per the specifications for coatings given in this chapter. Tolerance for steel fittings shall confirm to the requirements of IS: 7322.

(a) Flanged Branches

Flanged branches shall be fabricated in accordance with the general specification and to the Engineer-in-Charge's requirement. Flanged branches for air and scour valves shall be welded into pipe in the required position. The branch for an air valve shall be vertical and at right angle to the longitudinal axis of pipe. The invert of the branch for a scour valve shall be horizontal and at right angles to the axis of pipe and shall align with the invert of the barrel of the main pipe. All the flanges shall be machined to standard thickness, square to the axis of the pipe.

(b) Bends

Bends to provide change of alignment in pipe laying shall be manufactured to suit the site conditions. Bends shall be manufactured from tested pipes by angle cutting of the barrel or by such other standard procedure and re-welding. Bends shall be lined internally and coated externally as specified for the pipes.

Bends shall be fabricated taking into account the vertical and horizontal angles for each case.

The bends shall have welded joints and the upstream and downstream ends of each bend shall have a straight piece of variable lengths as required.

Bends shall be designed with deflection angle between two segments as per provisions of IS: 7322 (amended up to date).

When the point of intersection of a horizontal angle coincides with that of a vertical angle, or when these points can be made to coincide, a single combined or compound bend shall be used.

Details of thrust collars anchor bolts, holding down straps, saddle plates should be furnished together with full specifications in Contractor's fabrication drawing.

(c) Tapers

Tapers shall be manufactured out of steel plates and lined internally and coated externally. The tapers shall be suitable for connections to the sluice valves or flanged tailpiece on one side and to MS pipe on the other side. Stiffener rings shall be provided to afford rigidity to pipe. They shall be manufactured generally in accordance with IS: 7322.

(d) MS flanges

Welding neck flanges confirming to BS 6392 for nominal pressure rating 1.6, 1.0 and 0.6 N/mm2 must be used in accordance to the design pressure at the place of installations. Nominal Size of flange shall be in conformity to the equipment or pipe appurtenance with which they are to be used. The flange drilling shall conform to IS 1538 for flanges up to 1500 mm ID.

Flanges shall be provided at the end of pipes or special where sluice valves, blank flanges, tapers, etc. must be introduced. The Contractor shall assemble the flanges in the exact position by marginal cutting, if necessary, to get the desired position of the sluice valves, etc. either vertical or horizontal and shall then fully weld the flanges from both sides in such a way that no part of the welding protrudes beyond the face of the flanges. In case the welding protrudes beyond the flanges and if the Engineer-in-Charge orders that such protrusions shall be removed, the Contractor shall file or chip them off. If required and when ordered by the Engineer-in-Charge, the Contractor shall provide and weld gusset stiffeners, as directed on site.

(e) Blind Flanges

Blank flanges shall be provided at all ends left unattended for the temporary closure of work and for commissioning a section of the pipeline or for testing the pipeline laid. For temporary closures, non-pressure blank flanges consisting of mild steel plates, tack welded at the pipe ends may be used. For pipes subjected to pressures, the blank flanges or domes suitably designed as per Engineer-in-Charge's requirements shall be provided. The thickness of the blank flanges shall be as

defined in IS 6392 for the nominal size and design pressure at the place of installation, the flange drilling for all flanges up to 1500 mm ID shall conform to the provisions of IS 1538.

(k) Dismantling Joint:
All butterfly valves, scour valves, Bulk water meters or any other online valves etc. shall be installed between flanges with a flexible MS dismantling joint at one side. The joint must allow dismantling of the valve, meters etc. without causing stress to the joints of the attached pipes. The minimum clearance of the dismantling joint shall be five (5) cm. The pressure class of the dismantling joint shall be the same as that of the pipe. Drawings of the dismantling joint shall be submitted to the Engineer-in-Charge for approval. The Nuts and Bolts of the joint shall be galvanized. The joints shall be painted / coated as per specification given for exposed pipes.

7.1.2.1.80.4 Inspection and Tests on MS Pipe and Fittings/Specials
The pipe shall be tested as per provision of the above specifications.
Each special or fittings shall be subjected to tests as per IS: 7322 before inner and outer coating. The hydraulic test pressure shall be as per IS: 3589 for specials. Dye penetration test as prescribed in IS: 7322 is acceptable in lieu of hydraulic test for all specials. The workmanship and marking on pipes must be conforming to the above specification. All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the Contractor of his responsibility to furnish material and perform work in accordance with these specifications. The Engineer-in-Charge or the authorized inspection agency shall have free access to those parts of the plants that are concerned with the furnishing of materials of the performance of work under this specification. The bidder shall furnish the Engineer-in-Charge reasonable facilities and space without charge for inspection, testing and obtaining of any information he desires in respect of the quality of material used and the progress and manner of the work. Sampling of pipes shall be taken as per IS 4711-1974. Contractor shall provide and operate suitable equipment capable of conducting the specified hydraulic test pressure to the inside surfaces of the pipe and of sustaining the pressure for the required period.

7.1.2.1.80.5 Specification for Paint for Pipeline above Ground

Material
Zinc rich epoxy primer and Epoxy based Paint conforming to the following specifications and as per the approved make shall be used for painting. IS: 14589- Epoxy based two packs Zinc Priming paint and IS: 14209 Epoxy enamel two component glossy. Each lot of the paint supplied shall be accompanied by the certified copies of the results of the tests carried out by the manufacturer. The manufacturer of primer and paint shall have ISO standard license. If any sample of the paint and /or primer is not conforming to the specifications, the entire consignment to which the sample may pertain shall be rejected. Only those primers and painting materials that have been approved by Engineer in Charge shall be used for the work.

General
All oil and grease shall be removed from surface to be painted by washing with a suitable solvent and by wiping with rags until completely clean. After removal of all oil and greases, removing all rust, loose scale and dirt by sandblasting, grit blasting or other effective means shall clean surfaces of metal work required to be painted. Surface, which will be permanently or intermittently

submerged or subjected to moisture from spray or excessive condensation, shall be cleaned to clean metals by sand or grid blasting. After cleaning, all surfaces shall be maintained free from oil, greases, rust, dirt and other contaminations until they have received the final coat of paint.
Surface of stainless steel and bronze and machined surfaces which are attached or adjacent to metal work that is being cleaned or painted shall be protected by adhesive tape or other suitable means during the cleaning and painting operations.

7.1.2.1.80.6 Sand Blasting (only for pipes fabricated at manufacturing plant)
The surface of the steel pipes and specials to be painted shall be thoroughly cleaned by sand or shot blast cleaning process to SA 2.5 finish, to remove all rust mill scale etc. Applying a suitable metal cleaning solution and wiping with clean rags shall remove oil and grease. All foreign matter, which cannot be removed by blasting process, shall be removed as directed by the Engineer/Owner. Blasting should be done at a pressure of 5.62 kg/sq.cm. (80 psi) at the compressor end and at 4.93 kg/sq. /cm. (70 p.s.i.) at nozzle end. This pressure should be maintained during the entire blasting operations. Improper jointing of hosepipes and resultant reduction in pressure at nozzle end shall be checked and avoided. The blast-cleaned surface shall be primed immediately after blasting is over. The sequence and the programme of blast cleaning and application of red oxide primer shall be arranged in such a way that the blast cleaned surface shall not remain uncovered with red oxide primer for more than 2 hours. Any deviation from above shall require the approval of the Engineer/Employer.

7.1.2.1.80.7 Manual Cleaning (Only for Site Fabricated Items)
Wherever the Engineer approves manual cleaning shall be thoroughly cleaned by using scrapers and wire brushes to remove all rust, mill scale etc. to give a shining metallic (SA 2.5) surface. The surface so cleaned shall be washed with water and allowed to dry. A metal cleaning solution of approved make shall then be applied over it. After it is dry, the surface shall be again washed with water, scrapping wire brushes simultaneously. A copious use of water is necessary at this state to ensure that the metal cleaning solution is completely removed. The primer coat shall be applied immediately after the surface has become dry.

Epoxy based two pack Zinc Priming paint (grade II)

DESCRIPTION	Two pack Zinc Rich consisting of Priming paint
BASE	Fine zinc Dust Ground in Epoxy Resin Solution, supplied in paste form
CATALYST	Abduct Type - The non-volatile portion of the material (mixed) should consist of 92% Zinc Dust and 8-10% Epoxy Resin and curing agent.
SHADE	Grey
CHARACTERISTICS	The paint shall provide a complete rust inhibitive barrier coating of high mechanical and abrasion resistance. The film shall be compatible for fusion and spot weld.
POT-LIFE	4 – 6 hours
MIXING RATIO	The proportion of mixing of base and hardener should be as specified by the Manufacturer by weight and volume. The mixed primer shall conform to the specifications detailed
VISCOSITY OF	15-22 in Fort Cup No.4 at 30oC

READY MIXED PAINT	
DRYING TIME	Dust free - 10-15 minutes Chamber curing - 24-48 hours
THICKNESS	45 Micron
SHELF LIFE	The paint which has been under storage for more than 6 months shall not be used. In order to ensure non settlement of heavier contents, the Paint drum should be turned upside down every 14 days or such a period as the manufacture recommends. For this purpose, dates on which overturning is to be done, may be painted on drum ends.

Epoxy enamel two components glossy

Characteristics	Requirements	Method of Test
DRYING TIME	Surface dry: Not more than 4 hours. Hard dry: Note more than 18 hours	On application, a nonabsorbent surface should give a film thickness of 30 micron per coat
CONSISTENCY	Thixotropic liquid	
FINISH	Smooth and glossy	
COLOUR	Black. For the 2nd coat, slightly red tinted color will be applied.	
STRIPPING TEST	Scratches free	Apply one coat of the material by brushing on a mild steel panel 6"x2". Allow drying for 48 hours. Scratch the film with a sharp penknife so that the bare metal is visible. The scratch so produced shall be free from jagged edges.
FLEXIBILITY AND ADHESION AFTER 96 HOURS AIR DRYING	No visible damages or detachment of the film	Prepare a panel above. Allow it to dry for 96 hours and bend the panel double 3" from the upper edge over a 6 mm dia. rod with the paint film on the outside. The time of bending shall not exceed one second and the film shall not become visibly damaged or detached.
PROTECTION AGAINST CORROSION UNDER CONDITIONS OF CONDENSATION	No sign of corrosion when tested on the complete with	Prepare a panel 150mm X 100 mm of cold rolled iron properly derusted system one coat of zinc rich primer and three coats of epoxy based paint as indicated in the

		detailed specification. Allow the panel to stand in air for 7 days complete curing. Keep the panel in a corrosion chamber temperature of which is maintained at 42 deg. C to 48 deg.C in such a way that continuous condensation of water takes place on the panel. After exposure to these conditions for 7 days, take out the panel and examine for sign of corrosion after removing a portion of the film at the center of the panel. These corrosion.
IMPACT TEST	To pass test as per described herein after	
RESISTANCE TO HEAT	To pass test as per described herein after	
RESISTANCE TO SEA WATER	To pass test as per Test II attached	
FLASH POINT	Not below 35 deg.C	When tested in Abel's closed Flash Point Apparatus
KEEPING PROPERLY	Not less than 6 months	
FREEDOM FROM LEAD	Not more than .03% Chemical Analysis lead calculated as PbO	
FREEDOM FROM PHENOL OR PHENOLIC COMPOUNDS	Total	Chemical Analysis
PACKING	The paint shall be packed in metal containers	
WEIGHT	The minimum weight of 10 liters of the material should not be less than 11.5 kg.	

7.1.2.1.80.8 AIR RELEASE VALVE

Standard Double air valve, directly operated by the flow medium. The air valve shall be designed for air admission during draining of pipe line, venting during pump starting and continuous venting during pump operation.

Design Specifications:

Ends : Flanged as per relevant code

Rated Pressure : 10 Bar

Surface protection : Electrostatic powder coating (EP- P) inside & outside

Material of Construction:

Body and Cover : Ductile Cast iron (GGG-40)

Float : Austenitic Alloy steel
Gaskets& Seals : EPDM
Inner parts : Stainless Steel
Type & Make: Make-Reputed/Approved make
The ARVs are to be installed on Ductile Iron pipes of relevant sizes as mentioned in BOQ. The job includes providing of all such fittings ,accessories etc.required for the installation alongwith the ARVs.Nothing extra shall be paid for arranging such fittings/accessories .
The testing of Air release valves shall be as per relevant IS codes.

7.1.2.2 **ELECTRICAL WORKS**.
Specification for Pumping Station

7.1.2.2.1.General

It is not the intent to specify herein all the details pertaining to the design, drawing, selection of equipment/materials, procurement, manufacture, installation, testing & commissioning, however, the same shall be of high standard of engineering and shall comply with all currently applicable standards, regulations & safety codes. These specifications cover the equipment to be installed in transmission line, switchgear, substation, control equipment's, cables etc. along with the specifications for workmanship, laying cables, earthing systems, lightning protection etc.
It shall be the responsibility of the Bidder to design the electrical system based on the selection of the mechanical equipment. The work will be executed as per the detailed designs and drawings approved during execution. The equipment / material installed at headworks shall commensurate with those installed by the contractor constructing the pump house building. The power shall be made available at the nearest tapping point of pumping station, from which all works shall be done by the contractor.
Wherever the electrical equipment and system has to be connected with the Instrumentation system, the details of the connectivity of the electrical system/equipment with the Instrumentation system has to be worked out by the bidder to be commensurate with the requirement of the Instrumentation system to be provided, Irrespective of the provisions given in these specifications for electrical equipment/works. The successful bidder shall provide all necessary accessories with the equipment

dealt herein or additional equipment required for effective functioning of the electrical and Instrumentation systems.
The successful bidder shall provide all necessary interfaces like RS- 485 for communicating to SCADA/PLC for monitoring and controlling the following:-

Pumps and Motors
All Valves
Level Controller
Pressure Monitor
Flow Monitor
Water Quality Monitor
Transformer
DG Set
Servo Stabilizer
Fire Detection Systems
LV Panels

The brief technical specifications of various electrical equipment's are given in subsequent clauses comprising the following:
_ Applicable Indian Standards
_ Other considerations (if any)
_ Technical parameters provided in specifications
Drawings and documents for review/approval
The various systems covering the installation practices are described separately.
The scope of the Bidder shall cover design and drawing of electrical systems, selection of the equipment/materials, procurement, expediting, inspection, packing and forwarding, delivery at site, erection, testing, commissioning, obtaining the statutory approvals, handing over the complete plant etc.

a. Power Supply Information
The proposed power supplies are as follows:

1	11 KV AC System	Voltage variation +10 to -15% Freq. Variation +3 to -5%	Three Phase,50Hz, effectively earthed system, SC. rating of 300 MVA
2	415V AC System	Voltage variation +10 to -15% Freq. Variation +3 to -5%	Three Phase and neutral, 50 Hz, effectively earthed system, SC. rating of 50 kA
3	240V AC System	Voltage variation +10% to -15 % Freq. Variation + 3% to - 5%	Single phase and neutral, 50Hz, effectively earthed system

The ambient temperature for design of the electrical equipment shall be 50° C. The MSL for design of equipment shall be 1733 M above sea level.

b. Fault Levels

The fault levels of the proposed units in the substation / pump house shall be as per follows:
11 kV systems: 300 MVA

415 V systems: 20 MVA

Design Considerations

General Design Considerations
The electrical installations proposed under the contract are for the project requirement. Future extension shall be consider for Transformers and LV Panels.

Pumping Station

11kV, three phase power shall be made available at pumping station. The location of the tapping point shall be within the headwork area. From this point onward, the bidder is required to design & construct all electrical works for the pumps and motors and other auxiliary works. The bidder shall furnish all data at the time of execution to the concern authorities.

Miscellaneous
The specifications mentioned subsequently cover broad outlines of system requirements and this is not the limit of specifications and therefore contractor shall not limit to mentioned specification but shall design and formulate the system as per standards and practice in electric company in the state of J&K.

Requirements of Protections and metering sub-station(s) and pumping station(s)
Protections

Following protection / relays are proposed for incomer, transformers, motors and other plant feeders.

APFC relay with summation CTs compatible for large/small loads.
AC inverse definite min. time over current relay
AC inverse definite min. time earth fault relay
AC overvoltage and under voltage relays.

Other Feeders for 415 V systems

MCCB
MCB with HRC fuses

All relays shall have to be numerical microprocessor based having RS-485 port to communicate with PLC and SCADA system.

Meters

The following meters shall be provided
On L.V side of transformers
Ammeter with selector switch
Voltmeter with selector switch
Multi-Functional Meters, Class 1.0

L.V Panel must be provided with Ammeter and Ammeter switch and Voltmeter with selector switch
Capacitor feeders shall be provided with Ammeter and Ammeter selector switch

All multifunction meters shall have RS-485 port to communicate with PLC and SCADA system.

7.1.2.2.2 Specifications for Power Transformers
The power is to be tapped from 11/33 kV transmission line with Dog conductor. A minimum rating of transformer as defined in BOQ is to be provided in each SUBSTATION. Prior to the transformer, suitable capacity 6 Pole or 4 Pole or 2 Pole structure consisting of LA, AB switch and Drop-out Fuse earthing arrangements shall be provided as per standards.

No	Standard	Description
1	IS 1180	Specifications of Energy Efficient Transformers
2	IS 2026	Specification for power transformer
3	IS 2099	Specification for bushing for alternating voltages above 10000V
4	IS 3347	Specification for porcelain transformer bushing

Other considerations

The height of the transformer foundation shall be such that the line terminal (33 kV side) and cable termination box in LT Side shall at least be 4575 mm above top of the finished ground level of the 33-kV outdoor 6 Pole, 4 pole, 2 or single pole structure.
The main transformer shall be complete with an off-load tap changing up to 1500 KVA and above shall be provided with on Load Tap Charging, and all other accessories. Requirements of Indian Electricity Rules should be fulfilled as required.
Technical parameters for Power Transformers

Transformer Particulars

1	Application	Power distribution
2	Nos. & Rating and voltage ratio of each unit	As per BOQ with step down Voltage , 33-11kv/0.415Kv
4	Percentage Impedance (subject to IS tolerance)	As per IS 1180
5	Cooling method	ONAN
6	3 Phase unit/single phase unit	Three phase single unit
7	Winding material	Copper above 100 KVA & Aluminum below and up to 100 KVA
8	Type of winding	Delta – Star
9	Vector Group	Dyn11
10	Fault Level on HV side for 33kV/0.44 kV	300MVA/20 MVA
11	Neutral earthing of LV system	Solidly earthed
12	Whether fully insulated	Yes
13	Impulse voltage withstand on 11 kV	-
14	Power Frequency withstand voltage for 33kV	75 KV for 33 KV line

15	Temp. rise of oil by Thermometer	40 degree Centigrade over ambient
16	Temp. rise of winding by resistance	45 degree Centigrade over ambient
17	Tapping on winding	HV
18	Total Tapping Range & step range	+/-7.5% in step of 2.5% & as per IS 1180/2026
19	HV side termination suitable for 33 kV/0.44 kV Transformer	DOG ACSR Conductor
20	LV side termination suitability suitable 11kV/0.44kV transformer	1.1 kV grade 3 1/2" core armored AYFY cable
21	LV winding neutral end	Additional bushing for external system earthing
22	Installation	Outdoor, Pole mounted
23	Color shade of final painting as per IS 5	Yes - (Shade No. 632)

Accessories for Power Transformers

1	Relay for 33/0.44 kV transformers	Required
2	WTI with 2 mercury contacts for 33/0.44 kV transformers with RS 485 port	Required
3	OTI with 2 mercury contacts for 33/0.44 kV transformers with RS 485 port	Required
4	MOG with 1 mercury contact for 33/0.44 kV transformers only	Required
5	Silica gel breather	Required
6	Oil conservator tank	Required
7	Pressure relief valve for 33/0.44 kV transformers only	Required
8	Inspection manhole for 33/0.44 kV transformers only	Required
9	Lifting lugs	Required
10	Tap position indicator for 33/0.44 kV transformers only	Required
12	Detachable radiators	Required
13	Oil drain cum sampling valve for 33/0.44 kV transformers only	Required
14	Air release drive for 33/0.44 kV transformers only	Required
15	Explosion vent	Required

Installation Requirements

The Transformers are required to be installed on Two Pole or Four Pole Structure / concrete bed as per approval of EIC. The Transformers are required to be installed as per the norms specified in Indian Electricity Rule. The Transformer Body and Neutral Earthing are required to be done separately considering the fault levels specified. The installation of transformer shall have to be done in a way considering the ease of maintenance at latter stage. Minimum clearances as specified in Indian Standards and Indian Electricity Rules are to be taken care at the time of Installation.

Drawing and documents required

1) GA drawing of the complete transformer
2) Foundation drawing for transformer
3) GA drawings for bus duct termination (if provided), marshalling box
4) Schematics and wiring diagrams for MB
5) Instruction manual for installation, operation and maintenance

7.1.2.2.3 Drop Out Fuse (DOF)

This specification covers outdoor, open, drop out expulsion type fuse cut outs suitable for installation in 50Hz, 33/11KV system for protection of H. T. lines and transformer lines in Srinagar city. It is not the intent to specify completely herein all the details of design and construction of 33KV D.O. fuse.

1	Applicable Standards	IS: 9385 (Part-I to III)
2	Rated Voltage	33 KV
3	Rated Current	As per design maximum to 100 A
4	Rated Lighting Impulse withstand voltage	
a.	Earth and Between Pole	75 KV Peak
b.	Across the Isolating Distance	85 KV Peak
5	One Minute Power Frequency withstand voltage	
a.	Earth and Between Pole	28 KV rms
b.	Across the Isolating Distance	35 KV rms
6	Rated Breaking Capacity	KA
7	Class	Station class

Drawing and documents required

1) GA drawing of the Drop our fuse (DOF) including structure mounting details.
2) Instruction manual for installation, operation and maintenance.

7.1.2.2.4 Outdoor Lightning Arrestor

This specification covers outdoor Lighting arrestor suitable for installation in 50Hz, 33kv/11KV system for protection of H. T. lines and transformer lines in Srinagar city. It is not the intent to specify completely herein all the details of design and construction of 33KV L.A.

1	Applicable Standards	IEC publication No. 60099 – 4
2	Type	Metal Oxide, Class "A"
3	Rated Voltage	33/11 KV
4	Rated Current	As per design
5	Pressure Relief Device	Pressured Relief Class "A"
6	Terminal Connectors	"Panther/DOG"
7	Nominal Discharge Current	10 kA, heavy duty station Class type "Class 3"

Drawing and documents required

1) GA drawing of the Drop our fuse (DOF) including structure mounting details.
2) Instruction manual for installation, operation and maintenance.

7.1.2.2.5. Diesel Generator

Applicable Standards

The Diesel Standby Generator and its components shall conform to the latest applicable standards specified below:

Diesel Engines for General Purposes	:	BS 5514 / ISO 3046
The Electrical Performance of Rotating Electrical Machinery	:	BS 5000
Rotating Electrical Machines	:	IS 4722
Circuit breakers	:	IS-13118, BS-5311, IEC-56 & 694, BSEN-60942 (P-2)
Air break switches air break disconnectors, air break switch disconnectors and fuse combination units for voltage not exceeding 1000 V AC or 1200 V DC	:	IS-13947 (P-3), BS-EN60947, IEC-60947-3
Current transformer	:	IS-2705/BS-7626, IEC-60185
Voltage transformer	:	IS-3156/BS-7625/IEC 60186
Electrical Relays	:	IS-3231, 3842/BS-142/IEC-60255
Contactors for voltage not exceeding 1000 V ac or 1200 VDC	:	IS-13947 Part-IV/ BSEN-60947-4-1/ IEC-60947-4-1
Control Switches	:	IS-6875/BSEN-60947 / IEC-60947-4-1
High Voltage Fuse	:	IS-9385/BS-2692/ IEC-60282
Low Voltage Fuse	:	IS-13703/BS-1362 IEC-269-1
Electrical direct acting indicating Instruments	:	IS-1248/BS-89/IEC-60051
A.C. electricity meters of induction type voltage greater than1000 volts	:	IS722, 8530/BS-5685 / IEC-60145, 60211

Resistance wire, tapes and stripes for heating elements	:	IS-3725
Wrought aluminum and aluminum alloy bars, rods, tubes and sections for electrical purposes	:	IS-5082
Specification for copper rods and bars for electrical purposes	:	IS-613
Toggle switches	:	IS-3452/BS-3676
Control switches/push buttons	:	IS-6875/BSEN 60947
Noise and Emission Limit	:	As per latest notification of ministry of Environment and Forests

General Requirements

The diesel engine and generator shall be skid mounted and shall be located at Pumping station building. The diesel engine shall draw cooling air directly from outside the room through a weatherproof, acoustically treated duct. The exhaust system shall be insulated to minimize the amount of heat entering the room and to prevent injury to personnel. The exhaust system pipe shall be 2 Meters above the nearest building as per CPCB. The exhaust pipe line diameter shall be suitably designed to avoid back pressure when discharged at higher elevation. The silencer shall be of the 'residential' type and be located externally.
The diesel engine fuel shall be stored inside the diesel generator room in a steel tank as a part of generator system. The storage tank shall be sized to store fuel for 12 hours running of the engine at full load subject to maximum of 990 liters as per Statutory Requirements. The tank shall be provided with fittings to permit the visual observation of fuel level and filling by local tanker operators. A level sensor shall also be mounted in the tank so that remaining fuel volume can be monitored at the generator / substation PLC and the operator station in the SCADA room.
All arrangement should be incorporated for alarms to be conveyed to the central HMI through the PLC. The bidder should consider the provision of controlling the operation of DG set through Local PLC and remote location SCADA system.

Alternator for Diesel Generating Set
The generation voltage shall be 415V. Alternator shall be 4 pole, 3 phase,50 Hz, 0.8 P. F, salient pole, revolving field, Brush less type, self-regulating continuously rated and manufactured in accordance with IS 4722, BS 5000: Part 99 or IEC 60034-1. They shall be totally enclosed, screen protected, fan ventilated and vertical drip-proof conforming to IP 23.The Alternator shall be complete with excitation system, AVR and all necessary auxiliaries. The alternator shall be driven by diesel engine detailed below and shall match the same in all respects. The terminal box shall be dustproof with IP 54 degree of protection. The terminal box shall be suitably sized to terminate the size and number of cables involved. Alternators shall be capable of withstanding a 10% overload for 1 hour in any 12-hour Period under the specified conditions of temperature, humidity and atmospheric pressure. Alternator windings shall be of Class H insulation with Class F temperature rise and tropical zed. The alternator shall have pre-packed grease lubricated ball or roller bearings and provided with facilities for degreasing whilst in service. The alternator shall be foot mounted on a common bed frame with the prime mover close coupled to the engine flywheel housing. The direction of alternator rotation when viewed from the driven end shall be clockwise and phase voltage sequence UVW. The alternator vibration level shall not exceed the values defined in IS

12075. The alternator shall be capable of maintaining a short circuit current of three times full load current for a period of 10 seconds. The alternator shall be fitted with an anti-condensation Alternator shall have 6 nos. duplex RTDs inside the stator winding. No individual harmonic shall exceed 1% and the total harmonic shall not exceed 3%. The alternator, it's neutral and control panel shall be earthed as per relevant standards. Alternator rotor assembly shall comprise exciter rotor, full wave silicon bridge rectifier, surge protection device and salient pole rotating field system. The rotor shall be fitted with interconnected pole face damping windings. Voltage regulation shall be maintained to within ±2.5% for a power factor of 0.8 to unity, including hot to cold variations. Alternator shall have sensors for alternator protection and shall be wired to control panel. The alternator shall be provided with class F insulation with temperature rise limited to that of class B insulation.

Diesel Engine for Generating Set

Engine shall be four-stroke, direct injection, and turbocharged industrial machines with preheating for engine & fuel due to cold weather condition at site. They shall be fitted with renewable wet cylinder liners if water cooled and shall be direct coupled to the alternator and mounted on a common rigid steel bedplate. Engines shall be rated for continuous duty at site ambient conditions with an inherent O/ L Capacity of 10% for 1 hour in any 12 hours. The engine shall be capable of running at full load for not less than 180 hours without maintenance adjustments and 10,000 hours between major overhauls. The maximum operating speed shall be 1500 rpm. The range of manual adjustment shall not be less than ±5% of rated speed. The performance of engine governors under load conditions shall be to Class A2 in accordance with BS 5514: Part 4. Engine governors shall be suitable for remote control load sharing between identical engine units. In addition to any electrical over speed trips, there shall be a mechanical over speed device which shall operate at 120% of the rated speed. Re-setting of the over speed trip shall be possible by hand only. The steady state output speed drop between no load and full load shall not exceed 5%. The transient output speed deviation shall not exceed 10% for a step of 60%. Engines shall be designed to run on fuel oil complying with IS 1460 or BS 2869, Class A2. Engines shall be cooled by means of a water jacket, heavy duty air blast radiator with integral radiator header tank, circulating pump and engine driven pusher type fan. The fan shall draw air in from the vicinity of the engine block and discharge it through the radiator core. The radiator shall be mounted on the same bedplate as the engine and alternator on suitable vibration isolators and be arranged so that it is located directly behind automatic louvers set into the external wall of the engine room. A thermostatically operated by-pass valve shall be fitted in the cooling system to maintain an optimum operating temperature during starting and running conditions. Drain cocks shall be provided so that all the water can be drained from the system. A separate oil cooler shall be used for cooling the engine oil. A thermostatic by-pass valve shall be incorporated. Engine lubrication shall be by a closed circuit wet sump, forced feed system supplied by an engine driven pump fitted with pressure regulating and relief valves, sump suction filter and changeover renewable micro-felt full flow line filters. A hand operated semi-rotary oil pump shall be installed to carry out initial priming or to fill or empty the sump as required. The sump shall be fitted with an easily accessible drain point. The oil shall be of the grade recommended by the engine manufacturer.

The starting system shall comprise 12 or 24 V heavy duty maintenance free batteries (positioned on a floor mounted stand adjacent to the engine) connected by heavy duty flexible butyl rubber cables. Batteries shall be sized to give six consecutive starts of the engine at 0°C. An engine driven alternator and charging system shall be provided for batteries. An automatic main energized battery

charger shall be provided, with sufficient capacity to maintain the battery in a condition to full fill the starting requirements.

Twin heavy duty air intake filters in accordance with IS 3169 or BS 7226 suitable for operating in dust laden atmospheres shall be fitted. The filters shall be of the paper element with pre-cleaner type. Turbo charger filters shall be fitted. Breathers shall be fitted with washable filters which are easily accessible for maintenance.
Instrumentation shall be provided to monitor speed, oil pressure, oil temperature (sets larger than 25 kVA), water temperature and battery charge current. The bedplate shall be of heavy gauge steel construction, stress relieved and free from distortion. Engine shall be provided with sensors for engine protection and shall be wired to control panel.
Machined surfaces shall be incorporated for mountings and for leveling. Anti-vibration mountings shall be fitted between the bedplate and the floor to prevent vibrations being transmitted to the building. The mountings shall be adjustable for leveling purpose and shall be designed to resist horizontal movement of the diesel set.

Diesel Generator Control Panel

The control panel shall have provision such that inter-opera ability with instrumentation control system. The control panel shall be separately mounted on anti-vibration mountings and shall comprise the following:
Breaker incorporating short circuit and overload trip
Earth fault protection for the Alternator
Alternator Over & Under Voltage Protection
Voltage Controlled Over Current Relay Voltmeter with built in selector switch /(digital)

Ammeter with built in selector switch (digital with RS 485 port)
Frequency meter
Power Factor Meter
KWh Meter (Multifunction meter with RS 485 port)
Engine temperature and oil pressure gauge
Service hours run indicator
Key switch start and stop control
Operational status indicator
Anti-condensation heater and thermostat
Alternator anti-condensation heater controls
Mains fed battery charger
Auto start on mains power supply failure facility
Fails to Start (Alarm)
Over / Under Voltage (Alarm)
Battery Charger Fault (Alarm)
Low fuel Oil Level (Alarm)
Over Load (Alarm)
Low Lube Oil Pressure (Trip)
High Water Temperature(Trip)
High Lube Oil Temperature (Trip)
Electrical Protection Relays (Trip)

A reset button shall be provided to cancel the alarm /shut-down condition prior to re-starting.
Simple operating instructions shall be detailed on the fascia of the control panel. All alarm and trip status signals from diesel supply system, engine control panel and alternator protection shall be hard wired to a instrumentation control system i.e. PLC/SCADA System.

Acoustic Enclosure
(i) The DG Set shall be provided with acoustic enclosure, fully integrated, weather proof with superior finish for long and durable life.
(ii) The acoustic enclosure shall be CRCA sheet steel enclosed with necessary panels and doors, inside lining of fire retardant foam/glass wool as acoustic material.
(iii) The sound level shall be restricted to 75 dB at a distance of 1 meter, under full load, free field conditions as per relevant standards.
The acoustic enclosure shall be certified to meet the emission norms.

7.1.2.2.7 Specifications for Servo Stabilizer

a. General

The unit shall be copper wound, oil cooled, servo controlled, three phase, with automatic & manual operation designed for voltage range 170V – 480V and output shall be 415V with frequency 50 Hz of AC supply.
The no load current shall not be more than 5% of the rated output current. The stabilizer shall be totally dry powdered coated from outside and zinc chromate painted from inside. Panel shall be screen printed. The stabilizer should withstand inductive inrush currents(inductive load) The unit shall be housed in a steel case suitable thickness having wheels with sturdy construction to withstand the rigorous shifting movement, repair works and handling. The unit shall be supplied with first oil filling and spare oil in separate drum.
Instruments/Accessories
The automatic voltage stabilizer shall be provided with following accessories.

Indicating Lamps – Mains ON/ under voltage/ over voltage
Audio alarm when the input voltage exceeds beyond limit or overload.
Digital Voltmeter for input and out voltage with selector switch.
Switch to changeover from automatic to manual operation.
Auto/manual- raise/lower push button
Digital Ampere meter for input & output current with selector switch.
Audio alarm when the output current exceeds beyond the limit or overload.
Protection against high & low voltage, cut off alarm, its cancellation short circuiting, overload protection and earth fault relay.
Bypass Switch/ on load changeover switch to shift the load from stabilizer and to switch off the unit.
Heavy terminal block and solid state controlled circuits for input, output & earth /connection these should be clearly marked.
Overload & Short circuit protection at input side through suitable size of MCCB.
Efficiency at full load more than 95%. The stabilizer should be confirming to IS 9815/1981.
The transformer oil should be confirming to IS 355 amended up to date.
Purity of copper shall be minimum 99.97%.

Characteristic Features

The three phase servo controlled automatic stabilizer shall have following features.
Continuous duty performance at ambient temperature 2 deg to 55 deg centigrade.
Stable and effective under system power factor and frequency fluctuation as well as over load up to 15% for one hour and under load 50% of the connected load.
Low internal impedance.
Negligible wave form distortion during starting, under operation and stopping condition.
Accommodate the effect of higher starting current and should be able to recover from the shock.
No over shooting or hunting.
Should ensure fast correction of voltage according to the voltage variation specified.
The stabilizer shall have a suitable breather with leak proof de-sledging and drain valve, transformer oil lifting hook for mechanical handling gauge of oil, lever, etc.
The stabilizer should have inbuilt suitable tripping arrangement against input voltage going beyond specific range and to start automatically after time delay when the specified range of input voltage is restored in the system. The tripping arrangement shall be clearly specified.
The display unit, meters & alarms in the stabilizer should be digital with RS -485 port for communication to PLC/SCADA for future purpose.

Markings

The stabilizer shall be marked with manufacturer's name, trade mark on the plate on the stabilizer and should indicate its manufacturing serial number, KVA, rating, range of input voltage and output voltage, rated output current, frequency, no. of phases, quantity of transformer oil and reference of IS Standard.

Earthing & Lightning Protection System

General

The earthing and lightning protection system covers earthing conductors, earth electrodes and accessories. Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system; Crane rails, tracks, metal pipes and conduits also shall be earthed at two points. Steel RCC Columns, metallic stairs and rails of the building housing electrical equipment also shall be connected to nearby earthing grid conductor. Metallic sheaths/ screens and armoured of multicore cables shall be earthed at both ends. Metallic sheaths and armoured of single core cables shall be earthed at the switchgear end only. Each Continuous laid length of cable tray shall be earthed at minimum two places by GS Flats to earthing system; the distance between the earthing points shall not exceed 30m. Lightning Protection System shall compromise horizontal roof conductors, down conductors, test limits and earth electrodes. Air terminations, down conductors and test links shall be of galvanized steel conductors and earth connection below the ground level shall be of mild steel.
Lightning Protection System down conductors shall not be connected to other earthing conductors above the ground level.

Applicable Standards

The earthing and lightning protection system shall conform to the Indian Electricity rules, and the latest applicable standards indicated below:

Code of Practice for Earthing	: IS:3043
Code of Practice for the Protection of	: IS:2309

Building and allied structure against lightning Hot dip galvanizing : IS:2629, 2633, 4759
Structural steel : IS:2062 & 808
Welding : IS:816

Earthing Conductor

The electrical installation shall where required be connected to the general mass of the earth by an earthing conductor. The material used for the earthing conductor shall be as follows:

(a) Conductors above ground shall be galvanized steel flat;

(b) Conductor buried in the ground or embedded in concrete shall be galvanized steel, rod /flat/plate. Allowance shall be made for reduction in the cross section of the steel over the design life of the earthing system;

The earth electrode system shall comprise one or more earth electrodes, earthing network, mesh or a combination of these in order to obtain the required earth electrode resistance. Earth electrodes where used shall be of heavy duty galvanized mild steel plate of not less than 10 mm thickness and 900x900mm size plate(for conventional earthing). Where multiple electrodes are used they shall be separated by a distance of not less than the driven length. Each earth electrode plate shall be welded at the top to a mild steel plate to which the earthing tapes shall be connected. These connections shall each be housed in individual concrete inspection chamber set flush to the finished ground level and shall allow disconnection for testing of individual electrodes. The chamber shall be permanently marked `Electrical Earth'. All materials used for the earth electrode installation shall be purpose made for the application and site conditions and shall be approved by the Employer's Representative. Unless otherwise stated all excavation for the installation of the earth electrodes and the inspection pit shall be carried out by the Contractor. After the earth installation has been completed the Contractor shall demonstrate to the Employer's Representative that the resistance of the electrodes to earth and the continuity of the earth network are within the limits specified. Any additional earth electrodes and test instruments required for the tests shall be provided by the bidder. Marker posts and plates shall be provided to mark the route of buried tape or conductor electrodes. The markers shall be similar to those provided for cable routes.

The lightning protection shall be provided by the contractor as per code of practice for lightning protection – IS : 2309 and NBC -2016.

Main Equipotential Bonding Conductor

Main equipotential bonding conductors shall be provided to connect the earth electrode system to conductive parts forming the Works.

Equipotential bonding conductors shall have the following minimum sizes.

a) Main Equipotential Conductors

- Main Earth Conductor buried in earth 65 mm dia GI pipe / 50 x 6 mm GS flat
- Transformers, main switchboard and standby generator installation 50 x 6 mm flat.
- Inter- connection to lightning protection system 50 x 6 mm flat
- Inter - connection to MCC s 50 x 6 mm/25 x 6mm flat

b) Equipotential Conductors

- Inter - connection to CP s 25 x 5 mm flat
- Power factor correction capacitor panel 25 x 5 mm flat
- Local push buttons 25 x 5 mm flat
- lighting distribution board 25 x 5 mm flat
- lighting and receptacle system 12 SWG wire

- outdoor street lighting 8 SWG wire
- ladder rack and cable tray at suitable points 25 x 5 mm flat
- hand rails and metallic structures 25 x 5 mm flat
- building reinforcement 25 x 5 mm flat
- incoming and outgoing process services 25 x 5 mm flat
- steel structures comprising storage tanks, 25 x 5 mm flat

Notes :
Equipotential conductors shall interconnect between the device to be bonded and the main equipotential conductor.
Connections to building structural steelwork or concrete reinforcement shall be made by a bolted connection to a tag welded to the steelwork or reinforcement bars. Unless otherwise specified at least two connections shall be made to the steelwork and reinforcement bars at the perimeter of each building at diagonally opposite locations.
The Earth Pit Chambers should be constructed with Brick missionary the size of the chamber shall 300mm X 300 mm minimum with CI covers for checking the connections & watering purpose.

LT SWITCHBOARD: METAL ENCLOSED SWITCHGEARS (PMCC / MCC)

415V Metal Enclosed Switch gear (PMCC / MCC) system shall have provision such that inter-operability with instrumentation controls system.

Applicable Standards

The switchgear and components shall conform to the latest applicable standards specified below.

Switchgear General Requirements	IS:13947/BS:5486/IEC:60947
Factory Built Assemblies of SWGR and Control gear for Voltages up to and including 1000V AC & 1200V DC	IS:8623/BS:5486/IEC:60439
Air Break Switches	IS:13947-P3 /BSEN60947 /IEC:60947-3
Moldded Case Circuit Breaker	IS 2516 / IEC 60947-2/ BS EN 60947-2
Miniature Circuit Breakers	IS:8828/BSEN:60898
Low voltage Fuses	IS:13703/BS:1362/IEC:60269-1
Contactors	IS:13947/BS EN60947-4 /IEC:60947-1
Starters	IS:13947/BS EN60947-4/ IEC:60292-1TO 4
Control Switches / Push buttons	IS:6875 / BSEN 60947
Current Transformers	IS:2705/BS:7626
Voltage Transformers	IS:3156/BS:7625/IEC:60044, 60186
Indicating instruments	IS:1248/BS:89/IEC:60051
Marking and Identification of Conductors and Apparatus Terminals	IS:11353/BS:159
A.C. Electricity Meters	IS:722, 8530/BS:5685 / IEC 60145,60211
Degree of Protection	IS:13947/IEC:60947-P1
Selection installation and maintenance of switchgear and control gear	IS:10118

Code of practice for phosphating iron and steel	IS:6005/BS:3189
Specification for copper rods and bars for electrical purposes	IS:613
Control transformers for switchgear and control gear voltage not exceeding1000V AC	IS:12021
Classification of Hazardous areas having Flammable gases and vapors for Electrical Installation	IS 5572
Guide for Selection of Electrical Equipment for Hazardous areas	IS 5571
Electrical apparatus for explosive gas atmospheres-General Requirement	IEC 60079

Features of Construction

The switchgear shall be metal enclosed, dust proof, modular type, suitable for indoor floor mounting and shall have following features.

Total height of switchgear shall not exceed 2300 mm. Height of Switches, Push buttons shall not exceed 1800 mm and shall not be less than 300 mm from finished floor level.

Shall be double front execution and fixed type

Shall have designation labels both on front and rear sides

Shall be provided with proper gasketing for removable covers, doors, between panels and base frame and all around the perimeter of adjacent panels.

Degree of Protection shall be IP54 for indoor & IP55 for Outdoor.

Thickness of CRCA Sheet the panel doors shall be 2. 5mm.or over

Shall follow IS 5572 /IEC 60079, standard specification and standard practice for installation in Hazardous area.

The Paint Shade shall be as IS : 5, Shade 631, Siemens Grey.

Switchgear shall be divided into distinct vertical sections each comprising:

A completely enclosed busbar compartment running horizontally

Enclosed vertical busbar serving all modules in vertical section

A separate horizontal enclosure for all auxiliary power and control buses, if required.

Vertical cable alley of 300mm wide covering entire height

Operating devices shall be incorporated only in the front of switchgear

Each shipping section shall have metal sheets at both ends

Cable alley shall be provided with suitable hinged doors

GS Earth bus of size 50mm x 10 mm shall be provided at the bottom.

Rear of Single Front Switchgear shall be provided with removable panels with screws.

All doors shall be with concealed type hinges and captive screws or locks
Each vertical section shall be equipped with 240 V, 1 Phase, 50 Hz space heaters controlled by thermostat.

A 240 V, 1 phase, AC plug point shall be provided in the interior of each cubicle with on-off switch for correction of head lamps

Interchangeability:
All identical equipment and corresponding parts be fully interchangeable without any modifications.
Main and Auxiliary Buses

(i) Switchgear busbars shall be of uniform cross section throughout the Length and made of high conductivity, electrical grade hard drawn Aluminum/ copper conductor.
(ii) Busbar shall be fully insulated by encapsulation in epoxy resin with moulded caps protecting all joints and shall be adequately supported to withstand stresses developed due to short circuits. Supports shall be of glass reinforced phenolic material or cast resin.
(iii) Busbar joints shall be provided with contact grease at the joints and shall be complete with tensile steel bolts and Belleville washers and nuts.
All construction shall be as per type test design.

Air Circuit Breaker (ACB)

Bus bars shall be colour coded for easy identification of individual phases and neutral. The breakers shall comply fully with IEC 947-2 Or IS 13947-2 and should have All Air Circuit breakers shall be Triple Pole with Neutral link or Four Pole as specified in the Bill of material or in drawing. All the Breakers shall be air break, motorized EOD horizontal draw out type, designed to be maintained.

Air Circuit Breakers having rating maximum of 1600 Amps or Below shall have Maintenance Free Electrical life of minimum 6000 operations.
Circuit breakers shall be operated by a motor spring charging type of mechanism. The motor operated spring charged mechanism shall be complete with motor, opening spring, closing spring and all accessories to make the Mechanism a complete operating unit.

The circuit breakers shall be fitted with detachable arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc.
The tripping spring shall be charged by the closing action, to enable quick tripping. Closing of the circuit breaker shall automatically initiate recharging of the springs to enable the mechanism to be ready for the next closing stroke. Charging time for the springs shall not exceed 30 seconds. It shall be possible to manually charge the springs in an emergency. Transfer from motor to manual charging shall automatically disconnect the charging motor. The charging mechanism shall be provided with mechanical indicators to show "charged" and "discharged" conditions of the spring. Failure of any spring, vibration or mechanical shock shall not cause tripping or closing of the circuit breaker.
Only one closing operation of the circuit breaker shall result from each closing impulse (manual or electrical), even if the breaker trips while the control device (manual or electrical) is being held in the "close" position.
The circuit breaker mechanism shall make one complete closing operation, once the push button has been operated and the first device in the control scheme has responded, even though the PB is released before the closing operation is complete, subject to the condition that there is no counter-impulse for tripping.
Means shall be provided to manually open and close the breakers slowly, when the operating power is not available, for maintenance and adjustments. A local manual trip device shall be provided on the operating mechanism.
All operating mechanisms shall be provided with "ON" - "OFF" mechanical indication.
Closing coils and other auxiliary devices shall operate satisfactorily at all voltages between 85-110 % of the control voltage. Trip coils shall operate satisfactorily between 70 -110 % the rated control voltage. The Coils shall be suitable for 230V, AC Supply.
The Breaker shall be provided with Microprocessor based releases for Inverse-time delayed overload releases for the phases, Short-time delayed short-circuit releases and earth-fault releases.
Auxiliary switches directly operated by the breaker operating mechanism and having 6 NO and 6 NC contacts, shall be provided on each breaker. The auxiliary switch contacts shall have a minimum rated thermal current of 10 Amps.
Circuit breakers shall be individually housed in sheet metal cassettes provided with hinged doors. The breaker along with its operating mechanism shall be mounted on a robust carriage moving on guide rollers within the cassettes. Isolating contacts for both power and control circuits shall be of robust design and fully self-aligning. The assembly shall be designed to allow smooth and easy movement of the breaker within its cassette.

Moulded Case Circuit Breaker (MCCB) / Motor protection Circuit Breaker (MPCB)

MCCBs shall be of the current limiting type, air break, quick make, quick break and trip free type and shall be totally enclosed in a heat resistant, moulded, insulating material housing. MCCBs shall have an ultimate short circuit capacity not less than the short circuit current Specified. MCCBs shall have a service short circuit breaking capacities (ICS) defined not less than 50k equal to the ultimate short-circuit capacity (ICU).
Each pole of MCCB shall be fitted with a bi-metallic thermal element for inverse time delay protection and a magnetic element for short circuit protection. Alternatively, they shall be fitted with a solid-state protection system. Such a protection system shall be fully self-contained, needing

no separate power supply to operate the circuit breaker tripping mechanism. Thermal element shall be adjustable. Adjustments shall be made simultaneously on all poles from a common facility. Thermal elements shall be ambient temperature compensated.
The MCCBs shall be provided with the following features.
Common trip bar for simultaneous tripping of all poles
Shrouded terminals
Time for clearing short circuit current of 20 msec.
2 NO + 2 NC auxiliary contacts

Extended rotary handle with pad lock arrangement. Design ambient temperature shall be 500C.
MCCB for motor load must be of AC-3 type (for motor application)
Switches and Fuses

415 V air-break switched shall be of the load break, fault make, group operated type. For use on 3-phase systems, the switches shall be of the triple pole type with a link for neutral wire. For use on single phase system, the MCB type switches shall be of the two pole type.

Switches shall be of the heavy duty, quick make and quick break type. Switch contacts shall be silver plated, and contract springs shall be of stainless steel. Switch handles shall have provision for locking in both fully open and fully closed positions. Mechanical ON-OFF indication shall be provided on the switches.
Switches for controlling motor circuits shall be of the load break, fault make type, and shall be capable of breaking locked rotor current of the associated motor.
All circuit fuses shall be on both poles and 415 V switches and fuses shall be provided with the following interlocks so that:
The fuses are not advisable unless the system requires the same.
It is not possible to close the switch when the cover is open, but an authorized person may override the interlock and operate the switch. After such an operation, the cover shall be prevented from closing if the switch is left in the ‘ON’ position
Fuse less system shall be provided in case fuses required, fuses shall be of the HRC cartridge type, mounted on plug-in type of fuse bases. Fuses shall be provided with visible indicators to show that they have operated.
Earthing and neutral lines in main supply circuits shall be of solid silver plated copper and be of the bolted pattern.

Fuses and links functionally associated with the same circuit shall be mounted side by side.
Miniature Circuit Breaker (MCB)

MCB shall be hand operated, air break, quick make, quick break type. Operating mechanisms shall be mechanically trip-free from the operating knob to prevent the contacts being held closed under overload or short-circuit conditions. Each pole shall be fitted with a bi-metallic element for overload protection and a magnetic element for short-circuit protection. Multiple pole MCBs shall be mechanically linked such that tripping of one pole simultaneously trips all the other poles. The magnetic element tripping current classification shall be of the type suitable for the connected load. Where this is not specified, it shall be Type C. The short circuit rating shall be not less than that of the system to which they are connected.
Contactors

The power contactors used in the switchboard shall be of, air break, single throw, triple pole, electromagnetic type. Contactors shall be suitable for uninterrupted duty and rated for Class AC3 duty in accordance with the latest edition of IS 13947. Operating coils of all contactors shall be suitable for operation on 240 V, single phase, 50 Hz supply. Contactors shall be provided with at least two pairs of NO and NC auxiliary contacts. Contactors shall not drop out at voltages down to 70 % of coil rated voltage. Contactors shall be provided with a three element, positive acting, ambient temperature compensated, time lagged, hand reset type thermal overload relay with adjustable settings. The hand reset button shall be flush with the front door of the control module, and shall be suitable for resetting the overload relay with the module door closed. Relays shall be either direct connected or CT operated. Overload relay and reset button shall be independent of the "Start" and "Stop" push buttons. All contactor shall all be provided with single phasing preventer (SPP). Motor starters shall be complete with auxiliary energy meters, protective relays, timers and necessary indications such that inter-opera ability with the instrumentation system.

Current Transformers / CT

All CTs for metering class shall have an accuracy class as 1 of measurement of energy consumption and class 1 for current and other parameters measurements. In case the combined metering is made applicable with various parameters then class 0.5 will be strictly applicable. The errors in CTs shall be within limits specified in the standards for that particular accuracy class. The metering CTs has to be accurate from 5% to 120% of the rated primary current, at 25% and 100% of the burden at the specified power factor.

Current Transformers shall be Cast Resin type.

Current transformers shall have polarity markings indelibly marked on each transformer and at the lead terminations at the associated terminal block.

Current transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary duties of the switchgear, as indicated in the Technical Specification.

CT core laminations shall be of high grade silicon steel.

Identification labels shall be fitted giving type, ratio, rating, output and serial numbers.

Voltage Transformers

Voltage Transformers shall be Cast Resin type. Secondary and tertiary windings of voltage transformers shall be rated for a three-phase line to line voltage of 415 V. It shall be possible to replace voltage transformer fuses easily without having to de- energizer the main bus-bars.

The accuracy class for the VT shall be class 0.5 as per IS 3156 Parts I to III for incomer and class 1 for outgoing panels.

Indicating Instruments & Meters

All indication instruments and watt hour meters shall be of the digital type and shall have an accuracy of Class 1.0. Digital type ammeters, voltmeters and multifunction energy meters shall have RS 485 communication facility.

The indicating meters shall be of flush mounting industrial pattern, conforming to the requirement of the I.S.
The Instruments shall have non-reflecting bezels, clearly divided & indelibly marked scales, and shall be provided with zero adjusting devices in the front.

Integrating instruments shall be flush mounting switchboard pattern, complying with requirement of I.S.
Indicating Lights

Indicating lights shall be of the cluster LED type, with low watt consumption. Indicating lamp shall be rated for operation at 240 V AC system voltage as applicable. LED shall be provided with translucent lamp covers.
Push Buttons

"Start" and "Stop" push buttons shall be colored green and red respectively. Stop Push Button shall be lockable stay-put type with Mushroom head without key or Emergency push button lockable in OFF position and open able only with key. “Reset” push buttons shall be colored black.
Space Heaters

Adequately rated anti-condensation space heaters shall be provided, one for each control panel, for each switchboard and for each marshalling kiosk. Space heater shall be of the industrial strip continuous duty type, rated for operation on a 240 V, 1 phase, 50 Hz, AC system. Each space heater shall be provided with a single pole MCB with overload and short circuit release, a neutral link and a control thermostat to cut off the heaters at 35 0C.
Safety Arrangements

All terminals, connections and other components, which may be “live” when front access door is open, shall be adequately screened. It shall not be possible to obtain access to an adjacent cubicle or module when any door is opened. Components within the cubicles shall be labeled to facilitate testing.

Earthing of Switchboards/Panels

Each switchboard, control panel, etc. shall be provided with an earth busbar running along its entire length. The earth bus bar shall be located at the bottom of the board/panel.
Earth bus bars shall be of galvanized steel and shall be rated to carry the rated symmetrical short circuit current of the associated board/panel for one second, unless otherwise specified. Earth bus bars shall be properly supported to withstand stresses induced by the momentary short circuit current of value equal to the momentary short circuit rating of the associated switchboard/panel.

Positive connection of the frames of all the equipment mounted in the switchboard to the earth bus bar shall be maintained through insulated conductors of size equal to the earth bus bar or the load current carrying conductor, whichever is smaller.
All instrument, doors and relay cases shall be connected to earth bus bar by means of 1100 V grade, green colored, PVC insulated, stranded, tinned copper, 2.5 sq. mm conductor looped through the case earth terminals.

Internal Wiring

The internal wiring shall be carried out with 650/1100V grade, FRLS, PVC insulated, stranded conductor wires. The minimum size of conductor for power circuits shall be 4 Sq.mm copper conductor. Control circuits shall be wired with copper conductor of at least 1.5 Sq.mm.
I/O for Instrumentation, Control & Automation System from Electrical panels

I / O signals from instruments shall be wired to marshalling box of MCC / Switch gear such that instrumentation engineers will not enter power system panel that are not familiar with them. Necessary provisions shall be incorporated to meet the requirements indicated in
I / O Schedules
Data Transfer Schedule
Alarm Schedule

All motor feeder circuits and equipment shall be so designed and selected to operate/control from local PLC & SCADA at remote location. Status of all control switchgears & Meters and relays should be available on RS 485 port to communicate with PLC and SCADA for remote monitoring and control.

Drawings and Data

All Drawings, data, technical particulars, temperature rise calculations, detailed literature, catalogues, type test certificates shall be submitted along with the bid/ after award of contract as specified in Bid Document.

7.1.2.2.11. LT Automatic Power Factor Capacitors Panel

Standards

Standard	Description
IS 2834	Power factor improvement capacitors

Other considerations

The Contractor shall check with manufacturer regarding providing of inductor coil. The Contractor shall work out the power factor control scheme to achieve a power factor of 0.99. The power factor improving capacitor requirement shall be as per the power factor of the equipment selected by the Contractor. MCCB for capacitor must be of AC-2 type (for Capacitor application)
Technical parameters

a)	Quantity and output	The quantity and output must be designed as per the requirement of different load combinations to achieve the objective.
b)	Capacitor type	MPP
c)	Rated voltage and frequency	415 Volts 3 phase (line to line), 50 Hz
d)	Maximum over voltage the unit	110 %

	capacitor is capable of withstanding continuously	
e)	Capacity	Capacitor must be so designed that it improves the PF for individual, different and collective motor load from 0.65 to 0.99
f)	Digital fascia to be provided	Input and output

Drawing and documents required

1) GA drawing of the capacitor unit, bank.
2) Instruction manual for installation, operation and maintenance for capacitor

7.1.2.2.12 General Specifications for Soft Starters

The soft- starter shall be developed and qualified in accordance with international standards, particularly with the standard dedicated to soft-starter EN / IEC 60947-4-2. The starter must be CE marked under the harmonized standard EN / IEC 60947-4-2.

Description

The operating principle of the Soft-starter should not simply take ground on a limitation of motor current during the transitional phases or on a voltage ramp but on a torque control motor. The Soft-starter should provide a torque ramp during the acceleration phase. Thus, it can control the torque during the starting period and if necessary provide a motor torque constant throughout the acceleration phase. For pumping applications, the deceleration will be on torque a ramp. All Soft-starter sizes will have the same control board. That control board must be identical for all applications. All Soft-starters shall be equipped with means for measuring motor current to ensure protection. The measurements of the current will be active when the Soft-starter is by-passed (embedded by-pass for all sizes). The Soft-starter should have a separate power control. The terminals of the board control shall be of plug type for easy maintenance. Soft Starter should control 3-phase output with Programmable display. The Soft-starter will handle the by-pass itself: manage the closure of the by-pass at end of acceleration time and open that by-pass at end of stop sequence. That function must be compatible with the types of stop: freewheel, ramp. The access to the settings can be locked by code. The monitoring parameters should remain accessible.
Environment

The maximum relative humidity will be 95% without condensation or dripping water according to standards IEC60947-4-2. The storage temperature can be between -25 ° C to + 70 °C
Electrical characteristics of the Soft-starter

The Soft-starter will automatically adapt itself to the frequency of the mains 50 Hz with a tolerance of + / -5%. Outputs: the Soft-starter must have at least 2 relays with a NO/NC contact
Protections

The starter will include the management of Motor PTC probe. The starter will calculate continuously the motor overheating from the real current value (the current must be measured and not estimated). Several classes of thermal protection will be proposed following the standard EN/IEC60947-4-2: Classes 10, 20, 30. The calculation of the thermal protection must be active

even when the Soft-starter is not power energized. The starter shall be protected against thermal overload. Dry run protection for pump motor. Protection against reverse-phase network, the loss of phases on mains or on motor. The protections will always be maintained even the Soft-starter is by-passed internal or self.

Communication

The starter will include a multipoint serial link to be connected directly to a Modbus network. The starter shall be able to be connected to Ethernet communication bus option. The communication shall provide access to the control, adjustment and monitoring of the Soft-starter through PLC/ SCADA

Display

The starter shall have a display and programming push buttons.

The following information must be accessible on the display

- Motor current (by phase)
- Motor state
- Status (acceleration, deceleration, Running).
- Operating time.
- The last fault occurred
- Fault history
- I/O status

7.1.2.2.13 Cables

XLPE Insulated HV all Aluminum/Copper Cable

The Cables shall be 11 KV unearthed grade, heavy duty, stranded aluminium/copper conductor, XLPE insulated, conductor screening by extruded Semiconducting compound, insulation screening through combination and non-magnetic tape (Copper Tape), inner sheath over laid up cores, galvanized steel strip armoured, outer sheath of extruded black PVC compound type ST-2, core Identification shall be printed numerals.

LT Cables

Standards

No.	Standard	Description
1	IS 1554	PVC insulated electric Cables/, XLPE insulated
2	IS 8130	Conductors for insulated electric cables
3	IS 5831	PVC insulation and sheath of electric cables.
4	IS 3975	Mild steel wires, strips and tapes for armouring of cables.
5	IS 1753	Aluminium conductors for insulated cables

Other Considerations

Power cable shall be of Al conductor, whereas control and lighting cables shall be of Cu conductor. The minimum size of Al conductor cable shall be 4 sq. mm and Cu conductor cable of 1.5 sq. mm. Power cable sizing shall be based on the various de-rating factors recommended by cable

manufacturer, rated current, temperature rise of conductor and voltage drop. Control cables of CTs shall be based on the VA burden of CT and relays, meters.

Technical parameters

LT Cables	XLPE insulated, armored, conductor screening by extruded semi conductor compound and outer sheath 650/1100 V grade, with multi-stranded aluminum/copper conductor
Cable selection	Cable shall be selected considering following points Current rating of the load De-rating due to grouping of cables. Voltage drop up to 3% in cable due to cable resistance De-rating factor due to ambient temperature. De-rating due to depth in case of buried cables
Spare cores for control cables	Up to 4 cores – nil 5 cores to 9 cores - 1 core 10 cores to 20 cores - 2 core 21 cores to 30 cores - 3 core More than 30 cores - 4 core

Cold Shrinkable Jointing Kits

The term cold shrink applies to materials, which are cable of shrinking without raising the material above the ambient temperature of its immediate surroundings. The material of the rubber insulator used in the cold shrink assembly which is factory expanded and placed on a removable core. The removing of the core causes the cold shrink assembly to shrink. The cold shrink assembly shall maintain a compressive force on the cable continuously through out the life of the product. This pressure will ensure a complete moisture seal.
The Jointing Kit shall be of type tested quality.
Drawing and documents required

1) Cable catalogue
2) Cable Schedule
3) Voltage Drop Calculation, Cable Sizing Calculations.
Cabling System

Installation

The cables shall be laid in trenches, trays or conduits or shall be buried in ground. Cable routings shall be checked at site to avoid interference with structures already provided in the pump house, piping and ducting. All cables shall be carefully measured and cut to the required length, leaving sufficient length for final connections to the equipment on both ends.
The Bidder shall ascertain the exact requirement of cable, for a particular feeder, by measuring at site along the actual finalized route. Cables shall be laid in complete uncut lengths from one item of equipment to another. Cables shall be neatly arranged in the trenches, trays in such a manner, that crisscrossing is avoided and final take off to the motor, switchgear is facilitated. LT Cables shall be

laid a maximum two layers in each tray for cables up to 3 ½ C x 95 mm2. Arrangement of cables within the trench, tray shall be the responsibility of the Bidder. Power and control cables shall be laid on different trays in one trench. 1.1 kV grade cable may be laid on one tray. All cables shall be identified close to their termination point by cable numbers. Cable numbers will be punched on aluminum straps, (2 mm thick), securely fastened to the cable and wrapped around it. Underground cables shall be provided with cable markers. These cable marker posts shall be located at every 50 meters and every corner or change of direction. All temporary ends of cables shall be protected against dust and moisture to prevent damage to the insulation. While laying cables, the ends shall be taped with PVC tape. Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with protective cover until the final termination to the equipment is completed. Directly buried cable shall be laid underground in excavated cable trenches wherever required. The trenches shall be suitably designed for accommodating all the cables. Before cables are placed, the trench bottom shall be filled with a layer of sand. This sand shall be levelled and cables laid over it. The cable shall be covered with 150 mm of sand over the top of the largest dia. cable and sand shall be lightly pressed. A protective covering of RCC tiles shall then be laid on top in case of HT cable and ordinary brick in case of LT cables. The balance trench area shall then be back filled with soil, rammed and leveled.
As each cable is laid in the trench, it shall be subjected to an insulation test in the presence of the Engineer in Charge before covering. Any cable which proves defective shall be replaced at no additional cost. All wall openings shall be effectively sealed after installation of cables. Where cables rise from trenches to motors, control station, lighting panels etc., they shall be taken up in GI pipes (rigid, flexible) for mechanical protection up to a minimum of 600 mm above grade level. The diameter of the GI pipe shall be at least 3 times the diameter of the cable. Cable shall be carefully pulled through conduits to prevent damage. Wherever cables are taken in conduits, pipe, the Bidder shall ensure that the area of conduit, pipe is at least 100 % more than the cable area. If pipe sleeves installed are inadequate due to a greater number of cables being laid, then additional pipe sleeves shall be laid. After the cables are installed and all testing is complete, conduit ends above grade level shall be plugged with suitable weatherproof plastic compound.

Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. At road crossings and other places where cables enter pipe sleeves an adequate bed of sand shall be given. Cables installed above grade level shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel to, or at right angles to, beams, walls or columns. The cables shall be so routed that they will not be subjected to heat. Cables running along with structures will be clamped by means of GI saddles and saddle bars at a spacing of 300 mm. Cable carrier systems i.e. site fabricated ladder type cable trays and supporting steel shall be painted before laying of cables. Painting shall have two coats of red oxide and one coat of Aluminum paint. For all outdoor buried cables a 3 meter diameter loop shall be provided at both ends before termination.

Termination
All XLPE insulated cables shall be terminated using HT or LT termination kit only. All PVC cables shall be terminated at the equipment/panel by means of double compression type brass glands and tinned copper/Aluminum lugs. Power cable cores shall be identified with red, yellow and blue PVC tapes.

In case of control cables, all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules. Wire numbers shall be as per inter-connection diagrams, to be furnished to the Bidder.
The cable shall be taken through an adequate size gland inside the panel or any other electrical equipment. Cable leads shall be terminated at the equipment terminals by means of crimped type solderless connectors. Crimping shall be done by hand crimping/hydraulically-operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping.

Testing of cables

Before energizing, the insulation resistance shall be measured from phase to phase and phase to ground.

7.1.2.2.13 Earthing System
General

Earthing of all non-current carrying metal work of starters, motors etc. shall be earthed. All the material required for the earthing system shall be supplied and installed by the Bidder. The bidder shall integrate instrument earthing with the general earthing system of the pump house.
All the material required for making earthing station, such as electrode, charcoal, salt, chemical(bentonite) etc. shall be supplied by the Bidder. Excavation and refilling for laying of earth strip and for earth pit shall also be in Bidders scope.
The entire earthing system shall fully comply with Indian electricity act and rules. The Bidder shall carry out all changes desired by the electrical inspector, in order to make the installation conform to I.E. Rules.
Conduits in which cables have been installed shall be bonded and earthed. Cable armours shall be earthed at both ends.
All electrical equipment above 230 V shall be earthed at two points and equipment 230 V and below shall be earthed at one point.

Conductor size for connections to various equipment shall be as per the table as follows:

Equipment	Conductor Size	
Motors	Up to 11 kW	8 SWG GI wire
	11 kW up to 22 kW	25 x 5 mm GI flat
	22 kW up to 37.5 kW	25 x 5 mm GI flat
	37.5 kW to 90 kW	25 x 6 mm GI flat
	90 kW to 200 kW	40 x 6 mm GI flat
	Above 200 kW	50 x 10 mm GI flat
PDB	50 x 6 mm GI flat or Suitable Size Cu Flat	
DG & other panel	50 x 6 mm GI flat or Suitable Size Cu Flat	
Local control station, street light pole & its junction box	8 SWG GI wire	

Lighting Panel	25 x 5 mm GI flat
Indoor fixtures	14 SWG GI wire

All paint, scale etc. shall be removed before earthing connections are made.
Anchor bolts or fixing bolts shall not be used for earthing connections.

7.1.2.2.14 Miscellaneous

Cable glands and lugs

All HT cables shall be terminated with HT cable termination kit of indoor or outdoor type depending on the application. All LT cable glands shall be made of brass and shall be of double compression type. All LT cable lugs shall be of tinned copper, crimping type.

Cable trays

Cable carrier system shall comprise of site fabricated ladder type cable trays made of structural steel and painted with two coats of red oxide primer and 2 Coats of epoxy paint . The construction of the cable trays shall be as per the site requirement. The size of tray has to be adequate to lay required number of cables on it or multiple layers of tray can be laid to accommodate the number of cables. The earthing strip of adequate size is required to be run all the way with the tray so as to maintain proper earthing of the system.

Rubber mats

Electrical grade rubber mats shall be provided in the switchgear room in front of all panels. The rubber mats shall be supplied in compliance to the latest Indian Standard for HT/LT. The Rubber Mats are required to be supplied with test certificate as specified in the latest Indian Standard.

Local Push-button (PB) station

Construction	Indoor type weatherproof
Main pump motor	On-off with digital millimeters
Other motors	On-off
Valve motors	Forward-stop–reverse spring return starter with indication for full open/close position of valve.
Indication	Digital Multimeter (A, V, KW, PF)

7.1.2.2.15 Lighting and System

a. General Requirements

The lighting system shall include the following items.

(i) LED Lighting Fixtures complete with accessories (lumen per watt shall be indicated).

(ii) Lighting system equipment

Light Control switches, receptacle units with control.

Switch units, lighting wires, conduits, and other similar items necessary to complete lighting system.

Lighting fixture supports, street lighting poles.

Lighting Distribution board, lighting panels.

Multi- core cables for street and boundary lighting.

Load balancing of lighting system shall be made.

Lighting Fixtures (luminaries)

Luminaries shall be designed for continuous trouble-free operation without reduction in led life or without deterioration of materials and internal wiring. Outdoor fittings shall be weather-proof and rain-proof type.

The Luminaries shall be designed so as to facilitate easy maintenance, including cleaning, replacement etc.

Connections between different components shall be made in such a way that they will not work loose by small vibration.

For each type of Luminaries, the Contractor shall furnish the utilization factor tables to indicate the proportion of the light emitted by the bare leds which falls on the working plane.

All Luminaries shall be supplied complete with led's suitable for operation on a supply voltage with the variation in supply voltage, frequency and combined voltage and frequency of ±10%, ±5% and ±10% respectively.

The Luminaries and accessories shall be designed to have low temperature rise. The temperature rise above the ambient temperature shall be as indicated in the relevant Standards.

Each luminaries shall have a terminal block suitable for loop-in, loop-out and T-off connection by 250/400 V, 1 core, PVC insulated copper conductor wires up to 4 sq.mm in size. In outdoor areas the termination at the luminaries shall be suitable for 1100 V, PVC insulated, copper/aluminum conductor, armored cables of sizes up-to 6 sq.mm conductor. Terminals shall be of stud or clamp type. The internal wiring should be completed by means of standard copper wire of minimum 1 sq.mm size and terminated on the terminal block. Terminal blocks shall be mounted with minimum two fixing screws.

Mounting facility and conduit knock-outs for the luminaries shall be provided.

The fixtures provided shall be energy efficient and shall be consuming less power.

Each luminaries shall be provided with an earthing terminal suitable for connection to the earthing conductor of 12 SWG GI wire.

Where separate control gear box is provided for housing the accessories the same shall be provided with an earthing terminal suitable for connecting earthing conductor of 12 SWG GI wire.

All metal or metal enclosed parts of the luminaries/control gear box shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity.

All surfaces of the Luminaries/Control gear box housing accessories shall be thoroughly cleaned and degreased. It shall be free from scale, rust, sharp edges and burrs.

External control gear box provided for housing accessories shall be painted or galvanized.

When enamel finish is specified, it shall have a minimum thickness of 2 mils for outside surface and 1.5 mils for inside surface. The finish shall be non-porous and free from blemishes, blisters and fading.

The finish of the luminaries shall be such that no bright spots are produced either by direct light source or by reflection.

Street Lighting Luminaries
LED Luminaries

Street lighting LED luminaries shall be outdoor weather proof type for illumination of secondary roads, walkways, peripheral lighting of buildings etc.

The luminaries shall be of semi-cut off or non-cut off type, with CRCA sheet steel housing, vitreous enameled, plain or corrugated clear acrylic cover, complete with integral mounted control gear, neoprene gaskets, side pipe entry or top suspension type.

The Luminaries shall be suitable for 8-12 led lamps, 54 watt fluorescent for mounting height upto 6 meters minimum.

Wiring
The wiring for lighting circuits shall be done by wires run in GI conduits for indoor areas (Except office / store/ toilet etc. where PVC conduits shall be used). For outdoor lighting, wiring shall be done by armored cables.
All indoor and outdoor areas will be provided with A.C. lighting and the same will be available as long as A.C. supply is healthy.
Lighting fixtures and fans will be grouped on the circuit wherever required. However, separate circuits shall be used for receptacles wiring.
Lighting fixtures, receptacles, switches, conduits and junction boxes shall be properly earthed using 12 SWG G.I. wire unless specified otherwise.
Receptacles of 5A and 15A, single phase, 3 pin shall be provided with switch. Receptacles in offices and control rooms shall be decorative type and in other areas shall be industrial type. Three phase receptacles shall be associated with TPN switch housed in the same enclosure. The receptacle shall become live only when the associated switch in "ON" position. The enclosure for all outdoor receptacle shall be provided with degree of protection of IP-55.
The internal wiring should be completed by means of standard copper wire of minimum 1.5 sq.mm size and terminated on the terminal block. Terminal blocks shall be mounted with minimum two fixing screws.

1. LED Luminaries with complete assembly and fixing arm (180W) for outside premises (6 No.)
2. Exhaust Fans (12" sweep) (4 No.)
3. Ceiling Fan (18" sweep) (2 No.)
4. Tube light (2x40W) (4 No.)
5. LED Lamps (9W) (6 No.)

6. LED Lamps with assembly (32W) (4 No.)
Including heating points - 4 No., 2 pin sockets- 4 No., 3 pin sockets- 4 No,5 pin sockets with wiring, MCCB/ MCB as per the direction of Engineer In charge

Drawings

All Drawings, data, technical particulars, temperature rise calculations, detailed literature, catalogues, type test certificates of typical equipment's shall be submitted along with the bid/ after award of contract as specified in Bid Document.

7.1.2.2.16 Metering Cubical 33 KV

Construction

The metering panel shall be fabricated with 2mm MS plate and shall have external dimensions of 1600x750x700mm (height x width x depth) (approx). Height of panel is fixed but width & depth is minimum and may be increased suitably to accommodate CTs/PTs, if required. Thus, total height including base channel will be 1700 mm. The panel should be provided with 4 Nos. lifting hooks.
The panel shall be dust and vermin proof and totally enclosed. The panel shall have two separate compartments. The upper one shall house tri-vector meter, energy meter with associated wiring and shall be termed as "Meter compartment". The upper compartment will be double door type and the arrangement for meter fixing will be in the inner portion. The other section i.e. lower compartment shall house the 33 KV, 1 Ph, dry type epoxy resin casted CT (3 Nos.) and 33 KV,1 Ph, dry type epoxy resin casted PT (3 Nos.) and shall be termed as "HT CT/PT compartment". A separate and independent vermin proof door shall be provided for each of the upper and lower compartments with provision of locking and sealing arrangement.
The Metering cubicle shall be totally enclosed and shall be provided with one no. hinged door made of MS sheet which shall rest on the collar along rear sides of cubicle so that the doors remain flushed with body of the cubicle.
The door shall be provided with a handle and two no"s sealing arrangement. There shall be one fixed (non-openable) window (approximate size 300 x 200mm) fitted with transparent acrylic glass to enable the meter reader to note down the reading without opening the door of the panel. The glass shall be fitted / tightened with MS Frame from inside of window.
The metering panel shall be provided with two Nos. MS channels of size 100x 50 mm of 750 mm length on the front and rear sides duly welded at the bottom of the panel. These shall have 4 holes of 16 mm for foundation bolts at both the ends of each channel. All the joints of the metering panel shall be welded to provide strong mechanical construction both for transportation as well as during its use. The metering panel shall have arrangement to connect it with earth at two independent points. One earthing knob /bolt shall also be provided in the "Meter compartment" for connection to star point of wiring. All the three earthing bolts shall be provided with nuts and washers.

The metering panel shall be cleaned suitably and will go through phospating using seven tank dipping procedure and its surface shall be made smooth. It shall be powder coated as per relevant IS specification. The colour of paint shall be decided at the event of order. Height of panel is fixed but width & depth is minimum and may be increased suitably to accommodate CTs/PTs, if required. Thus, total height including base channel will be 1700 mm. The panel should be provided with 4 Nos. lifting hooks.

All the moving/mating edges shall be provided with synthetic/semi synthetic gasket firmly glued to surface, to make the metering panel dust & vermin proof. The metering panel shall be provided with two cable entries inside from bottom along with glands /gland plate for 33 kV XLPE cable of various sizes corresponding the CTS ratio and Short Circuit Current Rating without cable boxes. There should be suitable provision for which cable can be taken out of the panel without damage.
The meter compartment shall contain hanger arrangement of slotted angle for mounting main meter having flexibility for moving meter vertically or horizontally. Clearances between all parts and components of panel should comply with relevant Indian standard & Jammu & Kashmir electricity rules, 1978 . One TTB(Test Terminal Block) to be provided just below the meter for smooth connection to meter terminals.
Sealing

The metering cubicles shall be completely lockable and sealable with at least one locking and two sealing arrangements of the door of each compartment. Apart from sealing arrangement of both compartments, mounting bolts of CTs and PT shall have the provisions for sealing arrangement so that removal of CTs & PTs from the installed positions in the panel (for tampering/replacement) by the unauthorized person is not possible without breaking/ tampering the sealing arrangement. The hinge arrangement, sealing of CTs and sealing of PTs shall be diagonally arranged in the base of each CTs & PTs. CT/P T Chamber to have louvers with screen at the top for heat dissipation.
The epoxy casting of 33kV CTs & PTs Coils is required to be carried out under vacuum to avoid any blow holes in the casted material. To establish this epoxy hardener and accelerator, if any is mixed in the missing chamber under vacuum and poured into the dyes placed in the casting chamber which is also kept under vacuum as per relevant IS Specifications.

7.1.2.2.17 Civil Works for Electrical jobs

The civil works required for electrical installation will also be part of this package. The bidder shall also co-ordinate all inter-disciplinary interfaces between civil and electrical works.

7.1.2.2.18 Guarantee

All equipment's shall be guaranteed for a period of 12 months, from the date of taking over the installation by the department, against unsatisfactory performance and/or break down due to defective design, workmanship or material. The equipment's or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in- charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor. The decision of the Engineer-in-charge in this regard shall be final & binding on the contractor.
The tenderer shall guarantee among other things, the following:
Quality, strength and performance of the materials used as per manufacturers' standards.
Safe mechanical and electrical stress on all parts under all specified conditions of operation.
Satisfactory operation during the maintenance period.

7.1.2.2.19 (a) POWER SUPPLY

A temporary three phase power supply of 15 KW shall have to be arranged during execution of work by the contractor as and when needed. Further arrangements for tapping power connection from this point shall be made by the contractor. Contractor shall provide a meter with necessary protection. The necessary charges as per the electricity department rates shall be borne by the contractor.

7.1.2.2.19 (b) WATER SUPPLY

Water supply for the use of construction work and for any other purpose shall be arranged by the contractor at his own cost.

7.1.2.2.20 DATA MANUAL AND DRAWINGS TO BE FURNISHED BY THE TENDERER

With Tender
The tenderer shall furnish along with the tender, detailed technical literature, pamphlets and performance data for appraisal and evaluation of the offer.

After Award of Work
The successful tenderer would be required to submit the following drawings within 15 days of award of work for approval before commencement of installation.

General arrangement drawing of the equipments like Pumping units, DI pipes, Valves, HT panels transformers, bus duct, LT panel etc. in the sub-station building, with complete dimensions for LT Panel & Bus Duct. The tenderer shall also give dimensions, details of LT Panels and Bus Duct got tested at CPRI successfully for fault withstand capacity of 31 MVA for 1 Sec.
Details of foundations for the equipment and the weights of assembled equipment.
Cable/bus duct layout between HT panel boards, transformers & LT panel etc.

Any other drawings necessary for the job.
The successful tenderer should furnish well in advance three copies of detailed instructions and manuals of manufacturers for all items of equipment regarding installation, adjustments operation and maintenance including preventive maintenance & trouble shooting together with all relevant data sheets, spare parts catalogue etc. all in triplicate.

EXTENT OF WORK

In addition to supply, installation, testing and commissioning of pumping station equipment's, following works shall be deemed to be included within the scope of work to be executed by the tenderer as this is a turnkey job:
Minor building works necessary for installation of equipment's, foundation, making of opening in walls or in floors and restoring them to their original condition / finish and necessary grouting etc. as required.
All supports for over head bus ducts, cables and MS channels for erection of panels & transformers etc. as are necessary.

Inspection Clearance of electrical equipments including DG set installed at Pumping station through Inspection Division of J&K PDD. Getting inspection done & obtaining approval for energizing the installation. All charge to be borne on this account by tenderer.

7.1.2.2.21.INSPECTION AND TESTING

All major equipment i.e. HT Cable, Transformers, bus duct, LT panel, LT power and Control Cables etc. shall be offered for initial inspection at manufacturers works by third party agency and engineer from the department. The contractor will intimate the date of testing of equipment at the manufacturer's works before dispatch. The successful tenderer shall give advance notice of minimum 4 weeks regarding the dates proposed for such tests to the department's representative to facilitate his presence during testing. The Engineer-in-charge may witness such testing. The charges on account of TPI and the engineer nominated by department (including travelling, boarding and lodging) to witness the inspection/tests at manufacturers works shall be borne by the contractor. Equipment will be inspected at the manufacturer/Authorized dealers' premises, before dispatch to the site by the contractor if so desired by the Engineer-in-charge.
Copies of all documents of routine and type test certificates of the equipment, carried out at the manufacturers premises shall be furnished to the Engineer-in-charge and consignee.
After completion of the work in all respects the contractor shall offer the installation for testing and operation.

7.1.2.2.22.COMPLIANCE WITH REGULATIONS AND INDIAN STANDARDS

All works shall be carried out in accordance with relevant regulation, both statutory and those specified by the Indian Standards related to the works covered by this specification. In particular, the equipment and installation will comply with the following:
Factories Act.
Indian Electricity Rules.
B.I.S. & other standards as applicable.
Workmen's Compensation Act.
Statuary norms prescribed by local bodies like CES, Power Supply company etc.
After completion of the installation, the same shall be offered for inspection by the representatives of the Central Electricity Authority. The contractor will extend all help including test facilities to the representatives of CEA. The observations of CEA will be attended by the contractor. The installation will be commissioned only after getting clearance from CEA.

Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes.

7.1.2.2.23 ERECTION TOOLS

No tools and tackles either for unloading or for shifting the equipment's for erection purposes would be made available by the department. The successful tenderer shall make his own arrangement for all these facilities.

7.1.2.2.24 VERIFICATION OF CORRECTNESS OF EQUIPMENT AT DESTINATION

The contractor shall have to produce all the relevant records to certify that the genuine equipment's from the manufacturers has been supplied and erected.

7.1.2.2.25 TRAINING

The scope of works includes the on job technical training of five persons of department at each site. Nothing extra shall be payable on this account.

7.1.2.2.26 Pre-Dispatch Inspection

Pre-Dispatch Inspections and Tests
The contractor shall submit a Quality Assurance Programme (QAP) for each item for approval of Engineer-in-Charge. Actual manufacturing shall start only after approval of QAP.
It is proposed to get the equipment and material listed in the table below, inspected prior to dispatch for work site through third party/project consultants/departmental engineer(s).

S.No.	Equipment/Material
1	All type of pipes
2	All type of Valves
3	Expansion Joints
4	All pumps and motors above 10 KW
5	Electrical Hoist
6	All other Electric control panels for LV distribution
7	Capacitor panel, DG panel, etc.
8	Sluice Gates
9	Power Transformer and Servo Voltage Stabilizer
10	Instrument Control Panels for PLC Systems
11	Electro Magnetic Full Bore Meters
12	Any other material, as requested by the department

The Contractor shall notify Engineer-in-Charge at least 4 weeks in advance for carrying out the Pre-Dispatch inspection, and tests before the dispatch of materials. The Engineer-in-charge may witness such testing. The cost of the Engineer's visit to the factory will be borne by the department. However the charges on account of TPI shall be borne by the contractor. Failure to Pre-Dispatch inspection/tests, the contractor shall be liable for all costs incurred against such dispatches. No material scheduled or notified for pre-dispatch shall be accepted until inspection have been successfully carried at manufacturers or other selected premises and the inspection report has been approved by Engineer-in-Charge and he has given consent for dispatch of material.
In addition to the pre-dispatch inspections, the Engineer-in-Charge may ask for additional certificates from manufacturer to satisfy with the quality of material used and for the compliance to respective standards.
For all materials and equipment not listed above, the contractor shall produce manufacturers test certificates for material, performance, efficiencies, workmanship and standard compliance etc. as directed by the Engineer-in-Charge, to satisfy with the quality of the material to be received.

The Engineer-in-Charge may also ask for Pre-Dispatch inspections for any other item(s) not shown in the list of items requiring pre-dispatch inspection, for which the contractor shall make necessary arrangements, without any additional costs to the Department.
Considering the less quantity of material to be got tested at manufacturer's work, the EIC may condone such pre-dispatch inspection after obtaining manufacturer's test certificates for satisfactory completion of tests for pre-dispatch as mentioned hereinafter. The Contractor shall thereafter be responsible for the equipment performance at site for given duty conditions. Pre-dispatch inspection and its approval shall also not relieve the Contractor from its responsibility of performance of material in design conditions during execution and maintenance.
Testing and Inspection of MS/DI/HDPE Pipes & Specials

At all the manufacturing sites Department's Representative shall be stationed to witness the manufacturing and all the tests mentioned in the Chapter for Specifications for MS Pipes. For DI pipes departments representative shall review the record of online hydrostatic test of all pipes to be supplied. He shall conduct all other tests as relevant Standards which include dimensional tests, ovality test, mechanical test, straightness test etc. The pipes or specials will only be dispatched after necessary certification by the Department's representative. The Engineer-in-Charge may also ask for repetition of some tests, even after successful testing by the Department's representative in his presence or in front of a third party authorized by the Department. The contractor in such cases will cooperate and provide all necessary facilities for re-testing, without any additional costs to the Department. All pipes will be tested at the factory test pressures in accordance to the relevant IS.

Inspection and testing For Butterfly Valves

During testing there shall be no visible evidence of structural damage to any of the valve component.
a) The following test shall be carried out for butterfly valves:
(i) Seat leakage test at rated pressure
(ii) Body hydrostatic test at 1.5 times the rated pressure
(iii) Disc strength test at body test pressure
(iv) Valve operation with and without actuator
(v) For effort required in manual operation of valve
(vi) Crack opening test under tension
(vii) Other tests specified in BS 5155
(viii) General construction features of gear box as per requirement.
Valves to be tested with actuators shall be tested with actuators, with a differential head equivalent to their maximum working pressure, to prove that the actuators are capable of opening and closing the valves under maximum unbalanced head condition within the specified opening or closing period.

Inspection and Testing For Sluice Valves

During testing there shall be no visible evidence of structural damage to any of the valve component. Following tests shall be carried out.
i) Seat leakage test at rated pressure
ii) Hydrostatic test at 1.5 times the rated pressure
iii) Valve operation with and without actuator

iv) For effort required in manual operation of valve
v) Other tests specified in IS 14846
vi) General construction features of gear box as per requirement.
Valves to be tested with actuators shall be tested with actuators, with a differential head equivalent to their maximum working pressure, to prove that the actuators are capable of opening and closing the valves under maximum unbalanced he ad condition within the specified opening or closing period.

Inspection and Testing For Check Valves

During testing, there shall be no visible evidence of structural damage to any of the valve component.
Seat leakage test at rated pressure
Body hydrostatic test at 1.5 times rated pressure
Other tests specified in API 598

Inspection and Testing of Pumps of all ratings

The performance and hydraulic tests of the pumps shall be made with their respective duty motors and frequency drive. The following inspections/tests shall be carried out:

1	Non-destructive special test	Casing - Dye penetration test on critical area, Impeller -Dye penetration test on critical area, Shaft - Ultrasonic test,
2	Hydrostatic Test	1.5 times the shut-off head
3	Performance Test	As per IS 5120 & IS 9137 at reduced speed as approved by Engineer-in-Charge. Head v/s Discharge characteristic - Power absorbed v/s Discharge - Efficiency v/s Discharge - Readings for the above tests shall be taken at duty points.
4	Strip Test	Clearances within tolerance limits and no signs of cavitation evident.
5	Mechanical Balancing	As per IS: 11723, Gr 6.3 or better
6	Other Tests	For Vibration levels of Shafts For noise levels
7	Visual Inspection	Pumps shall be offered for visual inspection before shipment. The pump components shall not be painted before inspection.

Inspection of LV Distribution Panel or LT Switchgear Panel

All routine tests on all panels.
All type test certificate conducted on similar panels within last 5 years are to be provided.

Other Equipment

All the items listed below shall be inspected before dispatch for the general requirement of testing in the standards to which they conform, the Department's requirement as given in the specifications, the general arrangements and for workmanship.
Electro Magnetic Full Bore Meters.
Power Transformers
DG Set
PLC or Instrument Control Panel
Power and Control Cables
Cable Tray/Steel Structure.

Manufacture's certifications

For other items to be used for the work, the department may ask for relevant certificate of the manufacturer.

7.1.2.2.27. Testing, Commissioning & Trial Run
Inspection and test after erection

In addition to the progressive supervision and inspection by the Engineer-in-Charge the Contractor shall offer for inspection to Engineer in Charge, the complete, erected System or its Parts on which tests are to be carried out. After such inspection by Engineer in Charge, each equipment/subsystem shall be tested by the Contractor in accordance with the applicable standards in the presence of Engineer in Charge.
It is not the intent to specify herein all details about the commissioning activities. However the commissioning checks in brief are given as guidance.
The pre-commissioning test results shall be documented for record purposes and compared with the shop test certificates.
Testing Instruments or Equipment

All required testing instruments with valid calibration certificate from NABL Approved Laboratory, for the performance and efficiency tests, shall be supplied by the Contractor and shall be retained by him upon satisfactory conclusion of all such tests at the site. All costs associated with the supply, calibration, installation and return of the testing instruments shall be included in the contract price. The testing instruments for the performance tests shall be in accordance with the code. All testing instruments shall be as per Indian Standards or Equivalent, as approved by the Engineer in Charge. All calibration procedures and standards shall be subject to the Engineer in Charge's approval. Batch calibration will not be accepted.

Pipe Line

The sectional testing of pipeline shall be done as per provisions laid in "Specifications" along with the laying of pipelines. The tested pipeline will be joined by gap pieces to complete the total physical completion of works. The laid pipeline will be joined with respective manifold through valves. Just before the commissioning the complete pipeline will be checked for:
All the valves in the system will be inspected for proper lubrication, manual/electrical operation.

All air valves shall be inspected for proper fitting and operation of isolating valves.
All flange joints will be checked for tightness of all bolts, clamps, etc.
The entire transmission shall be checked for proper soil cover.
The structures will be checked for any constructional defects.
The valve chambers and their surroundings will be checked for its cleanliness.

7.1.2.2.28 Performance Tests at Site

Execution of the tests
As soon as possible after the equipment has been installed and after physical completion of the work, performance tests shall be carried out as per relevant test requirements and mutually agreed/specified Codes and Standards. These tests may repeat the tests carried out at the manufacturer's works and/or his sub-vendor/sub-contractor's works and any other tests the Engineer in Charge may require in order to determinate that the equipment and works are in accordance with the specifications and guarantees.
Performance tests for individual items of Equipment's, shall be conducted on all equipment supplied by the Contractor.
A program for conducting the performance tests shall be submitted to the Engineer in Charge, for approval, at least fourteen days before the commencement of the tests.
If the Contractor so desires, the equipment may be run for a reasonable time, immediately before the performance test is conducted. A request for this run, stating duration and operating point must be made, in writing to the Engineer in Charge at least three days before the performance test.
During the period of any test, the conditions shall be held as steady as possible, compatible with safe and effective operation.
The power consumption of all continuously running auxiliary equipment shall also be measured and recorded during the performance tests.

After the results of the performance tests have been submitted to and approved by the Engineer in Charge, a summary of the test readings and the performance calculations shall be incorporated in the final version of the Operating and Maintenance Instruction Manuals.
Rejection of the system or system components
If the performance tests indicate the computed values of performance parameters have deviated from the guaranteed values and the Contractor is unable, within 21 days or such extension of time as may be allowed by the Engineer in Charge, to remedy such deficiency, then the Engineer-in-Charge shall have the right to reject the component or the system.
Documentation

Set of documents shall be prepared and maintained by the Contractor and one set of the latest revised documents shall always be kept at site. The following documents shall be prepared by the Contractor:
Data sheets for instrument specification and selection
Instrument Schedule
Instrumentation schedule
Instrumentation cable schedule
Loop drawings for instruments in the field and control panel
Instrument test and calibration report
Instrument installation drawings

As built drawings and G.A. Drawings for equipment and instrument installation

The Contractor shall keep on site, two sets of the latest revised Operation, Maintenance and Calibration manuals for all field instruments and sub systems, annunciation system, indicating controllers and PLC system etc.

7.1.2.2.29 Commissioning

General
After successful checks and after erection and pre-commissioning tests, the entire system shall be commissioned by the Contractor.
During commissioning, the Contractor shall supply all material and labour to supervise, operate, keep in operation, adjust, test, service, repair and do all things necessary to keep the System running to the satisfaction of the Engineer in Charge. This shall include labour on a 24 hour-a-day basis during the test period and for such other period of continuous operation, as the Engineer in Charge may consider necessary to establish the efficient operation of the System.

If any test results/operations show noticeable variation from the Specification requirements for the System or any particular item of the System, the Contractor shall immediately take steps to rectify the deficiency without any extra cost to Department.
System Commissioning
The Contractor shall be responsible for trial runs, testing and commissioning of the entire system under design and operating conditions or under conditions which the Engineer in Charge may define and which in no case shall exceed the design and operational conditions. The System commissioning shall commence after the work has been physically completed to the satisfaction of the Engineer in Charge. The design and operation conditions are as follows:
Design capacity of the pumps
Starting of pumps against closed/ open valves
Stopping of pumps after closure/ opening of delivery header valves
Power cut and sudden stop of all pumps under design flow conditions
Closing of the line valves against full static pressure
Operation of all valves (manual and motorised/ manual)
Operation of all air valves
Operation of Air vessel if any
Operation of all measuring instruments
Operation of entire system through PLC w.r.t. approved control philosophy of the system.
The timing of the commissioning tests will depend on the availability of water and power.
The Contractor shall prepare the entire system for the execution of the tests complete with all required taps, branches with blank flanges, etc. All these provisions have to be of a durable nature so that the tests can be repeated even after several years. He has to provide all the equipment for the execution of the tests and for the measuring and recording of:
Pressure at various points within the pump station and the pipeline, precision 1 m (0.1 bar)
Head losses across different valves and fittings
Overall energy efficiency of the pumping system at the prescribed flow rates
Performance of the non-return valves
other tests required for the verification of the performance data of the pump station system in conjunction with the pipeline system

Loss of water in mains
The Contractor may engage an institution for the execution of the required tests and their monitoring at his own cost. The institution must be approved by the Engineer in Charge.
The system shall be treated as commissioned only when the entire system has been successfully operated over a period of time as follows:
36 hours uninterrupted, continuous running for three days, at design flow/ flow noticed by Engineer-in-Charge. Or
Short duration operation of 8 hours with a 8 hour stop and a further 4 hours pumping totaling 12 hours working per day for a three day period, at design flow/ flow noticed by Engineer-in-Charge. Or Any repairs or replacement required during this period shall be done by the Contractor at his own cost.

The operation of the system solely for the purpose of maintaining partial pumping by or on behalf of the Department shall not be taken as evidence that any work has fulfilled the commissioning tests, or has been taken over unless the Engineer in Charge specifically states so in writing.

7.1.2.2.30 Trial Runs

The Contractor shall run and maintain the System for 30 days at a stretch, or any other stipulated periods and conditions prescribed by the Engineer-in-Charge. During the trial run all components of the system must function in a synchronized manner so as to give all desired outputs at efficiencies guaranteed or as stipulated in the specifications, failing which the Engineer-in-Charge may extend the period of trial run, till a date the entire system functions to the complete satisfaction of Engineer-in-Charge.
Standard test reports shall be compiled at all stages of installation, pre-commissioning and commissioning. Any modifications or changes shall be incorporated and marked on the respective reference drawings and the Engineer in Charge shall be advised.
The necessary protocol must be maintained for record purposes, jointly with Engineer in Charge and/or the authorized Representative of the Department.

7.1.2.2.31 List of Spare Parts to be supplied for the Pumping Station

(i) Spares for Mechanical Works

S.No	Item Description	Quantity
1.	Impellers with bowl assembly of Submersible Pumps including mechanical seal, cable gland and O-ring	01 set for each pump
2.	Motor bearings	2 sets of each type
3.	Pump thrust bearings	2 Nos of each type
4.	Actuator for butterfly valves & sluice valves	1 No of each rating
5.	Sluice valve rod with check nut with accessories	1 No. of each size installed in the contract
6.	Gland Cap for sluice valves	1 No. of each size installed in the contract
7.	Gaskets for all valves- sluice valves, butterfly valves, NRV etc.,	1 No. of each size installed in the contract

9.	Nuts & Bolts	1 Kg of each size used under the contract
10.	Rubber sheet	2 kg

Spares for Electrical Works

S. No.	Item Description	Quantity
1.	Selector Switch	2 Nos
2.	Digital Multimeter	2 Sets
3.	Set of three lamps with resistors	2 set
4.	Set of three push buttons	2 sets
5.	Electrical protection relays like earth fault, over/under current, under frequency etc.,	1 No. of each type
6.	Lightening arrestor	1 set
7.	LED lamps (9W)	6 no.
8.	MCB/MCCB/ACB	1 no. of each type and rating
9.	Copper/Aluminium Lugs with washer & Nut-bolt	6 no of each size
10.	Cable kits for LT Cables	2 sets
12.	Double compression gland for each type of cable	1 set for each type
13.	Lugs for each size of cables for phase and neutral	6 sets for each set
16.	11 KV DO fuse set	1 set
17.	Conductor clamp	1 set for each type for each type

7.2 SUPPLEMENTARY INFORMATION

SUPPLY, INSPECTION, TESTING, ERECTION, COMMISSIONING, TRIAL RUN, MAINTENANCE, PERFORMANCE, GUARANTEE AND OTHER RELATED MISCELLANEOUS MATTERS

7.2.1 This part covers conditions pursuant to the contract and will form an integral part of the contract. The following provisions shall supplement the General Conditions, Detailed Specifications and Requirements.

The installation/ erections of machinery is linked up with construction of civil works such as pump station, sumps, screen chamber etc and as such the contractor has to dove tail construction of Civil, Mechanical and Electrical works so as to achieve commissioning of the scheme as a whole by the stipulated date.

7.2.2 Limit of Contract

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures, and standard accessories normally provided with such equipment and / or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the technical specifications, unless included in the list of exclusions.

7.2.3 Engineering Data

The contractor shall furnish complete engineering data of each set of equipment such as name of manufacturer, the type and model of each principal item of equipment proposed to be furnished and erected, standard catalogues, designations, number and the name of the project. All titles, marking and writing on the drawing shall be in English. All the dimensions should be in metric units.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the contractor's risk. The contractor may make any changes in the design, which are necessary to make equipment conform to the provisions of the contract and such changes will again be subject to the approval by the purchaser. Approval of contractor's drawings or work by the purchaser shall not relieve the contractor of any responsibilities and liabilities under the contract.

Drawing shall include all installation and detailed piping drawings wherever applicable.

7.2.4 Design Improvements

The purchaser or the contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes, the specification shall be modified accordingly.

If any such agreed upon changes are such that it affects the price and schedule to completion, the parties shall agree in writing as to the extent of any change in the price and / or schedule of completion before the contractor proceeds with the changes.

7.2.5 Transportation:

1) When materials are to be supplied in bundles, the weight of each bundle should not exceed 1.5 tones. If the weight of the bundle or any individual item exceeds 1.5 tones and if any extra handling charges etc. are required to be paid as heavy lift charges due to this, the contractor shall be liable to pay the same.

2) The contractor, wherever applicable, after proper painting, shall pack and crate all equipment for sea shipment in a manner suitable for export to a tropical, humid climate region in accordance with the internationally accepted export practices and in such a manner as to protect them from damage and deterioration in transit by road, rail and/ or sea and during storage at the site till time of erection. The contractor shall be held responsible for all damages due to improper packing.

3) The contractor shall give complete shipping information concerning the weight, size, content of each package including any other information the owner may require.

4) The contractor shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment dispatched to site. The contractor shall further be responsible for making all necessary arrangements for loading, unloading and other handling right from his works till the site and also till the equipment is erected, tested and commissioned. He shall be solely responsible for proper storage and safe custody of all equipments.

5)All demurrage, wastage and other expenses incurred due to delayed clearance of material or any other reasons shall be to the account of the contractor.

7.2.6 Protection of Equipment:

1) All coated surface shall be protected against abrasion, impact discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping sealed with suitable devices to protect them from damage.

Factory finish plant shall be adequately protected during transport and installation against damage to finished surface, fitted components etc. The contractor shall make good to the satisfaction of the engineer for any deterioration of the protective coatings, paints work, which may occur during transportation, erection, commissioning, etc. until the plant is taken over; finish painting of the plant at site shall be carried out before the plant has been taken over.

7.2.7 Preservative shop coating:

All metallic surfaces subject to corrosion shall be protected by shop applications of suitable coatings. All surfaces, which will not be easily accessible after the shop assembly, shall beforehand be treated and protected for the life of the equipment. The surface that are to be finished painted after installation or required corrosion protection until installation, shall be shop painted with atleast two coats of primer. Transformers and other electrical equipments, if included, shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The

finished colour shall be as per manufacturer's standards, to be selected and specified by the purchaser at a later date.

Shop primer for all steel surfaces shall be selected by the contractor after obtaining specific approval or purchaser.

All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound approved by the purchaser.

7.2.8 Inspection and Test at Manufacturers Premises (Shop Test)

Following equipment shall be liable for inspection and testing before dispatch at the manufacture's premises or workshop as required by the engineer or his representative, who reserve the right to be present in all testing, whether conducted at the manufacturer's workshop to see that they conform to the specifications.

i) Pumps ii) All Electrical Gadgets viz. Transformers, Servo Stabilizers, Switchgears, Cables, etc. iii) Lifting arrangement/Crane iv) DG Set v) LT Panel vi) Capacitors and Electrification equipments vii) Valves viii) Pipes.

The Contractor, at the option of purchaser, shall arrange for inspection of the equipment during manufacture and before dispatch at supplier's / his sub-supplier works by any approved 3rd party inspection agency nominated by the purchaser, engineer (or his representative) or both. The charges for inspection & testing by the third party inspection agency, including all other expenses such as travel, board and lodge of the 3rd party inspection agency shall be borne by the contractor. The supplier shall give purchaser clear 15 days notice for arranging inspection. Inspection notice shall include reference of approved drawings, supplier's un-priced copy of the order for the equipment on the manufacturer, type test certificate as applicable, name and address of contact persons among other information. If the equipment is not ready when the purchaser's representatives arrive at supplier or his sub-supplier's works, Contractor shall have to bear the full cost of subsequent visits of the purchaser's representative. Contractor shall show purchaser's representative, the original material supplier's test and guarantee certificates for the bought-out items and furnish photocopies the same for purchaser's records.

Purchaser may waive inspection, if he so desire, in which case test certificates are to be submitted for his approval before requesting for dispatch clearance.

No materials shall be delivered to the site without inspection having been carried out or waived off in writing by the engineer or his representative.

The contractor shall carry out all tests of pumping plant & other equipment and shall supply two copies of all test result to the engineer or his representative. All tests shall be subject to the approval of the engineer or his representative, who if necessary, may require the test to be repeated, postponed or modified to ensure that all items of the plant conform to the contract. The engineer's representative shall be permitted to inspect the plant, which is undergoing tests, and he may himself conduct the test on the plant.

The purchaser requires the following inspection procedures and tests:
Routine tests shall be carried out on standard equipment.

Shop testing and testing at site on pumping plant and equipment shall be carried out as per BIS.
Electrical items shall also be tested as per Indian electricity rules and Act.
Functional and acceptance test of the assembled equipment shall be carried out after the plant is made ready for operation.
Where recognized standard does not exist for any equipment, the bidder shall indicate the tests to be carried out on the same. The supplier shall conduct test as per the test procedure agreed mutually between the purchaser and the supplier.
Test certificates shall confirm that the materials conform to the relevant specifications / BIS or equivalent standard published in the country where the component is manufactured.
Four (4) sets of test certificates are to be sent to the relevant executive / department of purchaser by the supplier while requesting for issue of dispatch instruction.
In no circumstances inspection shall be carried out or waiver granted on the basis of test certificates where all drawings of equipment including its associated sub-systems or components do not have clear approval by the purchaser.

7.2.9 Tests on Final Completion of System

The contractor shall carry out the final tests on all pumping plants, equipment, instruments, pipe work, valves, fittings etc. as per mentioned in respective specification, if any. The contractor shall also carry out all other tests required either by himself and/or the Engineer to approve the plant, and to comply systems and processes, all pumps, all motors, gantry cranes and hoists, instruments metering devices, gauges and all components of the plant over the range of operating conditions.
The contractor shall maintain on site a guard book in English of all tests carried out and will hand over a certified copy of the same to the Engineer at the time of completion of the works.
Tests, which shall be deemed to be the tests on completion, shall each be of at least one day (8 hrs.) duration for each pumping plant (or should the provision of water fail or other matters interfere outside the contractor's or employer's control, for such number of broken hrs.) as the Engineer's Representative may commence will previously mentioned tests and inspections have been completed to the satisfaction of the Engineer's Representative..

7.2.10 Commissioning and Testing including trial run for 30 days.

The contractor shall be responsible for setting all the pumping plants, equipment and pipe work to the line and level required.
After installation of equipment has been completed, it shall be offered to the engineer's representative for inspection prior to commissioning the item. Until such time as the equipment or material installed and erected under the contract is finally accepted by the engineer in keeping with the terms and conditions of this contract and associated specifications, the responsibility for proper testing, maintenance, efficient operation of the same shall be of the contractor. Prior to start up, the contract shall be required to service the equipment and during start-up render such assistance as may be necessary or required by the Engineer.
The contractor shall check all items of electrical plant for correct phasing and insulation resistance. Motors and control equipment shall be dried out and checks to the insulation resistance shall be carried out at regular intervals. In consultation with him a program for the period of commissioning and tests shall be finalized.
Commissioning shall commence after all plant has been inspected to the satisfaction of the Engineer's representative. At the commencement of the commissioning of the plant, the same shall be put into operation under manual control and subsequently under automatic control equipment

shall be completed, tested and brought into operation. During commissioning, the contractor shall supply all labour to supervise, operate, keep in operation, adjust, test, service, repair and to do all things necessary to keep all the equipment running.

The contractor will conduct trial running of all equipment for a period of 30 days after same is installed in all respects before commissioning. The commissioning shall commence after all components of the work i.e. Civil, Mechanical and Electrical are completed in all respects. The Contractor will bear all necessary expenditure for commissioning and trial running including cost of spare parts, HSD, Lubricants, packings etc. During the commissioning period, the contractor shall employ a commissioning representative who shall be a qualified engineer and who shall instruct the engineer's staff on all aspects of the operating procedure.

The Contractor shall during Trial running and commissioning impart Training to the staff, operational staff of Line Deptt. .

7.2.11 Taking over the Plant:

After successful Commissioning and when the engineer is satisfied that the entire works have been completely constructed, supplied, erected, tested, commissioned and trial running for 30 days all in complete operatable and reliable order, and only when all specified test certificates, the engineer will issue a taking over certificate. Until such certificate is issued, the contractor shall be responsible for making good any damage occasioned to the plant, however, caused.

7.2.12 Defect liability Period and the Contactors Obligations

The Defect Liability period shall be for 12 months and shall be reckoned from the date of issue of completion certificate or satisfactory trial run and commissioning in all respect of Civil, Mechanical and Electrical works.

7.2.13 Training of Personnel

The contractor at his own expenses shall arrange for the training of the personnel in charge of the O&M of the plant, during trial running and commissioning. The contractor shall provide a works training officer, whose sole duties shall be to advise the O&M personnel on the operation and maintenance of all the equipments and to instruct on a full time basis, the aforesaid personnel on the operation and maintenance of the work, the mechanical and the electrical and the instruments and systems.

7.2.14 Instruction Manuals:

The supplier shall furnish specified number of copies of the instruction manual which would contain detailed step by step instruction for all operational and maintenance requirements.

The manual shall include, among other information, the following aspects:

Storage for prolonged duration, unpacking, erection, handling at site, pre- commissioning details, operating and maintenance procedures.

Precaution to be taken during operation and maintenance work.

Outline dimension drawing showing relevant cross sectional views and constructional features.

Catalogue numbers of all components liable to be replaced during the life of panel.

Rated voltages, current, duty cycle and all other information, which may be necessary for safe operation of the panels.

The contractor shall deliver draft operation and maintenance manuals in duplicate applying to the plant. The manuals shall be accompanied by writing and erection diagrams, which show how

the plant is to be erected, how it operates and how it may be maintained. A collection of manufacturer's descriptive leaf lets will not be accepted in satisfaction of this clause.

During erection, commissioning and testing, the draft operation and maintenance manuals and diagrams are to be checked against the plant and amended if necessary to relate accurately to the plant as installed.

Certificates of taking over of plant will not be issued until such time as the requirements of the two above proceeding paragraphs, in the opinion of the engineer or his representative, have been adequately fulfilled. Three copies of the amended and corrected manuals in English and drawings relating to each item of the plant shall be printed on A4 size sheets and bound in suitable loose leaf binders and provide at the commencement of the period of running maintenance.

7.2.15 Materials Handling and Storage:

All the equipment furnished under the contract and arriving at site shall be promptly received, unloaded and transported and stored in the storage spaces by the contractor.

Contractor shall be responsible for examining all the shipment and notify the purchaser immediately of any damage, shortage and discrepancy etc. For the purpose of purchaser's information only, the contractor shall submit to the purchaser every week a report detailing all the receipts during the week.

The contractor shall maintain as accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the purchaser at any time.

All equipment shall be handled very carefully to prevent any damage or loss. No bars, wire ropes slings etc. shall be used for unloading and / or handling the equipment without the specific written permission of the purchaser. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.

All electrical panels, control gears, motor and such other devices shall be properly dried by heating before they are installed and energized. Motor bearings, slip rings, commutator and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.

All the electrical equipment, such as motors, generators, etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values maintained by the contractor. Such records shall be open for inspection by the purchaser.

All the materials stored in the open or dusty location must be covered with suitable weather proof and flameproof covering materials wherever applicable.

The contractor shall be responsible for making suitable indoor storage facilities to store all equipment, which require indoor storage. Normally, all the electrical equipment, such as motors, control gears, generators, exciters and consumable like electrodes, lubricants etc. shall be stored in closed storage space.

7.2.16 Contractors materials brought on to site

1) The contractor shall bring to site all equipment, components, parts, materials, including tools and tackles for the purpose of the works under intimation to the purchaser.

2) The owner shall have a lien on such goods for any sum or sums, which may at any time be due or owing to him by the contractor, under in respect of or by any reasons of the contract. After giving a fifteen (15) days notice in writing of his intention to do so, the owner shall be at liberty to sell and dispose of any such goods in such a manner as he shall think fit including public auction or

private treaty and to apply the proceeds towards the satisfaction of such sum or sums due as aforesaid.

After completion of the works, the contractor shall remove from the site, under the direction of the purchaser, the materials such as construction equipment, erection tools and tackles, scaffolding, etc. with the written permission of the purchaser. If the contractor fails to remove such materials with in fifteen days of issue of a notice by the purchaser to do so then the purchaser shall have the liberty to dispose of such materials and credit the proceeds thereof the contractor at the account of.

7.2.17 Field Office Records

The contractor shall maintain at his site office up-to-date copies of all drawings, specifications and other contractor documents and any other supplementary data complete with all the latest revisions thereto.

7.2.18 Quality Assurance Program

To ensure that the equipment and services under the scope of the contract, whether manufactured or performed within the contractor's works or at his sub-contractors premises or at the owner's site or at any other place of work, are in accordance with the specification. The contractor shall adopt suitable quality assurance program to control such activities at all necessary points. Such program shall be outlined by the contractor and shall be finally accepted by the purchaser after discussions before the award of contract and such agreed program shall form part of the contract.

7.2.19 Unfavorable Working Conditions

The contractor shall confine all his field operation to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, snowfall etc. and during other unfavorable construction condition. Such unfavorable condition will in no way relieve the contractor of his responsibility to perform the works as per the schedule.

7.2.20 Protective Guards

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts.

7.2.21 Painting

All exposed parts of the equipment including piping, structure, railings etc., wherever applicable, after installation, unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping or sandblasting and the same being inspected and approved by the purchaser for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery enamel paints.

7.2.22 Color Code for Pipe Services

All pipe services, wherever applicable, are to be painted in accordance with the owner's standard colour scheme by the contractor.

7.2.23 Lubrication

Equipment shall be lubricated by system suitable for duty of the equipment.

First fill of consumable, oil and lubrication

All the first fill consumable such as oils, lubricants and essential chemical etc. which will be required to put the equipment, covered under the scope of the specification, into successful trial operation shall be furnished by the contractor unless specifically excluded under the exclusion in these specification and documents.

7.2.24 Check out of Control System

After completion of wiring / cabling furnished under para of specifications and laid & terminated by the owner, the contractor shall check out the operation of all control system for the equipment furnished and installed under these specifications and documents.

7.2.25 Performance and Guarantee Test

The final test, as to the performance and guarantee, shall be conducted at site by the Engineer to determine compliance of the equipment with performance guarantee.. The contractor, during commissioning and startup shall make the equipment ready for such test and assist the owner in conducting such test free of cost. Such test will be commended after the successful completion of trial operations.

The available instrumentation and control equipment will be used during such tests and the purchaser will calibrate all such measuring equipment and devices as far as practicable. The tests will be conducted for the specified duty and as near to the specified condition as practicable.

Any special equipment, tools and tackles required for successful completion of the performance and guarantee tests shall be provided by the contractor, free of cost.

The guaranteed performance figures of the equipment shall be proved by the contractor during these performance and Guarantee tests. Should the result of these tests show any decrease from the guaranteed values, the contractor shall modify the equipment as required to enable them to meet the guarantees. In such case, performance and guarantee tests shall be repeated within one month from the date of equipment is ready for retest and all cost of additional testing to prove that the equipment meets guarantees, shall be borne by the contractor.

7.2.26 Work and Safety Regulation

The contractor will notify the purchaser of his intention to bring on to site any equipment or any containers with liquid on gaseous fuel or other substance, which may create hazard. The purchaser shall have the right to inspect any construction plant and to forbid its use, if in his opinion it is unsafe. The Owner shall entertain no claim due to such prohibition.

Where it is necessary to provide and or store petroleum product or petroleum mixtures and explosives, the contractor shall be responsible for storage in accordance with the rules and regulation laid down in petroleum Act. 1993, Explosive Act, 1948 and petroleum and carbide of calcium Manual published by the Chief Inspector of Explosive of India.

7.2.
27 Operation and Maintenance:

All works related to the proper operation and maintenance of the system shall be carried out by the contractor at his own cost and arrangement for which whatever provisions are stated in the price bid shall be treated as all inclusive. Repairs and restoration of damages developed in the network system in the pump house campus shall also be included under O&M aspect for which no claim other than the provision of BOQ shall be entertained. All material used for such repairs shall be of best approved quality. The electricity charges during O&M period shall however be borne by the employer. It should be clearly understood that no electricity charges shall be reimbursed which has been consumed in works other than O&M of the system. All approved quality of lubricants, fuel and other incidental material shall be deemed to have been considered by the bidder while quoting rates in relevant item of the BOQ. For deployment and services of requisite personnel for proper O&M of the system and cost thereto, is deemed to have been included and no claim on any such account shall be considered. Whole work shall be carried out as per the specifications and the directions of Engineer incharge.

SPECIFICATIONS FOR PERSONAL PROTECTIVE EQUIPMENT

Using personal protective equipment requires hazard awareness and training on the part of the user. Employees must be aware that the equipment does not eliminate the hazard. If the equipment fails, exposure will occur. To reduce the possibility of failure, equipment must be properly fitted and maintained in a clean and serviceable condition.

Selection of the proper personal protective equipment for a job is important. Employers and employees must understand the equipment's purpose and its limitations. The equipment must not be altered or removed even though an employee may find it uncomfortable. Sometimes equipment may be uncomfortable simply because it does not fit properly.

This explains those types of equipment most commonly used for protection of the head, including eyes and ears and the torso, arms, hands and feet.. Information on respiratory protective equipment may be found in OSHA Title 29 CFR Part 1910.134. The standard should be consulted for information on specialized equipment such as that used by firefighters.

7.3 Drawings

Drawings are provided in Annexure-1

Note :- Drawings are attached as Annexure I in a separate folder alongwith with this document.

Environmental, social, health and safety requirements

The Environment and Social Management Plan is attached as Annexure II at the end of this document.

PART 3 – Conditions of Contract and Contract Forms

General Conditions of Contract

A. General

1. Definitions

1.1 Boldface type is used to identify defined terms.

(a) The Accepted Contract Amount means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

(b) Not used.

(c) The Adjudicator is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in GCC 23.

(d) Bank means the financing institution **named in the PCC**.

(e) Bill of Quantities means the priced and completed Bill of Quantities forming part of the Bid.

(f) Compensation Events are those defined in GCC Clause 42 hereunder.

(g) The Completion Date is the date of completion of the Works as certified by the Project Manager, in accordance with GCC Sub-Clause 53.1.

(h) The Contract is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC Sub-Clause 2.3 below.

(i) The Contractor is the party whose Bid to carry out the Works has been accepted by the Employer.

(j) The Contractor's Bid is the completed bidding document submitted by the Contractor to the Employer.

(k) The Contract Price is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.

(l) Days are calendar days; months are calendar months.

(m) Not used.

(n) A Defect is any part of the Works not completed in accordance with the Contract.

(o) The Defects Liability Certificate is the certificate issued by Project Manager upon correction of defects by the Contractor.

(p) The Defects Liability Period is the period named in the PCC pursuant to Sub-Clause 34.3 and calculated from the Completion Date.

(q) Drawings means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract, include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

(r) The Employer is the party who employs the Contractor to carry out the Works, as **specified in the PCC**.

(s) Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

(t) "In writing" or "written" means hand-written, type-written, printed or electronically made, and resulting in a permanent record;

(u) The Initial Contract Price is the Contract Price listed in the Employer's Letter of Acceptance.

(v) The Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is **specified in the PCC**. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

(w) Materials are all supplies, including consumables, used by the Contractor for incorporation in the Works.

(x) Plant is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

(y) The Project Manager is the person **named in the PCC** (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract.

(z) PCC means Particular Conditions of Contract.

(aa) The Site is the area **defined as such in the PCC**.

(bb) Site Investigation Reports are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

(cc) Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

(dd) The Start Date is **given in the PCC**. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

(ee) A Subcontractor is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.

(ff) Temporary Works are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.

(gg) A Variation is an instruction given by the Project Manager which varies the Works.

(hh) The Works are what the Contract requires the Contractor to construct, install, and turn over to the Employer, **as defined in the PCC**.

2. Interpretation

2.1 In interpreting these GCC, words indicating one gender include all genders. Words indicating the singular also include the plural and words indicating the plural also include the singular. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.

2.2 If sectional completion is **specified in the PCC**, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

(a) Agreement,

(b) Letter of Acceptance,

(c) Contractor's Bid & Priced Bill of Quantities,

(d) Particular Conditions of Contract,

(e) General Conditions of Contract including Appendices,

(f) Specifications,

(g) Drawings,

(h) Joint Venture Agreement [where applicable], and

(i) any other document **listed in the PCC** as forming part of the Contract.

3. Language and Law

3.1 The language of the Contract and the law governing the Contract are **stated in the PCC**.

Salient features of major labour and other laws that are applicable to construction industry in India are given as Appendix 1 to these General Conditions of Contract.

3.2 Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in India when

(a) as a matter of law or official regulations, India prohibits commercial relations with that country; or

(b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, India prohibits any import of goods from that country or any payments to any country, person, or entity in that country.

4. Project Manager's Decisions

4.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.

However, if the Project Manager is required, under the rules and regulations and orders of the Employer, to obtain approval of some other authorities for specific actions, he will so obtain the approval. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Project Manager.

5. Delegation

5.1 Unless otherwise **specified in the PCC**, the Project Manager may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may revoke any delegation after notifying the Contractor.

6. Communica-

6.1 Communications between parties that are referred to in the

tions Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered. All oral instructions shall be confirmed in writing in seven working days.

7. Subcontracting 7.1 The Contractor may subcontract with the approval of the Project Manager upto a ceiling **specified in PCC**, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations.

7.2 The Project Manager should satisfy himself before recommending to the Employer whether:

a) the circumstances warrant such sub-contracting; and,

b) the sub-Contractor so proposed for the Work possesses the experience, qualifications and equipment necessary for the job proposed to be entrusted to him in proportion to the quantum of Works to be sub-contracted.

7.3 If payments are proposed to be made directly to that sub-contractor, this should be subject to specific authorization by the prime contractor so that his arrangement does not alter the contractor's liability or obligations under the contract.

7.4 The Contractor shall not be required to obtain any consent from the Employer for:

(a) the sub-contracting of any part of the Works for which the Sub-Contractor is already named in the contract;

(b) the provision for labour, or labour component, and,

(c) the purchase of materials which are in accordance with the standards specified in the contract.

(*Note: 1. All bidders are expected to indicate clearly in the bid, if they proposed sub-contracting elements of the works amounting to more than 10 percent of the Bid Price. For each such proposal the qualification and the experience of the identified sub-contractor in the relevant field should be furnished alongwith the bid to enable the Employer to satisfy himself about their qualifications before agreeing for such sub-contracting and include it in the contract. In view of the above, normally no additional sub-contracting should arise during execution of the contract.*

2. However, [a] sub-contracting for certain specialized elements of the work is not unusual and acceptable for carrying out the works more effectively; but vertical splitting of the works for sub-contracting is not acceptable. [b] in any case, proposal for sub-contracting in addition to what was specified in bid and stated in contract agreement will not be acceptable if the value of such additional sub-contracting exceeds 25% of value of work which was to be executed by Contractor without sub-contracting.

3. Assignment of the contract may be acceptable only under exceptional circumstances such as insolvencies/liquidation or merger of companies etc.)

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as **referred to in the PCC.** The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

9. Personnel and Equipment

9.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid and **referred to in the PCC**, to carry out the Works or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.

9.2 The Project Manager may require the Contractor to remove from the Site of Works, a member of the Contractor's staff or his work force, who:

(a) persists in any misconduct or lack of care,

(b) carries out duties incompetently or negligently,

(c) fails to conform with any provisions of the Contract, or

(d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

9.3 If the Employer, Project Manager or Contractor determines, that any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with Clause 9.2 above

9.4 In all the above cases, the contractor shall ensure that the person leaves the site within seven days and has no further connection with the work in the contract. The Contractor shall appoint a suitable replacement within 28 days or earlier as may be agreed to between the Project manager and the Contractor.

9.5 The Contractor shall not employ any retired Gazetted officer who has either not completed two years after the date of retirement or has not obtained permission from the Government authorities for employment with the Contractor[23].

9.6 The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport. The Contractor shall, if required by the Project Manager, deliver to the Project Manager a return in detail, in such form and at such intervals as the Project Manager may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor

[23]Based on Government Directives.

on the Site and such other information as the Project Manager may require.

Compliance with Labour Regulations

9.7 During continuance of the Contract, the Contractor and his Sub-Contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour laws (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law prevailing on the Base Date either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contraventions including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Project Manager/ Employer shall have the right to deduct any money due to the Contractor including his amount of performance security and if applicable, the Environmental, Social, Health and Safety (ESHS) Performance Security. The Employer/ Project Manager shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

9.8 The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

9.9 The Contractor shall duly comply with the provisions of the Apprentices Act 1961 (III of 1961) and the rules made there under, and comply, failure or neglect to shall be subject to all liabilities and penalties provided in the said Act and Rules.

10. Employer's and Contractor's Risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's Risks

11.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Employer's risks:

(a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to

(i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or

(ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.

(b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

11.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer's risk except loss or damage due to

(a) a Defect which existed on the Completion Date,

(b) an event occurring before the Completion Date, which was not itself an Employer's risk, or

(c) the activities of the Contractor on the Site after the Completion Date.

12. Contractor's Risks

12.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.

13. Insurance

13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles **stated in the PCC** for the following events which are due to the Contractor's risks:

(a) loss of or damage to the Works, Plant, and Materials [which are incorporated in works];

(b) loss of or damage to Construction Equipment;

(c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and

(d) personal injury or death.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.

13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Data

14.1 The Contractor shall be deemed to have examined any Site Data **referred to in the PCC**, supplemented by any information available to the Contractor.

15. Contractor to Construct the Works including protection of environment, and assurance of public health and

15.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings and as per instructions of Project Manager.

15.2.1 The Contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other cause arising as a consequence of his methods of operation.

safety

15.2.2 During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made thereunder, regulations, notifications and by-laws of the Sate or Central Government, or local authorities and other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority. Salient features of the major laws are given in Appendix 1 to the General Conditions of Contract.

16 The Works to Be Completed by the Intended Completion Date

16.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

17 Approval by the Project Manager

17.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, for his approval.

17.2 The Contractor shall be responsible for design of Temporary Works.

17.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

17.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

17.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

18 Safety

18.1 The Contractor shall be responsible for the safety of all activities on the Site.

19 Discoveries

19.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

20 Possession of the Site

20.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date **stated in the PCC,** the Employer shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.

21 Access to the Site

21.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

22 Instructions, Inspections and Audits

22.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.

22.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub-consultants to keep, accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.

22.3 The Contractor shall permit and shall cause its Subcontractors and sub-consultants to permit, the Bank and/or persons appointed by the Bank to inspect the Site and/or the accounts and records relating to the performance of the Contract and the submission of the bid, and to have such accounts and records audited by auditors appointed by the Bank if requested by the Bank. The Contractor's and its Subcontractors' and sub-consultants' attention is drawn to Sub-Clause 25.1 which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under Sub-Clause 22.2 constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

23 Appointment of the Adjudicator

23.1 The Adjudicator named in PCC shall be appointed jointly by the Employer and the Contractor, at the time of the Employer's issuance of the Letter of Acceptance. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority **designated in the PCC**, to appoint the Adjudicator within 14 days of receipt of such request.

23.1.1 The Adjudicator should be in position before "notice to proceed with work" is issued to the Contractor and an agreement should be signed with the Adjudicator jointly by the Employer and the Contractor in the form attached – Appendix 3.

23.2 Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract; a new Adjudicator shall be jointly appointed by the Employer

and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority **designated in the PCC** at the request of either party, within 14 days of receipt of such request.

24 Procedure for Disputes

24.1 If the Contractor believes that a decision taken by the Project Manager was either outside the authority given to the Project Manager by the Contract or that the decision was wrongly taken, the decision shall be referred to the Adjudicator within 14 days of the notification of the Project Manager's decision.

24.2 The Adjudicator shall give a decision in writing within 28 days of receipt of a notification of a dispute.

24.3 The Adjudicator shall be paid daily at the rate **specified in the PCC,** together with reimbursable expenses of the types **specified in the PCC**, and the cost shall be divided equally between the Employer and the Contractor. Whatever decision is reached by the Adjudicator, either party may refer that decision to an Arbitrator within 28 days of the Adjudicator's written decision. If neither party refers the dispute to arbitration within the above 28 days, the Adjudicator's decision shall be final and binding.

24.4 The arbitration shall be conducted in accordance with the arbitration procedures published by the institution named and in the place **specified in the PCC.**

The Arbitrator(s) shall give a decision in writing within 120 days of start of the proceedings unless otherwise agreed to by the Parties. The Arbitrators shall entertain only those issues which have been earlier referred to the Adjudicator and either party is dissatisfied with the decision given by the Adjudicator.

25. Corrupt And Fraudulent Practices

25.1 The Bank requires compliance with its policy in regard to corrupt and fraudulent practices as set forth in Appendix A to the GCC.

25.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the bidding process or execution of the Contract. The information shall be disclosed as and when such payments are made or agreed to, and compliance with the disclosure requirement shall be furnished, while submitting each monthly statement for payments; such disclosure must include at least the name and address of the agent or other party, the amount and currency, and the purpose

of the commission, gratuity or fee.

B. Time Control

26. Program

26.1 Within the time **stated in the PCC**, after the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a revised Program showing the general methods, arrangements, order, and timing for all the activities in the Works alongwith monthly cash flow forecasts.

26.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

26.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period **stated in the PCC.** If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount **stated in the PCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

26.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

27. Extension of the Intended Completion Date

27.1 The Project Manager shall extend the Intended Completion Date including milestones if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date as per agreed milestones without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.

27.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date/milestones within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date/milestones.

28. Acceleration

28.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Employer accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Employer and the Contractor.

28.2 If the Contractor's priced proposals for acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.

29. Delays Ordered by the Project Manager

29.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

30. Management Meetings

30.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. (Which will be held at the place **indicated in PCC**. The periodicity to be fixed by Project Manager / Contractor jointly). The business of a management meeting shall be to review the progress of construction with reference to the construction program given in accordance with GCC 26.1, the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

30.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

31. Early Warning

31.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

31.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting

instruction of the Project Manager.

C. Quality Control

32. Quality Assurance

32.1 The Contractor shall institute Quality Assurance (QA) and Quality Control (QC) systems in accordance with Quality Assurance Plan to demonstrate compliance with the requirements of the Contract as approved by the Project Manager.

32.2 Compliance with the QA/QC systems shall not relieve the Contractor of any of his duties obligations or responsibilities under the Contract.

33. Tests

33.1 The Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently.

33.2 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

34. Identifying and Correction of Defects

34.1. The Project Manager shall check the Contractor's work and notify the Contractor of any defects that are found specifying a time by which it should be corrected. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

34.2 The contractor shall permit the Employer's Technical auditor to check the contractor's work and notify the Project Manager and Contractor of any defects that are found. Such a check shall not affect the Contractor's or the Project Manager's responsibility as defined in the Contract Agreement

34.3 The Project Manager shall give notice to the Contractor of any Defects [specifying a time limit by which it should be corrected] before the end of the Defects Liability Period, which begins at Completion, and is **defined in the PCC.** The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

34.4 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified

by the Project Manager's notice.

35. Uncorrected Defects

35.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected and the Contractor shall pay this amount.

Note: 1. Where in certain cases, the technical specifications provide for acceptance of works within specified tolerance limits at reduced rates, Project Manager will certify payments to Contractor accordingly.

2. Where the failure to correct a particular defect within the specified time is considered as a fundamental breach of contract a notice should be given to the contractor as stated in GCC 57.2(e).

D. Cost Control

36. Contract Price

36.1 The Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.

37. Changes in the Contract Price

37.1 If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change.

(a) If the quantity of work executed exceeds the quantity of the item in BOQ beyond the higher specified limit the Project Manager shall fix the rate to be applied for the additional quantity of the work executed.

(b) If the quantity of work executed less than the quantity of the item in BOQ lesser than the lower specified limit, the Project Manager shall fix the rate to be applied for whole of the quantity of the work so executed.

37.2. The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Employer.

37.3 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of

any rate in the Bill of Quantities.

38. Variations

38.1 All Variations shall be included in updated Programs, produced by the Contractor.

38.2 The Contractor shall provide the Project Manager with a quotation (with breakdown of unit rates) for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

38.3 If the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in Sub-Clause 37.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

38.4 If the Contractor's quotation is unreasonable, [*or if contractor fails to provide the Project Manager with a quotation within a reasonable time specified by Project Manager in accordance with GCC38.2*] the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs

38.5 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

38.6 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

39. Cash Flow Forecasts

39.1 When the Program, is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall be in Indian Rupees.

40. Payment Certificates

40.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously alongwith details of measurement of the quantity of works executed in a tabular

form approved by the Project Manager.

40.2 The Project Manager shall check the details given in the Contractor's monthly statement and within 14 days certify the amounts to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amount and under conditions set forth in GCC Sub-Clause 49.4 *[Secured Advance]*

40.3 The value of work executed shall be determined by the Project Manager after due check and measurement of the quantities claimed as executed by the contractor

40.4 The value of work executed shall comprise of the value of the quantities of work in the Bill of Quantities that have been completed;

40.5 The value of work executed shall include the valuation of Variations and Compensation Events.

40.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

41. Payments

41.1 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of contract & taxes to be deducted at source [TDS] as per applicable law. The Employer shall pay the Contractor the amounts certified by the Project Manager within 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made upto the date when the late payment is made at the rate **stated in the PCC**.

41.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated at the rate stated in GCC 41.1 above, from the date upon which the increased amount would have been certified in the absence of dispute.

41.3 Items of the Works for which no rate or price has been entered in shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

42. Compensation Events

42.1 The following shall be Compensation Events:

(a) The Employer does not give access to a part of the Site by the Site Possession Date pursuant to GCC Sub-Clause 20.1.

(b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.

(c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time.

(d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.

(e) The Project Manager unreasonably does not approve a subcontract to be let.

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

(g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

(i) The advance payment is delayed.

(j) The effects on the Contractor of any of the Employer's Risks.

(k) The Project Manager unreasonably delays issuing a Certificate of Completion.

42.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract

Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

42.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.

42.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.

43. Tax

43.1 The rates quoted by the Contractor shall be deemed to be inclusive of the VAT, Sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source [TDS] as per applicable law.

43.2 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the deadline for the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price.

44. Currencies

44.1 All payments shall be made in Indian Rupees.

45. Price Adjustment

45.1 Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants and other inputs to the works in accordance with the principles and procedures outlined below. A table of adjustment data is **included in the PCC** which indicates the coefficients of various inputs and the sources of indices for various schedules of BOQ. If the PCC does not include a table of adjustment data this sub clause shall not apply and there shall be no price adjustment.

(a) The price adjustment according to sub para (d) below, shall apply for the work done from the start date given in the PCC upto the end of the Intended Completion Date. If there is delay in completion beyond such date for reasons attributable to the contractor, the Price Adjustment for the work carried out during such period,

for reasons attributable to the Contractor, shall be regulated by sub-para (g) below.

(b) The Contract Price shall be adjusted to take account of any increase or decrease in cost after the base date, which affect the Contractor in performance of obligations under the Contract.

(c) The total value (R) of the work done during the specified period [GCC 40.1] shall be as under:

$R= SUM (R_{S1} + R_{S2} + R_{S3} + \ldots\ldots R_{Sn})$,

Where,

'R_{sn}' is the value of work done during the specified period to which the price adjustment shall be applied for the relevant schedule of Bill of Quantities (BOQ) specified in P.C.C during the specified period, and represented as under:

$R_{sn} = (V_{sn} + S_{sn})$ minus (amount of secured advance recovered in the same period + value of works executed under variations for which price adjustments will be worked separately based on terms mutually agreed between the Project Manager and the Contractor)

where,

V_{sn} is the total value of work done during the specified period for the respective schedule of BOQ, and

S_{sn} is the secured advance paid during the specified period for the respective schedule of BOQ,

(d) The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate schedule of BOQ and certified in Payment Certificates, shall be determined from formulae which shall be of the following general type:

$P_n = a + b\ L_n/L_o + c\ E_n/E_o + d\ M_n/M_o + \ldots\ldots$

where,

"P_n" is the adjustment multiplier to be applied to the value of the work done during the period "n", this period being a month unless otherwise stated in the PCC.

"a" is a fixed coefficient, stated in the relevant table of

adjustment data, representing the non-adjustable portion in contractual payments;

"b", "c", "d",… are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

"L_n"[*Labour*], "E_n"[*Equipment*], "M_n"[*Material*], …. are the current cost indices or reference prices for period "n", each of which is applicable to the relevant tabulated cost element [*Labour, Equipment, Steel, Cement, Fuel/Lubricants, Bitumen, others*] on the date, specified in the Table-2 of Adjustment Data, prior to the last day of the period (to which the particular Payment Certificate relates); and

"L_o", "E_o", "M_o", ….are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

(e) The cost indices or reference prices stated in the tables of adjustment data given in PCC shall be used. The base date shall be the deadline for the submission of bids.

(f) If the Contractor fails to complete the Works within the Intended Completion date, adjustment of prices thereafter shall be made using either:

(i) index or price applicable for each cost element tabulated in the tables of adjustment data on the specified date prior to the expiry of the Intended Completion Date, or

(ii) the current index or price applicable for the period in question whichever is more favourable to the Employer.

(g) The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be varied by the Project Manager if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

(h) Unless otherwise **stated in the P.C.C.**, the Price

adjustment shall be done in each monthly Interim Payment Certificate [IPC]. The coefficients and indices are given in the Tables of Adjustment Data in Contract data.

To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clauses in the contract, the unit rates and prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs

46. Retention

46.1 The Employer shall retain from each payment due to the Contractor the proportion **stated in the PCC** until Completion of the whole of the Works

46.2 Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC 53.1, half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected. On completion of the whole works the Contractor may substitute the balance retention money with an "on demand" Bank guarantee.

47. Liquidated Damages

47.1 The Contractor shall pay liquidated damages to the Employer at the rate per day **stated in the PCC** for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestones as stated in the PCC). The total amount of liquidated damages shall not exceed the amount **defined in the PCC.** The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

Time is the essence of the contract and payment or deduction of liquidated damages shall not relieve the contractor from his obligation to complete the work as per agreed construction program and milestones, or from any of the Contractor's other obligations and liabilities under the contract.

47.2 If the Intended Completion Date including milestones is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment,

at the rates specified in GCC Sub-Clause 41.1.

48. Bonus 48.1 Not used.

49. Advance Payment 49.1 The Employer shall make advance payment to the Contractor of the amounts **stated in the PCC** by the date **stated in the PCC,** against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts in Indian Rupees equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively (*each instalment not less than Rs. 500,000*) reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

49.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.

49.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Liquidated Damages.

Secured Advances 49.4 The Project Manager shall make advance payment in respect of materials intended for but not yet incorporated in the Works in accordance with conditions **stipulated in the PCC**.

50. Securities 50.1 The Performance Security and an Environmental, Social, Safety and Health (ESHS) Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in the amounts **specified in the PCC** (for GCC 50.1), and shall be issued by a Nationalized or Scheduled bank in India. The Performance Security including additional security for unbalanced bids, and the ESHS Performance Security, shall be valid until a date 28 days from the date of issue of the Certificate of Completion."

51. Dayworks 51.1 Not used.

52. Cost of Repairs 52.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the

Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

53. Completion

53.1 The Contractor shall request the Project Manager to issue a Certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the whole of the Works is completed.

54. Taking Over

54.1 The Employer shall take over the Site and the Works within seven days of the Project Manager's issuing a certificate of Completion.

55. Final Account

55.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract at the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate within 56 days of receiving the contractor's revised account.

56. Operating and Maintenance Manuals

56.1 If "as built" Drawings [including a compact disk containing digitized drawings] and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates **stated in the PCC.**

56.2 If the Contractor does not supply the Drawings [including a compact disk containing digitized drawings] and/or manuals by the dates **stated in the PCC** pursuant to GCC Sub-Clause 56.1**,** or they do not receive the Project Manager's approval, the Project Manager shall withhold the amount **stated in the PCC** from payments due to the Contractor.

57. Termination

57.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract after giving fourteen (14) days written notice.

57.2 Fundamental breaches of Contract shall include, but shall not be limited to, the following:

(a) the Contractor stops work for 28 days when no stoppage of

work is shown on the current Program and the stoppage has not been authorized by the Project Manager;

(b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 28 days;

(c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 84 days of the date of the Project Manager's certificate;

(e) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;

(f) the Contractor does not maintain a Security, which is required;

(g) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as **defined in the PCC**; or

(h) if the Contractor, in the judgment of the Employer, has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for or in executing the Contract, then the Client may, after giving fourteen (14) days written notice to the Contractor, terminate the Contract and expel him from the Site.

(i) The contractor has contravened Clauses 7 and 9 of GCC.

(j) The contractor does not adhere to the agreed construction program, agreed ESHS-MSIP [Clause 26 of GCC] and also fails to take satisfactory remedial action as per agreements reached in the management meetings [Clause 30 of GCC] for a period of 60 days.

(k) The contractor fails to carry out of the instructions of the Project Manager within a reasonable time determined by the Project Manager in accordance with GCC Clause 15.1 and 22.

(l) The contractor (in case of Joint Venture) has modified the composition of the joint venture and/or the responsibility of each member of the joint venture from what is stated in joint venture agreement without the prior approval of the

Employer.

57.3 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC Sub-Clause 57.2 above, the Project Manager shall decide whether the breach is fundamental or not.

57.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

57.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

58. Payment upon Termination

58.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received upto the date of the issue of the certificate less other recoveries due in terms of contract, less taxes to be deducted at source [TDS] as per applicable law, and less the percentage to apply to the value of the work not completed, as **indicated in the PCC.** Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

58.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received upto the date of the certificate less other recoveries due in terms of the contract and less taxes due to be deducted at source [TDS] as per applicable law.

59. Property

59.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default.

60. Release from Performance

60.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a

commitment was made.

61. Suspension of Bank Loan or Credit

61.1 In the event that the Bank suspends the Loan or Credit to the Employer, from which part of the payments to the Contractor are being made:

(a) The Employer is obligated to notify the Contractor of such suspension within 7 days of having received the Bank's suspension notice.

(b) If the Contractor has not received sums due it within the 28 days for payment provided for in Sub-Clause 40.1, the Contractor may immediately issue a 14-day termination notice.

APPENDIX A TO GENERAL CONDITIONS
Bank's Policy- Corrupt and Fraudulent Practices

(Text in this Appendix shall not be modified)

Guidelines for Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers, dated January 2011 Revised July 2014:

"**Fraud and Corruption:**

1.16 It is the Bank's policy to require that Borrowers (including beneficiaries of Bank loans), bidders, suppliers, contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts.[24] In pursuance of this policy, the Bank:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;[25];

(ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;[26]

(iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;[27]

(iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;[28]

(v) "obstructive practice" is

[24] In this context, any action to influence the procurement process or contract execution for undue advantage is improper.

[25] For the purpose of this sub-paragraph, "*another party*" refers to a public official acting in relation to the procurement process or contract execution. In this context, "*public official*" includes World Bank staff and employees of other organizations taking or reviewing procurement decisions.

[26] For the purpose of this sub-paragraph, "party" refers to a public official; the terms "benefit" and "obligation" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution.

[27] For the purpose of this sub-paragraph, "parties" refers to participants in the procurement process (including public officials) attempting either themselves, or through another person or entity not participating in the procurement or selection process, to simulate competition or to establish bid prices at artificial, non-competitive levels, or are privy to each other's bid prices or other conditions.

[28] For the purpose of this sub-paragraph, "party" refers to a participant in the procurement process or contract execution.

(aa) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 1.16(e) below.

(b) will reject a proposal for award if it determines that the bidder recommended for award, or any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

(c) will declare misprocurement and cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement or the implementation of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

(d) will sanction a firm or individual, at any time, in accordance with the prevailing Bank's sanctions procedures,[29] including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated[30];

(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers, to permit the Bank to inspect all accounts, records, and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by the Bank."

[29] A firm or individual may be declared ineligible to be awarded a Bank financed contract upon: (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross-debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of these Guidelines.

[30] A nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

APPENDIX B

Environmental, Social, Health and Safety (ESHS)

Metrics for Progress Reports

[Note to Employer: the following metrics may be amended to reflect the Employer's environmental, social, health and safety policies and/or the ESHS requirements of the project. The metrics that are required should be determined by the ESHS risks of the Works and not necessarily by the scale of the Works]

Metrics for regular reporting:

a. *environmental incidents or non-compliances with contract requirements, including contamination, pollution or damage to ground or water supplies;*

b. *health and safety incidents, accidents, injuries and all fatalities that require treatment;*

c. *interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);*

d. *status of all permits and agreements:*

   i. work permits: number required, number received, actions taken for those not received;

   ii. status of permits and consents:

   - *list areas/facilities with permits required (quarries, asphalt & batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, etc.);*
   - *list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent);*
   - *identify major activities undertaken in each area in the reporting period and highlights of environmental and social protection (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation);*
   - *for quarries: status of relocation and compensation (completed, or details of activities and current status in the reporting period).*

e. *health and safety supervision:*

   i. safety officer: number days worked, number of full inspections & partial inspections, reports to construction/project management;

   ii. number of workers, work hours, metric of PPE use (percentage of workers with full personal protection equipment (PPE), partial, etc.), worker violations observed (by type

of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any);

f. worker accommodations:

i. number of expats housed in accommodations, number of locals;

ii. date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, etc.;

iii. actions taken to recommend/require improved conditions, or to improve conditions.

g. HIV/AIDS: provider of health services, information and/or training, location of clinic, number of non-safety disease or illness treatments and diagnoses (no names to be provided);

h. gender (for expats and locals separately): number of female workers, percentage of workforce, gender issues raised and dealt with (cross-reference grievances or other sections as needed);

i. training:

i. number of new workers, number receiving induction training, dates of induction training;

ii. number and dates of toolbox talks, number of workers receiving Occupational Health and Safety (OHS), environmental and social training;

iii. number and dates of HIV/AIDS sensitization and/or training, no. workers receiving training (this reporting period and in the past); same questions for gender sensitization, flag person training.

iv. number and date of GBV /SEA sensitization and/or training, number of workers receiving training on code of conduct (in the reporting period and in the past), etc.

j. environmental and social supervision:

i. environmentalist: days worked, areas inspected and numbers of inspections of each (road section, work camp, accommodations, quarries, borrow areas, spoil areas, swamps, forest crossings, etc.), highlights of activities/findings (including violations of environmental and/or social best practices, actions taken), reports to environmental and/or social specialist/construction/site management;

ii. sociologist: days worked, number of partial and full site inspections (by area: road section, work camp, accommodations, quarries, borrow areas, spoil areas, clinic, HIV/AIDS center, community centers, etc.), highlights of activities (including violations of environmental and/or social requirements observed, actions taken), reports to environmental and/or social specialist/construction/site management; and

iii. community liaison person(s): days worked (hours community center open), number of people met, highlights of activities (issues raised, etc.), reports to environmental and/or social specialist /construction/site management.

k. *Grievances*: list new grievances (e.g. allegations of GBV / SEA) received in the reporting period and unresolved past grievances by date received, complainant, how received, to whom referred to for action, resolution and date (if completed), data resolution reported to complainant, any required follow-up (Cross-reference other sections as needed):

i. Worker grievances;

ii. Community grievances

l. Traffic and vehicles/equipment:

i. traffic accidents involving project vehicles & equipment: provide date, location, damage, cause, follow-up;

ii. accidents involving non-project vehicles or property (also reported under immediate metrics): provide date, location, damage, cause, follow-up;

iii. overall condition of vehicles/equipment (subjective judgment by environmentalist); non-routine repairs and maintenance needed to improve safety and/or environmental performance (to control smoke, etc.).

m. Environmental mitigations and issues (what has been done):

i. dust: number of working bowsers, number of waterings/day, number of complaints, warnings given by environmentalist, actions taken to resolve; highlights of quarry dust control (covers, sprays, operational status); % of rock/spoil lorries with covers, actions taken for uncovered vehicles;

ii. erosion control: controls implemented by location, status of water crossings, environmentalist inspections and results, actions taken to resolve issues, emergency repairs needed to control erosion/sedimentation;

iii. quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken in the reporting period at each, and highlights of environmental and social protection: land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation;

iv. blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, etc.), incidents of off-site damage or complaints (cross-reference other sections as needed);

v. spill cleanups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination;

vi. waste management: types and quantities generated and managed, including amount taken offsite (and by whom) or reused/recycled/disposed on-site;

vii. details of tree plantings and other mitigations required undertaken in the reporting period;

viii. details of water and swamp protection mitigations required undertaken in the reporting period.

n. compliance:

i. compliance status for conditions of all relevant consents/permits, for the Work, including quarries, etc.): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;

ii. compliance status of C-ESMP/ESIP requirements: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

iii. compliance status of GBV/SEA prevention and response action plan: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

iv. compliance status of Health and Safety Management Plan re: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance

v. other unresolved issues from previous reporting periods related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

Section IX. Particular Conditions of Contract

Except where otherwise indicated, all PCC *should be filled in by the* Employer *prior to issuance of the Bidding Documents. Schedules and reports to be provided by the* Employer *should be annexed.*

<table>
<tr><th colspan="2">A. General</th></tr>
<tr><td>GCC 1.1 (d)</td><td>The financing institution is: IDA</td></tr>
<tr><td>GCC 1.1 (r)</td><td>The Employer is: Chief Executive Officer J&K ERA/JTFRP
ERA Commercial Complex, Rambagh Srinagar.
2nd Floor JKPCC Building, Panama Chowk Jammu.</td></tr>
<tr><td>GCC 1.1 (v)</td><td>The Intended Completion Date for the whole of the Works shall be 18 months.</td></tr>
<tr><td>GCC 1.1 (y)</td><td>The Project Manager is Executive Engineer PMU JTFRP.</td></tr>
<tr><td>GCC 1.1 (aa)</td><td>The Site is situated in district Srinagar.</td></tr>
<tr><td>GCC 1.1 (dd)</td><td>The Start Date shall be one week after the date of issue of notice to proceed with works to the contractor.</td></tr>
<tr><td>GCC 1.1 (hh)</td><td>The Works consist of Construction of Drainage Network for Missing Link Zone - II

Identification number of Contract is PMU/JTFRP/MISSINGLINKS/02</td></tr>
<tr><td>GCC 1.1 (ii)</td><td>The following is added as GCC 1.1. (ii)

“ESHS” means environmental, social (including sexual exploitation and abuse (SEA) and gender based violence (GBV)), health and safety.</td></tr>
<tr><td>GCC 2.2</td><td>Not applicable</td></tr>
<tr><td>GCC 2.3 (i)</td><td>The following documents also form part of the Contract:
<table>
<tr><th>S. No.</th><th>Document</th><th>Description of the document</th></tr>
<tr><td>1.</td><td>Construction Methodology</td><td>Construction methodology given in bid amended as per comments of employer given in letter of acceptance.</td></tr>
<tr><td>2.</td><td>Quality control</td><td>Quality control procedures and assurance plans given in the bid and amended as per comments of Employer given in letter of acceptance.</td></tr>
</table>
</td></tr>
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<table>
<tr><td></td><td>
<table>
<tr><td>3</td><td>ESMP</td><td>Environment and Social Management Plans given in the Bid Document.</td></tr>
</table>
</td></tr>
<tr><td>GCC 3.1</td><td>The language of the contract is English.

The law that applies to the Contract is the laws of Union of India.</td></tr>
<tr><td>GCC 5.1</td><td>The Project Manager may delegate any of his duties and responsibilities.</td></tr>
<tr><td>GCC 7.1</td><td>The ceiling for sub-contractor is 30%</td></tr>
<tr><td>GCC 8.1</td><td>Schedule of other contractors: Not Applicable</td></tr>
<tr><td>GCC 9.1</td><td>Key Personnel and equipment: Given at Section III.</td></tr>
<tr><td>GCC 9.2</td><td>The following is inserted as GCC 9.2 (e):

“breaches the Code of Conduct (ESHS) (e.g. spreading communicable diseases, sexual harassment, gender based violence, (GBV), sexual exploitation or abuse, illicit activity or crime).”</td></tr>
<tr><td>GCC 13.1</td><td>The minimum insurance amounts and deductibles shall be:
<table>
<tr><td>S. No.</td><td>Description</td><td>Minimum cover for Insurance</td></tr>
<tr><td>(i)</td><td>Works and Plant and Materials which are incorporated in works</td><td>Cost of contract plus 10% excluding maintenance cost</td></tr>
<tr><td>(ii)</td><td>Loss or damage to Construction Equipment</td><td>10% of contract amount excluding maintenance cost</td></tr>
<tr><td>(iii)</td><td>Other Property</td><td>5% of contract amount excluding maintenance cost</td></tr>
<tr><td>(iv)</td><td>Personal injury or death insurance:

a) for other people;</td><td>Rs 10 lakh for each person</td></tr>
<tr><td></td><td>b) for Contractor’s</td><td>In accordance with the statutory</td></tr>
</table>
</td></tr>
</table>

	<table><tr><td></td><td>Employees</td><td>requirements applicable in India.</td></tr><tr><td colspan="3">Deductibles shall be as per actual premium of the insurance policies.</td></tr></table>
GCC 14.1	Site Data are: *Site Plans, Drawings etc.*
GCC 16.1 (add new 16.2)	**ESHS Management Strategies and Implementation Plans** The following is inserted as a new sub-clause 16.2: "**16.2** The Contractor shall not carry out any Works, including mobilization and/or pre-construction activities (e.g. limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits), unless the Project Manager is satisfied that appropriate measures are in place to address environmental, social, health and safety risks and impacts. At a minimum, the Contractor shall apply the Management Strategies and Implementation Plans and Code of Conduct, submitted as part of the Bid and agreed as part of the Contract. The Contractor shall submit, on a continuing basis, for the Project Manager's prior approval, such supplementary Management Strategies and Implementation Plans as are necessary to manage the ESHS risks and impacts of ongoing works. These Management Strategies and Implementation Plans collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP). The C-ESMP shall be approved prior to the commencement of construction activities (e.g. excavation, earth works, bridge and structure works, stream and road diversions, quarrying or extraction of materials, concrete batching and asphalt manufacture). The approved C-ESMP shall be reviewed, periodically (but not less than every six (6) months), and updated in a timely manner, as required, by the Contractor to ensure that it contains measures appropriate to the Works activities to be undertaken. The updated C-ESMP shall be subject to prior approval by the Project Manager."
GCC 20.1	The Site Possession Date(s) The Site Possession Date shall be immediately after finalization of contract agreement.
GCC 23.1 & GCC 23.2	Name of the agreed Adjudicator/Dispute Review Expert shall be agreed at the time of signing of contract
GCC 24.3	Daily rate and types of reimbursable expenses to be paid to the Adjudicator/Dispute Review Expert:INR5000/day
GCC 24.4	The procedure for arbitration will be as follows: As laid down in Arbitration and Conciliation Act 1996 ,with amendments

	from time to time and rules thereof.
B. Time Control	
GCC 26.1	The Contractor shall submit for approval a Program for the Works within 14 days of delivery of the Letter of Acceptance.
GCC 26.2	**ESHS Reporting** Inserted at the end of GCC 26.2 "In addition to the progress report the Contractor shall also provide a report on the Environmental, Social, Health and Safety (ESHS) metrics set out in Appendix B. In addition to Appendix B reports, the Contractor shall also provide immediate notification to the Project Manager of incidents in the following categories. Full details of such incidents shall be provided to the Project Manager within the timeframe agreed with the Project Manager. (a) confirmed or likely violation of any law or international agreement; (b) any fatality or serious (lost time) injury; (c) significant adverse effects or damage to private property (e.g. vehicle accident, damage from fly rock, working beyond the boundary) (d) major pollution of drinking water aquifer or damage or destruction of rare or endangered habitat (including protected areas) or species; or (e) any allegation of gender based violence (GBV), sexual exploitation or abuse, sexual harassment or sexual misbehavior, rape, sexual assault, child abuse, or defilement, or other violations involving children.
GCC 26.3	The period between Program updates is 60 days. The amount to be withheld for late submission of an updated Program is INR 500000
GCC 30	Venue of management meeting will be Srinagar/ Jammu
C. Quality Control	

GCC 34.3	The Defects Liability Period is: *365* days. The DLP shall commence from the date of successful completion of Operation and Maintenance period.
D. Cost Control	
GCC 38.2	In GCC 38.2, add the following after the first sentence: "The Contractor shall also provide information of any ESHS risks and impacts of the Variation."
GCC 40	Add new GCC 40.7: "40.7 if the Contractor was, or is, failing to perform any ESHS obligations or work under the Contract, the value of this work or obligation, as determined by the Project Manager, may be withheld until the work or obligation has been performed, and/or the cost of rectification or replacement, as determined by the Project Manager, may be withheld until rectification or replacement has been completed. Failure to perform includes, but is not limited to the following: (i) failure to comply with any ESHS obligations or work described in the Works' Requirements which may include: working outside site boundaries, excessive dust, failure to keep public roads in a safe usable condition, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion; (ii) failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ESHS issues, or anticipated risks or impacts; (iii) failure to implement the C-ESMP e.g. failure to provide required training or sensitization; (iv) failing to have appropriate consents/permits prior to undertaking Works or related activities; (v)failure to submit ESHS report/s (as described in Appendix C), or failure to submit such reports in a timely manner; (vi) failure to implement remediation as instructed by the Engineer within the specified timeframe (e.g. remediation addressing non-compliance/s).

GCC 41.1	The following changes are applicable The Employer shall pay the Contractor the amounts certified by the Project Manager within 56 days of the date of each certificate. Payment for the electrical and mechanical equipment, metallic pipes and other specials shall be made only when these are delivered to site as per the payment schedule given as under: (c) 70% of the price, when delivered to the site and properly stored (d) 15% after installation, (e) 10% after testing the system, (f) 5% on commissioning of system
GCC 45.1	Price Adjustment is not applicable.
GCC 46.1	The proportion of payments retained (Retention Money) shall be 6% from each bill subject to the maximum of 5% of final contract price.
GCC 47.1	The liquidated damages for the whole of the Works are *0.05 percent of the final contract cost per* day. The maximum amount of liquidated damages for the whole of the Works is *10%* of the final Contract Price.
GCC 49.1	The amount of the advance payment are: Nature of Advance | Amount (Rs.) | Conditions to be fulfilled 1. Mobilization | 10 % of the Contract price | 10% of accepted contract amount payable in two equal installments. 1st installment will be released immediately after signing of agreement & on submission of unconditional bank guarantee. 2nd installment will be released after establishing site office, site laboratory, submission of works programme, mobilization of

	construction equipments. Repayment of advance payment for mobilization: The advance shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the contractor has reached not less than 15 percent of the Contract Price or 04 months from the date of payment of first instalment of advance, whichever period concludes earlier, and shall be made at the rate of 10% of the amounts of all Interim Payment Certificates until such time as the advance has been repaid, always provided that the advance shall be completely repaid prior to the expiry of the original time for completion.
GCC 50.1	The Performance Security for 5 percent of contract price plus 50% of the amount of differential cost i.e. Difference between Engineer's estimated cost and quoted rate of bidder as additional security for unbalanced bids and frontloaded items in the BOQ [*in terms of ITB Clause 34.5*] An Environmental, Social, Safety and Health (ESHS) Performance Security '*shall'* be provided to the Employer. EQUAL TO 1% of accepted contract amount. The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee from a Scheduled or Nationalized bank in India of the type as presented in Section X of the Bidding Documents
E. Finishing the Contract	
GCC 56.1	* The date by which operating and maintenance manuals are required is within 28 days of issue of certificate of completion of whole or section of work, as the case may be ……[*insert date*] * The date by which "as-built" drawings (in scale…) including a compact hard disc containing digitized drawings in 2 sets are required is within 15 days of issue of certificate of completion of whole or section of the work, as the case may be ……..[*insert date*].
GCC 56.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals *by the date required in G.C.C. 56.1 is Rs. Rs.5,00000/=

GCC 57.2 (g)	The maximum number of days is: *200*
GCC 58.1	The percentage to apply to the value of the work not completed, representing the Employer's additional cost for completing the Works, is 20%.

Appendices

Appendix 1

Salient Features of Labour & Environment Protection Laws[31]

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK

(a) Employees Compensation Act 1923: The Act provides for compensation in case of injury, disease or death arising out of and during the course of employment.

(b) Payment of Gratuity Act 1972: gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(c) Employees P.F. and Miscellaneous Provision Act 1952 (*since amended*): The Act provides for monthly contribution by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:

(i) Pension or family pension on retirement or death, as the case may be.
(ii) Deposit linked insurance on the death in harness of the worker.
(iii) Payment of P.F. accumulation on retirement/death etc.

(d) Maternity Benefit Act 1961: The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(e) Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013: This Act defines sexual harassment in the workplace, provides for an enquiry procedure in case of complaints and mandates the setting up of an Internal Complaints Committee or a Local Complaints Committee

(f) Contract Labour (Regulation & Abolition) Act 1970: The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

(g) Minimum Wages Act 1948: The Employer is supposed to pay not less than the

[31] This list is only illustrative and not exhaustive. Bidders and Contractors are responsible for checking the correctness and completeness of the list. The law as current on the date of bid opening will apply.

Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employments.

(h) Payment of Wages Act 1936: It lays down the mode, manner and by what date the wages are to be paid, what deductions can be made from the wages of the workers.

(i) Equal Remuneration Act 1976: The Act provides for payment of equal wages for work of equal nature to male and female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.

(j) Payment of Bonus Act 1965: The Act is applicable to all establishments employing 20 or more employees. Some of the State Governments have reduced this requirement from 20 to 10. The Act provides for payments of annual bonus subject to a minimum of 8.33% of the wages drawn in the relevant year. It applies to skilled or unskilled manual, supervisory, managerial, administrative, technical or clerical work for hire or reward to employees who draw a salary of Rs. 10,000/- per month or less. To be eligible for bonus, the employee should have worked in the establishment for not less than 30 working days in the relevant year. The Act does not apply to certain establishments.

(k) Industrial Disputes Act 1947: the Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations, a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(l) Trade Unions Act 1926: The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(m) Child Labour (Prohibition & Regulation) Act 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in the Building and Construction Industry.

(n) Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979: The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.

(o) The Building and Other Construction Workers (Regulation of Employment and

Conditions of Service) Act 1996 and the Building and Other Construction Workers Welfare Cess Act, 1996 (BOCWW Cess Act): All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under these Acts. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be notified by the Government. The Employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as Canteens, First – Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

(p) Factories Act 1948: the Act lays down the procedure for approval of plans before setting up a factory engaged in manufacturing processes, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power.

(q) Weekly Holidays Act -1942

(r) Bonded Labour System (Abolition) Act, 1976: The Act provides for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of weaker sections of society. Bonded labour covers all forms of forced labour, including that arising out of a loan, debt or advance.

(s) Employer's Liability Act, 1938: This Act protects workmen who bring suits for damages against employers in case of injuries endured in the course of employment. Such injuries could be on account of negligence on the part of the employer or persons employed by them in maintenance of all machinery, equipment etc. in healthy and sound condition.

(t) Employees State Insurance Act 1948: The Act provides for certain benefits to insured employees and their families in case of sickness, maternity and disablement arising out of an employment injury. The Act applies to all employees in factories (as defined) or establishments which may be so notified by the appropriate Government. The Act provides for the setting up of an Employees' State Insurance Fund, which is to be administered by the Employees State Insurance Corporation. Contributions to the Fund are paid by the employer and the employee at rates as prescribed by the Central Government. The Act also provides for benefits to dependents of insured persons in case of death as a result of an employment injury.

(u) The Personal Injuries (Compensation Insurance) Act, 1963: This Act provides for the employer's liability and responsibility to pay compensation to employees where workmen sustain personal injuries in the course of employment.

(v) Industrial Employment (Standing Order) Act 1946: It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

SALIENT FEATURES OF SOME OF THE MAJOR LAWS THAT ARE APPLICABLE FOR PROTECTION OF ENVIRONMENT.

1. The Environment (Protection) Act, 1986 and as amended: This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.

2. The Forest Conservation Act, 1980, as amended, and Forest (Conservation) Rules, 1981 as amended: These provides for protection of forests by restricting conversion of forested areas into non- forested areas and prevention of deforestation, and stipulates the procedures for cutting any trees that might be required by the applicable rules. Permissions under the Act also stipulates the norms and compliance requirements of the employer and any contractor on behalf of the employer.

3. State Tree Preservation Acts as may be in force: These provide for protection of trees of important species. Contractors will be required to obtain prior permission for full or partial cutting, uprooting, or pruning of any such trees.

4. The Wildlife (Protection) Act, 1972, and as amended: This provides for protection of wildlife through notifying National Parks and Sanctuaries and buffer areas around these zones; and to protect individuals of nationally important species listed in the Annex of the Act.

5. The Biological Diversity Act, 2002: This provides for conservation of biological diversity, sustainable use of components of biological diversity, and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.

6. The Public Liability Insurance Act, 1991 as amended and The Public Liability Insurance Rules, 1991 as amended: These provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for mattes connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

7. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 and the Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010, the Ancient Monuments and Archaeological Sites and Remains Rules, 1959 amended 2011, the National Monuments Authority Rules, 2011 and the similar State Acts: These provide for conservation of cultural and historical remains found in India. Accordingly, area within the radii of 100m and 300m from the "protected property" are designated as "protected area"

and "controlled area" respectively. No development activity (including building, mining, excavating, blasting) is permitted in the "protected area" and development activities likely to damage the protected property is not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI) or the State Departments of Art and Culture or Archaeology as applicable.

8. The Environmental Impact Assessment Notification, 2006 and as amended: This provides for prior environmental clearance for new, modernization and expansion projects listed in Schedule 1 of the Notification. Contractors will be required to ensure that no work starts until applicable clearances under the Notification is not available. Contractors will be responsible for implementation of any environmental management plan stipulated as per the permission under this Notification; and will be required to prepare and submit to the employer and compliance report stipulated in the permission under the Notification.

9. The Water (Prevention and Control of Pollution) Act, 1974 as amended, and the Water (Prevention and Control of Pollution) Rules, 1975 as amended: These provide for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water(whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms. Contractors will need to obtain consent for establishment and consent for operation of any item of work or installation of equipment that generates waste water, and observe the required standards of establishment and operation of these items of work or installations; as well as install and operate all required waste water treatment facilities.

10. The Water (Prevention and Control of Pollution) Cess Act, 1977 and The Water (Prevention and Control of Pollution) Cess Rules, 1978: These provide for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution under the Water (Prevention and Control of Pollution) Act, 1974.

11. The Air (Prevention and Control of Pollution) Act, 1981 as amended, and the Air (Prevention and Control of Pollution) Rules, 1982: These provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. Contractors will need to obtain consent for establishment and consent for operation of any item of work or installation of equipment that generates air pollution such as batching plants, hot mix plants, power generators, backup power generation, material handling processes, and observe the required standards of establishment and operation of these items of work or installations.

12. Noise Pollution (Control and Regulation) Rules, 2000, and as amended: This provides for

standards for noise for day and night for various land uses and specifies special standards in and around sensitive receptors of noise such as schools and hospitals. Contractors will need to ensure compliance to the applicable standards, and install and operate all required noise control devices as may be required for all plants and work processes.

13. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996: This provides for Requirement of preparation of on-site and off-site Disaster Management Plans for accident-prone areas.

14. The Explosives Act 1884 and the Explosives Rules, 2008: These provide for safe manufacture, possession, sale, use, transportation and import of explosive materials such as diesel, Oil and lubricants etc.; and also for regulating the use of any explosives used in blasting and/or demolition. All applicable provisions will need compliance by the contractors.

15. The Petroleum Rules, 2002: This provides for safe use and storage of petroleum products, and will need to be complied by the contractors.

16. The Gas Cylinder Rules 2004 and amendments: This provides for regulations related to storage of gas, and possession of gas cylinder more than the exempted quantity. Contractors should comply with all the requirements of this Rule.

17. Manufacture, Storage and Import of Hazardous Chemical Rules of 1989 and as amended: These provide for use and storage of hazardous material such as highly inflammable liquids like HSD/LPG. Contractors will need to ensure compliance to the Rules; and in the event where the storage quantity exceeds the regulated threshold limit, the contractors will be responsible for regular safety audits and other reporting requirements as prescribed in the Rules.

18. Hazardous & Other Wastes (Management and Transboundary Movement) Rules, 2016: These provide for protection of general public from improper handling storage and disposal of hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal. Contractors will need to obtain permission from the State Pollution Control Boards and other designated authorities for storage and handling of any hazardous material; and will to ensure full compliance to these rules and any conditions imposed in the permit.

19. The Bio Medical Waste Management Rules, 2016: This provides for control, storage, transportation and disposal of bio-medical wastes. As and where the contractor has any first aid facility and dispensaries, established in either temporary or permanent manner, compliance to these Rules are mandatory.

20. Construction and Demolition Waste Management Rules, 2016: This provides for management of construction and demolition waste (such as building materials possible to be reused, rubble and debris or the like); and applies to all those waste resulting from construction, re-modelling, repair or demolition of any civil structure. Contractor will need to prepare a waste disposal plan and obtain required approval from local authorities, if waste

generation is more than 20 tons in any day or 300 tons in any month during the contract period; and ensure full compliance to these rules and any conditions imposed in the regulatory approval.

21. The E-Waste (Management) Rules, 2016: This provides for management of E-wastes (but not covering lead acid batteries and radio-active wastes) aiming to enable the recovery and/or reuse of useful material from e-waste, thereby reducing the hazardous wastes destined for disposal and to ensure the environmentally sound management of all types of waste of electrical and electronic equipment. This Rule applies to every manufacturer, producer, consumer, bulk consumer, collection centers, dealers, e-retailer, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts and spares which make the product operational.

22. Plastic waste Management Rules, 2016: This provides for control and management of the plastic waste generated from any activity. Contractors will ensure compliance to this Rule.

23. The Batteries (Management and Handling) Rules 2001: This provides for ensuring safe disposal and recycling of discarded lead acid batteries likely to be used in any equipment during construction and operation stage. Rules require proper control and record keeping on the sale or import of lead acid batteries and recollection of the used batteries by registered recyclers to ensure environmentally sound recycling of used batteries. Contractors will ensure compliance to this Rule.

24. The Ozone Depleting Substances (Regulation and Control) Rules, 2000 and as amended: This provides for regulation of production and consumption of ozone depleting substances in the country, and specifically prohibits export to or import from countries not specified in the Rules, and prohibits unless specifically permitted, any use of ozone depleting substance.

25. The Coastal Regulation Zone Notifications, 1991 and as amended: This provides for regulation of development activities within the 500m of high tide line in coastal zone and 100m of stretches of rivers and estuaries influenced by tides. Contractors will be required to ensure that no work starts until applicable clearances under the Notification is not available. Contractors will be responsible for implementation of any plan stipulated as per the permission under this Notification; and will be required to prepare and submit to the employer and compliance report stipulated in the permission under the Notification.

26. The Motor Vehicle Act 1988 as amended (and State Motor Vehicle Acts as may be in force) and the Motor Vehicle Rules, 1989, and as amended (and State Motor Vehicle Rules as may be in force): To minimize the road accidents, penalizing the guilty, provision of compensation to victim and family and check vehicular air and noise pollution. Contractors will be required to ensure full compliance to these rules.

27. Easement Act, 1882: This provides for the rights of landowners on groundwater. Contractors will need to ensure that other landowners' rights under the Act is not affected by any groundwater abstraction by the contractors.

28. State Groundwater Acts and Rules as may be in force and the Guidelines for Groundwater Abstraction for drinking and domestic purposes in Notified Areas and Industry/Infrastructure project proposals in Non-Notified areas, 2012: These provide for regulating extraction of ground water for construction/industrial and drinking and domestic purposes. Contractors will need to obtain permission from Central/State Groundwater Boards prior to groundwater abstraction through digging any bore well or through any other means; and will to ensure full compliance to these rules and any conditions imposed in the permit.

29. The Mines Act, 1952 as amended; the Minor Mineral and concession Rules as amended; and the State Mineral (Rights and Taxation) Acts as may be in force: These provide for for safe and sound mining activity. The contractors will procure aggregates and other building materials from quarries and borrow areas approved under such Acts. In the event the contractors open any new quarry and/or borrow areas, appropriate prior permission from the State Departments of Minerals and Geology will need to be obtained. Contractors will also need to ensure full compliance to these rules and any conditions imposed in the permit.

30. The Insecticides Act, 1968 and Insecticides Rules, 1971 and as amended: These provide for regulates the manufacture, sale, transport, distribution, export, import and use of pesticides to prevent risk to human beings or animals, and for matters connected therewith. No one should import or manufacture; sell, stock or exhibit foe sale; distribute, transport, use: (i) any misbranded insecticides, (ii) any insecticide the sale, distribution or use of which is for the time being prohibited under the Act; and (iii) any insecticide except in accordance with the condition on which it was registered under the Act.

31. National Building Codes of India, 2005 and as amended: This provides guidelines for regulating the building construction activities in India. The code mainly contains administrative regulations, development control rules and general building requirements; stipulations regarding materials, structural design and construction; and building and plumbing services. Contractors will be required to comply with all Bureau of Indian Standards Codes dealing with: (i) use and disposal of asbestos containing materials in construction; (ii) paints containing lead; (iii) permanent and temporary ventilations in workplace; (iv) safety, and hygiene at the workplace; (v) prevention of fire; (vi) prevention of accidents from faulty electrical gadgets, equipment and accessories; and all other such codes incidental to the Contract.

Appendix 2

Tables of Adjustment Data

(Cl. 45 of GCC)

Table 1: Coefficients governing the adjustment for changes in cost.

S. No.	Coefficients Name	Symbol	Schedules (Reference Number) [*Description of each schedule is given below*]								
			S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9
1.	Fixed	a	15	15	15	15	15	15	15	15	15
2.	Labour [L]	b									
3.	Steel [S]	c									
4.	Cement [C]	d									
5.	Plant & Equipment spares [E]	e									
6.	Diesel and Petroleum products [D]	f									
7.	Bitumen [B]	g									
8.	Others[O]	0									
	Total		**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**

[*Fixed element is normally 15%*]

BOQ SCHEDULES

[The following Schedules are for example only. The schedules may be modified and specified as appropriate for each work]

Schedule 1: Earth Work in Formation
Schedule 2: Civil Engineering Work (Bridge)
Schedule 3: Civil Engineering Work Building,
Schedule 4: Steel Fabrication Works
Schedule 5: Road Works –WBM
Schedule 6: Road BTM
Schedule 7:

Table 2: Cost Indices and Reference Prices (applicable for specific items) for adjustment in contract prices [as per GCC 45].
WPI with base 2004-2005 = 100 on the Base Date
Base Date = Deadline for submission of bids

S. No.	Cost Element	Symbol	Indices or Cost on the Base Date	Index for adjustment	Sources of Index
[1]	[2]	[3]	[4]	[5]	[6]
1.	Fixed	a			
2.	Labour	b	L_o- all India average Consumer Price Index (CPI) Number for Industrial Workers for ….. centre[32] (Base 2001 = 100) on the base date.	L_n-CPI for the month for which the IPC is related	Labour Bureau, Ministry of Labour and Employment, Government of India.
3.	Steel	c	S_o – Whole-sale Price Index (WPI) for Steel *[Steel Long]*	S_n-WPI for the month which is two months prior to the month to which IPC is related	Economic Advisor, Ministry of Commerce and Industry, Government of India.
4.	Cement	d	C_o-WPI for Grey Cement	C_n-WPI for the month which the cement is brought to site or one month prior to the month to which IPC is related, whichever is less	Economic Advisor, Ministry of Commerce and Industry, Government of India
5.	Plant & Equipment spares	e	E_o-WPI for "Construction machinery "	E_n – WPI for the month to which IPC is related	Economic Advisor, Ministry of Commerce and Industry, Government of India
6.	Diesel[33]	f	Do-Unit Cost from the identified depot on the base date	Dn-Unit Cost for on the first day of the month to which the IPC relates	From the ……. Depot
7.	Bitumen[34]	g	Bo-Unit Cost from the identified refinery on the base date	Bn- Cost per unit quantity on the first day of the month in which the material is brought to site or two months prior to the date to which IPC is related	From …. Refinery
8.	Others	h	Oo- All India Wholesale Price Index(WPI) for all commodities	On- All India WPI for all commodities for the month to which IPC is related	Economic Advisor, Ministry of Commerce and Industry, Government of India

IPC – Interim Payment Certificate

[32] The Centre to be specified should be the relevant one for which CPI is published by the Labour Bureau.
[33] The PCC specifies the identified depot for the rate of diesel for the base date and the applicable date for price adjustment.
[34] The PCC specifies the identified refinery for the rate of Bitumen for the base date and the applicable date price adjustment.

Appendix -3[35]

Appointment of Adjudicator

Suggested Draft of Letter of Appointment of Adjudicators in civil works contracts

Sub:_____(Name of the Contract)

To

Name and address of the Adjudicator

We hereby confirm your appointment as Adjudicator for the above contract to carry out the assignment specified in this Letter of Appointment.

For administrative purpose_____(*name of the officer representing the Employer*) has been assigned to administer the assignment and to provide the Adjudicator with all relevant information needed to carry out the assignment on behalf of both the Employer and the contractor. The services will be required during the period of contract for the work of (Name of the Contract)_____.

The Adjudicator shall visit the worksite once in 3 (three) months till the completion of the work indicated above or as specifically requested by Employer/ Contractor for the period upto the end of defects liability period with prior intimation to the Employer and the contractor. The duration of each visit shall ordinarily be for one day only. These durations are approximate and (*Name of the Employer and Name of the Contractor*) may find it necessary to postpone or cancel the assignment and/or shorten or extend the duration.

The appointment will become effective upon confirmation of letter by you. The appointment of Adjudicator shall be liable for termination under a 30 (thirty) days written notice from the date of issue of the notice, if both Employer and the Contractor so desire. Also the appointment shall automatically stand terminated 14 days after the defect notice / correction period as stated in Clauses 23 and 24 of the Conditions of Contract is over.

The Adjudicator will be paid a fee of Rs._____ (Rupees _____only) per each day of visit at the worksite. The actual expenses for boarding and traveling in connection with the assignment will be reimbursed to the Adjudicator. The Adjudicator will submit a pre-receipted bill in triplicate to the Employer indicating the date of the visit, fees for the visit and a proof in support of the actual expenditure [only for items valued above Rs. 200 each] incurred by him against boarding, lodging and traveling expenses after performing the visit on each occasion. The Employer will make the admissible payment (both the Employer's and the Contractor's share) to the Adjudicator within 30 days of the receipt of the bill. The Contractor's share on this account (half the paid amount) will be recovered by the Employer from the Contractor's bills against the work.

[35] If ITB 43 makes provision of an Adjudicator from list provided by an institution, kindly modify Appendix 3 to state that the fee and reimbursable payable to the adjudicator shall be as per the rules of the Institution.

In accepting this assignment, the Adjudicator should understand and agree that he is responsible for any liabilities and costs arising out of risks associated with travel to and from the place of emergency repatriation, loss or damage to personal/professional effects and property. The Adjudicator is advised to effect personal insurance cover in respect of such risks if he does not already have such cover in place. In this regard, the Adjudicator shall maintain appropriate medical, travel, accident and third-party liability insurance. The obligation under this paragraph will survive till termination of this appointment.

Procedures for resolution of disputes by the Adjudicator is described in the contract of _____(name of the contract) between the Employer and the contractor vide clause no.24 of the General Conditions of Contract. Your recommendation should be given in the format attached, within 28 days of receipt of a notification of dispute.

The Adjudicator will carry out the assignment in accordance with the highest standard of professional and ethical competence and integrity, having due regard to the nature and purpose of the assignment, and will conduct himself in a manner consistent herewith. After visiting the worksite, the Adjudicator will discuss the matter with the Employer and if necessary with the Contractor before arriving at any decision.

The Adjudicator will agree that all knowledge and information not within the public domain, which may be acquired while carrying out this service shall be all time and for all purpose, regarded as strictly confidential and held in confidence, and shall not be directly or indirectly disclosed to any party whatsoever, except with the permission of the Employer and the contractor. The Adjudicator's decision should be communicated in the form of a speaking order specifying the reasons.

The Adjudicator will agree that any manufacturing or construction firm with which he might be associated with, will not be eligible to participate in bidding for any goods or works resulting from or associated with the project of which this consulting assignment forms a part

Read and Agreed

Name of Adjudicator
Signature

Place:

Date:

Name of Employer
Signature of authorized representative of Employer

Name of the Contractor
Signature of authorized representative of Contractor

Attachment: Copy of contract document between the Employer and contractor and format for recommendation.

SUMMARY OF AJUDICATIOR'S RESPONSIBILITIES

The Adjudicator has the following principal responsibilities:

1. Visit the site periodically.

2. Keep abreast of job activities and developments.

3. Encourage the resolution of disputes by the parties.

4. When a dispute is referred to it, conduct a hearing (no legal presentation), complete its deliberations, and prepare a recommendations in a professional and timely manner(as per sample format)

Sample Format of Adjudicator's Recommendation

[Project Name]
Recommendation of Adjudicator

Dispute No. XX [*NAME OF DISPUTE*]

Hearing Date: _____

Dispute

Description of dispute. A one or two sentence summation of the dispute.

Contractor's Position

A short summation of the contractor's position as understood by the Adjudicator.

Employer's Position

A short summation of the Employer's position as understood by the Adjudicator.

Recommendation

The Adjudicator's specific recommendation for settlement of the dispute. (*The recommended course is consistent with the explanation*).

Explanation

(*This section could also be called Considerations, Rationale, Findings, Discussion, and so on.*)

The Adjudicator's description of how each recommendation was reached.

Respectfully submitted,

Date : _____ _____

Date : _____ _____

Date : _____ _____

ANNEXURE II

Missing Links Storm Water Drainage Scheme of Zone-2 in Srinagar City

1. ENVIRONMENTAL MANAGEMENT PLAN

1.1. Background

The Jammu & Kashmir region owing to its geographical and geo-climatic setting is a multi-hazard prone region, which experiences natural disasters like earthquakes, floods, etc. Floods and flash floods are frequent in the region. Floods generally occur in the summer when heavy rains are followed by snow melting. Flooding of the river Jhelum is the main cause of floods in the region. In September 2014, the northern region of India experienced torrential monsoon rains in the region causing major flooding and landslides. The continuous spell of rains from September 2nd to 6th, 2014, caused Jhelum and Chenab Rivers as well as many other streams/tributaries to flow above the danger mark. The Jhelum River breached its banks causing flooding in many low-lying areas in Anantnag, Srinagar and adjoining districts. Due to the unprecedented heavy rainfall, the catchment areas particularly the low laying areas were flooded for more than two weeks. Some areas in urban Srinagar stayed flooded for 28 days. The water level was as high as 27 feet in many parts of Srinagar city. The areas from the main tributaries of river Jhelum *vis-a-vis* Brengi nallah, Vishav nallah, Lider nallah and Sundran nallah started overflowing due to the heavy rainfall causing water levels in Jhelum River to rise. Subsequently, the discharge of the river Suran was 200 thousand cusecs against an average of 50 thousand cusecs. With the excessive discharge of water, the river Suran affected the basin areas and also took a different course at various locations causing damages to the surrounding villages in the catchment area. The water level also increased in rivers of Chenab and Tawi, both of which were flowing above normal levels. Due to severe flood in Srinagar city, public service infrastructure, equipment of hospitals and education centers were also severely damaged and are still not fully operational. The project “Jhelum & Tawi Flood Recovery Project (JTFRP)” focuses on restoring critical infrastructure using the international best practice of resilient infrastructure. Under the JTFRP, it is proposed to improve/re-construct the damages caused by 2014 September Floods in Srinagar city through efficient drainage system/ pumping station in areas lacking drainage system and by taking the machine floor level 1 m above HFL as recorded in 2014.

During pre-construction, construction and operation stages of Storm Water Drainage (SWD) Works of Zone 2 and Construction of Two Pumping Stations at Sempora and Palpora in Srinagar City under the JTFRP, several direct and indirect environmental impacts are anticipated. To mitigate anticipated environmental impacts during different stages of

construction of a stormwater drainage system in the Zone 2 areas, an implementable environmental management plan has been prepared.

1.2. Proposed Works of Storm Water Drainage

The proposed components of the stormwater drainage scheme (Missing Links) in Zone 2 of Srinagar City consist of the following main works:

- Laying of stormwater drainage network (pipes of different dia) as per drawing in the whole of left out areas of Zone 2 areas within the existing RoW following the central alignment of the road.
- Construction of two pumping stations (IPS at Sempora and Palpora) of required capacity with SCADA automation and with non-clog submersible pumps at Pumping Stations.
- Taking the Machine floor Level of Pumping Station (Sempora and Palpora), 1m above HFL as recorded in 2014.
- Restoration of existing roads, where RCC pipes would be laid down for the storm water drainage.

1.3. Outline of EMP and its Implementation Strategy

The EMP is a guiding tool that discusses the potential environmental impacts and specific mitigation and management measures for the proposed stormwater drainage scheme of Zone-2 in Srinagar City. It refers to the responsibilities person ensuring commitment for implementation and means of verifying and supervision whether the same has been implemented. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. As a part of the EMP, the contractors will commit to identification of the environmental and social impacts at the individual sub-project sites. In case of any future changes in the sub-project design, the EMP will need to be updated to reflect the new scope of the activities. Such revisions will be finalized in consultation with the World Bank.

The PIU will be responsible for the performance of all contractors with the overall accountability resting with the JTFRP-PMU. Whereas, the TAQAC will have go for periodic quality audit/ guidance to the PIU and by imparting regular training, monitoring and ensuring that all EMP commitments and policy requirements are translated into ‘contractors' requirements and that these requirements are implemented to their full intent and extent.

The overall responsibility will be of the Contractor for effective implementation and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities. The Contractor will be required to comply with the provisions of the EMP.

1.4. Environmental Management Plan

The Environmental Management Plan (EMP) will guide the environmentally-sound construction of the “Storm Water Drainage Scheme in Zone 2 areas in Srinagar City” and

ensure efficient lines of communication between the PIU, PMU, Contractor, and TAQAC. The EMP identifies the three stages of development as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization/ Operational Stage. EMP for Storm Water Drainage Scheme of Zone-2 in Srinagar City has been prepared. Various guidelines, checklists, strip mapping plan and reporting formats for implementation of EMP have been prepared and will form part of main Environmental Assessment (EA) as Annexures.

The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with.

Budgetary provisions for implementation of EMP shall be integrated the bid/construction contract in the form of technical specifications and environmental performance requirements. The costs to be incurred on implementation of EMP shall be incidental to the civil works and therefore, no separate environment budget/cost will be provided to the contractor for implementation of EMP. The contractor will ensure the effective implementation of EMP during pre-construction, construction, and demobilization/ operation stages. EMP for operation stage will be implemented by Srinagar Municipal Corporation (SMC).

The Contractor is deemed not to have complied with the EMP if within the boundaries of the project site/ ancillary sites, site extensions and haul/ access roads there is evidence of contravention of clauses. If environmental damage ensues due to negligence, the contractor fails to comply with corrective action measures or other instructions issued by the PIU/ JTFRP-PMU within a specified timeframe and the Contractor fails to respond adequately to complaints from the public.

1.5. Institutional Arrangements for Implementation of EMP

The subproject will be implemented by the Project Implementation Unit (PIU). Qualified and experienced Environmental Expert of PIU to supervise implementation of mitigation measures as defined in EMP for the Storm Water Drainage Scheme (Missing Links) of Zone-2 in Srinagar city.

The Environmental Specialist of PMU-JTFRP will overall monitor the implementation of EMP with the assistance of Environmental Expert of TAQAC.

Table-1: Environmental Management Plan for Storm Water Drainage Scheme (Missing Links) of Zone-2 in Srinagar City

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
I.	**Pre-Construction Stage**			
A.	**Pre-construction Activities By the Contractor**			
A-1	Regulatory Approvals	• Prior permission will be taken from line department offices of Electricity (PDD), Telecommunications (for OFC underground cables, etc), water Pipelines (PHE), etc. Utility shifting required to be undertaken by the contractor in the supervision of PIU. • Labour license from Department of Labour. • For setting–up of Batching Plant, Stone Crusher Plant, HMM Plant (required during restoration works), D.G Sets- Consent to Establish and Consent to Operate will be obtained from J&K State Pollution Control Board (J&KSPCB) or if contractor intends to procure construction materials from local authorized third party agencies then the contractor will collect and submit clearance/approval from authorized third party agencies.	Contractor	PIU PMU TAQAC
A.2	Appointment and Mobilization of Environment & Safety Officer	The contractor will appoint qualified and experienced Environment & Safety Officer (ESO), who will dedicatedly work and ensure implementation of EMP including Occupational, Health and Safety measures at storm water drainage scheme of Zone 2/pumping stations (IPS) at Sempora and Palpora in Srinagar city.	Contractor	PIU, TAQAC
A.3	Construction Camp Locations - Selection, Design & Layout	• If a contractor decides to establish a labour camp, the siting of the camp will be as per the guidelines given in Annexures and the layout of camp will be approved by PIU. • Labour camp will not be established within 250 m from the nearest settlement to avoid conflicts and stress with the local community.	Contractor	PIU, TAQAC

A.4	Arrangements for Temporary Land for Camp	The Contractor will obtain consent from land owners in writing for temporary use of labour camp, etc.	Contractor	PIU, TAQAC
A.5	Tree cutting	• Few indigenous trees like Willow/ Poplar mainly small trees/ saplings are required to be cut down/pruned or transplanted in areas of Zone 2. • Loss of trees will be compensated by 1:3 ratio (i.e. for loss of 1 tree 3 trees will planted or greater including transplantation of the same trees in the periphery of the PS (Bund Side) site in consultation with the Environmental Specialist of PMU.	Contractor	PIU, PMU TAQAC
A.6	Construction Vehicles, Equipment and Machinery	• All vehicles and equipment to be procured for construction of stormwater drainage works will conform to the relevant Bureau of Indian Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 2019 will be strictly adhered to. • The silent/quiet equipment like DG set as per regulations will be used at the construction site or labor camp. • The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to PIU for monitoring whenever required.	Contractor	PIU, TAQAC
A.7	Labour Requirement	The contractor preferably will use unskilled/semiskilled labor from the local area to give the maximum benefit to the local community. Community to avoid any additional stress on the existing facilities (medical services, power, water supply, etc). At an average >160 labours/ day will be required during construction stage depending upon extent of construction work	Contractor	PIU, TAQAC

A.8	Traffic Management Plan	• The construction of the Storm Water Drainage (SWD) Scheme (Missing Links) is located in Zone-2 of Srinagar City comprising mainly areas on right bank of River Jhelum. The excavation of trenches, laying of drainage pipes and the construction of manholes will lead to disruption of traffic movement in the area. • The Storm Water Drainage scheme (Missing links) having a total drainage network length of 18.318 km. These missing links are mainly internal colony roads. It is essential that before start of the construction works, the contractor will prepare site-specific traffic management plan in consultation with PIU to transport construction materials, excavation activities, laying of drainage pipes/ manhole construction, etc. Community heads of the locals should be taken into confidence in order to streamline pedestrian and vehicular movement within the affected areas. • Contractor to ensure construction works like excavation for laying of drainage pipes and manholes to be constructed on priority basis in winter period (December-March period when schools in Srinagar usually remains closed for the winter vacation) in order to avoid any such hindrances in normal functioning of the school. Contractor to incorporate the above measures in the traffic management plan. • The contractor will make an effort to transport materials to the site in non-peak hours or at night time. Contractor to follow timing schedule as per SMC protocol i.e., 8:00 pm to 8:00 am.	Contractor	PIU, TAQAC

A-9	Utility Shifting & Accessibility	• Construction of stormwater drainage scheme (missing links) of Zone-2 will involve excavation activities of trenches for laying of drainage pipes (RCC-NP3) and construction of main holes, which may impact existing utilities and cause disruption in services and inconvenience to the community. All the drainage works will be carried out following the center alignment of the existing road. • Existing underground utilities include PHE- water supply pipelines (main/ household/religious places, school connections), telecommunication lines like Optical Fiber Cables (OFC), PDD electric poles and transformers (distribution type) poles above ground may also get disrupted, etc. • Before commencement of works, a joint field inspection will be conducted by the Contractor, TAQAC, PIU along with the concerned line departments of PHE, PDD, Telecommunication/ private agencies to map out the alignments, to check if any utility is being impacted due to construction works such as water pipelines, underground telecommunication lines, PDD electric poles/ transformers etc. • Checking for accommodating utilities crossing the drains- raising, lowering or re-location if required • Get maps/ alignments of the underground infrastructure from the relevant institutions/ line departments • Contractor to mobilize experienced Utility Crew (Plumber, Electrician, etc) and Utility vehicle for repair/ restoration on immediate basis for any damage caused to utilities like PHE-Water Pipelines, telephone line, etc. in coordination with concerned line departments, during the execution of construction works. • Contractor in coordination with PIU to sensitize the workers (especially JCB operator/ supervisor) carrying out excavations so that they exercise caution to minimize the chances of underground utility damage. • Prior permission will be taken from regional offices of Electricity, Telecommunications, Waterworks, etc by PIU during excavation activity • Any Utility shall be relocated at the earliest, in case of damage and the services shall be restored within the shortest time. • Any common property resource, if removed due to the construction activity shall be restored/ relocated at the earliest with the consent of the immediate	Contractor	PIU, TAQAC

A-10	[36]Stockyard/ Storage of Construction Material and Establishing Equipment Lay-down Area	• Contractor in consultation with PIU shall identify the site for temporary use of land for construction sites /storage of construction materials including pipes etc. These sites shall not cause an inconvenience to the local population/traffic movement. These locations shall be approved by the PIU. • Selection of location for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent land uses, general on-site topography and water erosion potential of the soil. Impervious surfaces must be provided wherever necessary. • Protect material stockpiles from stormwater (e.g. by excavating a cut-off ditch around stockpiles to keep away stormwater). • Enclosed storage for fuel with non- permeable flooring. • The contractor shall cover material stockpiles with tarpaulin or other materials. Avoid stockpiling material near water bodies. • Proper cover and stacking of loose construction material will be ensured during the construction of outfall structures at the construction site to prevent surface runoff and [37]contamination of receiving water bodies. • Staff dealing with these materials/substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances like bitumen, diesel, used oil and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training. Necessary training and awareness programs shall be carried out to make aware the contractor and its staff aware of the hazardous nature of substances.	Contractor	PIU, TAQAC

[36] These storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully

[37] The most expected source of watercourse contamination is excavated soil or loose material being washed into water body during construction of drainage works

A-11	Information Dissemination and Communication Activities	• Prior to construction activity, information dissemination will be undertaken the contractor at the project site. The wider dissemination of information to the public will be undertaken by PMU through the disclosure of EIA / EMP reports on the website of PMU-JTFRP. • Project information Board showing the name of work, project cost, duration, date of commencement, date of completion, executing agency and contact details (including telephone numbers) shall be displayed both sides of the both roads in both English and in Vernacular. • Information boards will also be set up at the sites of construction camps, labour camps, plants and stockyard site. • Details of nodal officer with telephone numbers will be displayed for registering compliant/grievances by stakeholder/general public.	PMU Contractor	PMU PIU (ERA) TAQAC PIU (ERA)
A-12	Environmental Monitoring-Baseline Data	Ambient air quality, noise levels, and water quality monitoring on a six monthly basis as per the environmental monitoring plan and in accordance with the instruction of the Environmental Specialist of PMU.	PIU	PMU, TAQAC
B.	**Construction Stage**			
B.1	**Site Clearance & Levelling**			

B.1.1	Clearing, grubbing and levelling	• The proposed Pumping Station site at Sempora & Palpora is open land. • Minimum shrubs and ground flora will be removed from the designated sites. All works will be carried out in such a way that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval of PIU. • The Contractor, under any circumstances will not cut or damage trees. • Trees identified under the project will be cut only after receiving clearance from the Forest Dept (as applicable). Vegetation with girth size of over 30 cm will be considered as trees and shall be compensated.	Contractor	PIU, TAQAC
B.2	**Procurement of Construction Materials**			
B.2.1	Procurement for Aggregate and other construction materials	• The contractor will procure aggregate and other construction materials for concrete/reinforcement works for laying of drainage pipes, manholes, foundations and structures of pump house from authorized suppliers only. • The contractor will also work-out a road network to transport aggregate and other construction materials to the project site in synchronization with active works and report to PIU, which will be inspected before approval.	Contractor	PIU, TAQAC

B.2.2	Transporting Construction Materials	• The contractor will maintain all roads, which are used for transporting construction materials, equipment and machineries. • All vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by Tarpaulin to avoid spillage of materials and windblown dust from top of the vehicles. • Existing road used by vehicles of the contractor or any of his subcontractors or suppliers of materials will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Most of the material transportation shall take place from the Lasjan. As such most of the material sourcing like stone crusher plants, WMM, HMM, Batching plants, etc shall be procured from the Lasjan which is known for the construction material hub. • The contractor will make an effort to transport materials to the site in non-peak hours or in the night time.	Contractor	PIU TAQAC
B.3	**Construction Work**			

B.3.1	Labour Camp Site	• The project information board will be displayed at the labor campsite. • Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labor camp. • Red danger sign with bone & skull will be displayed as per The Electrical Rules at three stage motors, electrical panels and electrical machines, DG sets, etc. • Housekeeping at the labor camp will be maintained properly. Daily sweeping and cleaning will be done at the labor camp. • HIV Aids awareness posters will be displayed at the campsite. • Solid waste generated at the campsite will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealers. Biodegradable (food waste, paper, etc) solid waste will be disposed of in compost pit. Non-biodegradable inert wastes will be sent to the landfill site of Srinagar Municipal Corporation (SMC). • Proper drinking water well ventilated accommodation, sanitation, canteen facilities will be provided to workers at the labour camp. • Suitable signages will be displayed at labour camps.	Contractor	PIU (ERA), TAQAC

B.3.2	Safeguarding of Trees And Plantation	• During construction, the scheduled trees, if any along the periphery of the draiange will be covered/ wrapped with protective green mesh fiber cloth around the base tree trunk area by 6 feet in height. • No stockpiling of any construction will be allowed around or close to the tree particularly in case of scheduled tree. • Make-shift steel barricading will be provided around the trees (5 feet) in an active work zone where excavation takes place. • Any other trees within the area near the construction site will be marked with the same horizontal retro-reflective strip and green mesh as per the above measures.	Contractor	PIU, PMU, TAQAC

B.3.3	Pedestrian and Vehicular Traffic Movement Management	• Wherever the entry and exit to houses/ establishments are affected due to construction activities of excavation of existing roads for laying of drainage pipes, an alternate temporary arrangement for crossing over shall be provided. • Detailed traffic control plans will be prepared and submitted to the PIU for approval, one week prior to the commencement of works. • The traffic control plans shall contain details of temporary diversion, details of arrangements for construction (road stretches, timing, and stages). • Provide the construction itinerary in advance so that the potentially affected population can use alternative routes and start early to get to their destinations on time. • Erect warning and safety signs of ongoing works. • Access of residents should be facilitated by installing appropriate temporary bridges/ solid racks over the trenches. Entry should be bridge type as lateral access along with the longitudinal access to be provided along the trench. • Suitable fluorescent (reflective) warning signs should be placed near construction locations and should be visible at night. • Alternative access ways should be communicated to the community by way of announcement appropriately for the public information. • Install signage, barricading, fencing as required and include safety measures for transport of materials/equipment, which shall be limited to certain times, and arrangements for flagmen at intersection.	Contractor	PIU, TAQAC

B.3.4	Excavation for Laying of Drainage Pipes, Foundations for pumping stations (IPS) at Sempora and Palpora	• During excavation for laying of Reinforced Cement Concrete (RCC) drainage pipes and foundation work for pumping station (and its allied structures) at IPS site Sempora and at Palpora, necessary safety measures will be taken by the contractor as defined below; ○ At the excavation site, warning signboards will be displayed in vernacular language and English. ○ The entry of general public/unauthorized persons will be restricted. ○ Excavation of 1.5 meters deep or greater requires a side protection (Close Timbering and step cutting) unless the excavation is made entirely in stable rock. To ensure all the excavation activity in Zone-2 missing link network to be opened and executed only under the strict supervision of PIU. Contractor to follow strict protocol during excavation near sensitive receptors like schools, religious places (mosques), near graveyards, etc. ○ Safe access and egress will be required including ladders, steps, ramps, or other safe means of exit of workers in excavated depth of 4 feet (1.22 meters) or deeper. ○ Excavated earth will be collected and disposed of in a pre-identified site with the approval of PIU. ○ Casted drain block and drain cover will not be stacked on the road. ○ To ensure the elimination of excavation hazards, excavation will be carried in the presence of a competent person. ○ Suitable barricading will be provided around the excavation site. ○ Suitable personal protective equipment will be provided to the workers.	Contractor	PIU (ERA) TAQAC

B 3.5	Safe Disposal of Excavated Earth	• The excess excavated earth from drains will be collected and disposed of in a pre-identified site with the approval of PIU. • The excavated earth/ silt may be utilized by the locals for their use in filling purposes like lawn/ garden raising etc. For this purpose, the locals have to get written consent from the PIU. • All vehicles delivering material to the site shall be covered to avoid material spillage. • During excavation greater than 1.5 meters., protection (timber support) along the excavated drains are mandatory in order to avoid collapsing which may trigger the damage to the boundary walls (brick type). In case of damage, the contractor will inform the PIU immediately in order to ascertain the damages and reconstruction of the same	Contractor	PIU, TAQAC
B.3.6	Handling of Cement Bags	• Cement bags will be stored and emptied in a covered area to control fugitive dust emissions. • While handling and emptying of cement bags, workers will wear masks, hand gloves, and protective goggles. • The manual transferring of cement bags from one place to another place will not be allowed. For this purpose, the trolley will be used.	Contractor	PIU, TAQAC

B.3.7	Reinforcement with steel for foundations, pillars and roofs of structures for pumping station at Sempora and Palpora	• Manual cutting of steel bars for reinforcement will be discouraged. • Only skilled workers will be deployed by the contractor for steel bar bending and rebaring reinforced structures. • Correct hand and power tools will be used to tie and cut steel bars. • Workers engaged in steel bar bending and reinforcement will be provided helmet, suitably strong and flexible leather gloves, and safety shoes. • Workers will take extra caution and attention when walking on steel bar mattes and areas that contain exposed steel bars. • First aid facilities will be provided at the site to provide first aid in case of cuts or injuries to workers. After providing first aid, an injured worker will be taken to the hospital for further treatment.	Contractor	PIU, TAQAC
B.3.8	Machinery and Concreting Works for foundations, pillars and roofs of structures for pumping station at Sempora and Palpora	• Workers will be given induction training for machinery and concreting works. • Workers engaged in concrete pouring will wear alkali-resistant gloves, cover the body with long sleeves and full-length pants, waterproof gumboots and eye protection. • Safety barricading will be provided around the concrete pouring site. • Proper access will be provided to workers to engage in concrete pouring. • After concrete pouring, workers should be instructed to wash their skin with soap and eyes with fresh water.	Contractor	PIU, TAQAC

B.3.9	Safety Measures at Pumping Stations (Sempora and Palpora)	• Before starting the erection of pumps, the work area will be cleaned and will be kept free of any debris that might get in way of walking and handling of pumps, piping and electrical cable for erection. • Manual handling of heavy pumps will be discouraged. • For handling of heavy pumps, suitable lifting tools and tackles will be used. • Before use lifting tools and tackles to be used will be thoroughly checked. • Workers engaged in the erection of pumps will essentially use personal protective equipment (PPE), helmet, safety shoes, hand gloves, etc. • The right tools will be used for the right job during erection. No substitutions will be allowed for tools to avoid injury to workers. • Damaged fasteners or malfunctioned tools will not be allowed at the site. • During erection work, it will be ensured that loose electrical cables are not lying on the floor. • All metal cuttings, electrical wire pieces, etc will be collected daily and disposed of in an environmentally sound manner. • If welding will be used in the erection of pumps, proper eye and face protection shield will be used by welder for welding safety varies depending on the particular task being performed. • First Aid Box will be kept ready for all the time at the erection site. • During painting of piping with pumps the following safety measures will be ensured like common precautions including good ventilation and protection against fire will be ensured, painting on piping will be carried in such a way spillage on the ground is negligible, workers will be provided mask and hand gloves while carrying painting on piping, paint residue left in containers will be stored properly and disposed in environmentally sound manner.	Contractor	PIU, TAQAC

B.3.10	Sensitive Receptors- Impact Management	• The missing links of Zone-2 have number of identified sensitive receptors like schools, mosques, shrines and in general residential houses. Following measures to be implemented during the construction activity; o The construction operations in these areas should be limited to the time period from 7:30 am to 6:00 pm. o Contractor to ensure construction works like excavation for laying of drainage pipes and manhole to be constructed on priority basis in winter period (Dec-March period when schools in Srinagar usually remains closed for the winter vacation) in order to avoid any such hindrances in normal functioning of the school. During excavation works near mosques, safe access ramps/ bridges to be provided along with lateral access in order to avoid any hindrance. Contractor to incorporate the above measures in the traffic management plan. o Periodic maintenance and calibration of construction equipment/ vehicles to meet applicable CPCB emission standards. o Noise barriers shall be installed during the construction stage to protect the school from the noise from construction activities. o Adequate barricading and safety measures to protect dust pollution and noise impacts on sensitive receptors like schools and religious places etc. due to vehicle movement to be ensured prior to the start of work and their effectiveness to be checked during construction.	Contractor	PIU, TAQAC

B.3.11	Electrical Safety at Pumping Station (Sempora and Palpora)	• BIS mark control panel will be provided at the pumping station. • It will be ensured that there is no loose connection, exposed wires and open conduit at the pump stations. • Electrical cables will be laid in cable trays with cable identification tags. • Double earthing will be provided to all three-stage motors and electrical panels as per specification IS: 3043/5039. At three-stage motors and panels and DG sets, danger sign with Red Colour bone and skull sign will be conspicuously displayed. • BIS marked electric shockproof rubber mat will be to the electrical panels. • SOP for starting and stopping of pumps will be displayed.	Contractor	PIU, TAQAC
B.3.12	Occupational Health and Safety of Workers	• The contractor will follow the OHS plan in Annex VI, including provisions for emergency response and night time work • All workers will be provided with required personal protective equipment • Provision of all workers with requisite personal protective equipment will be made;	Contractor	PIU, TAQAC
		•		
B.4	**Pollution**			
B.4.1	**Water Pollution**			

B.4.1.1	Water Pollution from Construction Wastes	• The contractor will take all precautionary measures to prevent entering of wastewater into streams, water bodies or the irrigation system during construction. Contractor will avoid construction works close to the streams or water bodies during rainy season. • Contractor shall not wash his vehicles in river water and shall not enter riverbed for that purpose. • Any type construction wastes will not be disposed in rivers or water bodies. • No workers/ staff are permitted to use water from near water bodies for the purposes of bathing, washing of clothing or for any construction or related activities.	Contractor	PIU, TAQAC
B.4.1.2	Waste Water from Labour Camp	• Wastewater generated from the sanitary facilities at labour camp will be treated in a septic tank followed by soak pit. • No untreated raw sewage/ wastewater will be discharged into river and water bodies • Workers will not be allowed for open defecation. Proper toilets fitted with septic tank and soak pit will be provided for workers at camp and construction sites. • At the bridge construction site portable toilets shall be provided for workers and sewage from portable toilets shall be passed through septic tank followed by soak pit.	Contractor	PIU, TAQAC

B.4.2	**Air Pollution**			

B.4.2.1	Dust Pollution	• The contractor will take every precaution to reduce the level of dust from the Storm Water Drainage (SWD) construction site and construction of new pumping stations at Sempora and Palpora of Zone-2. • The contractor will procure the construction machineries, which conforms to the pollution control norms specified by the MoEF&CC/CPCB/J&KSPCB. • The excavated earth /construction materials will be stored properly so that it does not generate fugitive emissions. • Regular maintenance of vehicles to be used for material transportation and equipment will be carried and vehicular pollution checks should be made mandatory. • LPG will be used as a fuel source for cooking food in a labour camp instead of fuel wood. The kitchen area should be well ventilated equipped with the standard exhaust fan. At labor camp, persons/ cook dealing with the LPG gas stoves/ cylinders should be well sensitized for the operating procedures and the importance of maintaining ventilation. Sensitization to be provided by the ESO of the Contractor. • Mask and other PPE should be provided as a mandatory effort to the construction workers in dust prone areas. • While painting of piping, standard masks shall be used by workers. The following safety measures will be ensured like common precautions including good ventilation and protection against fire will be ensured, painting on piping will be carried in such a way spillage on the ground is negligible, workers will be provided mask and hand gloves while carrying painting on piping, paint residue left in containers will be stored properly and disposed in environmentally sound manner. • The location of the proposed dewatering station's outfall disposal pipe should be well away from the school and the pumping station should be designed in accordance with environmental standards and odor control shall be maintained.	Contractor	PIU, TAQAC

B.4.2.2	Emission from Construction Vehicles, Equipment and Machinery	• The contractor will ensure that all vehicles, equipment, and machinery used for construction works are regularly maintained and conform that pollution emission levels and comply with the requirements of CPCB and/Motor Vehicles Rules. The contractor will submit Pollution Under Control (PUC) certificates for all vehicles for the project. • DG set will be provided with the chimney of adequate height as per CPCB guidelines (Height of stack in meter = Height of the building + 0.2 √KVA). • The environmental monitoring is to be conducted as per the monitoring plan.	Contractor	PIU, TAQAC
B.4.3	**Noise Pollution**			

B.4.3.1	Noise Levels from Construction Vehicles and Equipment's	The contractor will confirm the following: • All construction equipment used in excavation, concreting, etc, will strictly conform to the MoEF&CC/CPCB/J&KSPCB noise standards. • All vehicles and equipment used in construction works will be fitted with exhaust silencers/mufflers. • Maintenance and servicing of all construction vehicles and machinery will be done regularly. • Only acoustic enclosures fitted DG sets will be allowed at the construction site and labor camp. • The erection of the new pump station will be such that noise generation is minimal. • At the construction sites within 150 m of the nearest habitation, noisy construction work and use of high noise generation equipment will be stopped during the night time between 10.00 pm to 6.00 am. • Working hours of the construction activities will be restricted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. • Noise monitoring shall be carried out in construction areas as per the monitoring plan	Contractor	PIU, TAQAC
B.5	**Personal Safety**			

B.5.1	Personal Safety Measures for Labours and Staff	The contractor will take necessary measures for the personal safety of workers: • Protective safety shoes, gumboots, hand gloves, protective goggles, etc (as required) will be provided to the workers employed in excavation, steel rebaring and bending, concrete works, erection of pump station, etc. • Welder's protective eye-shields will be provided to workers who are engaged in welding works. • Earplugs will be provided to the workers exposed to high noise levels. • Safety vests will be used by workers when on a construction site. • The contractor will comply with all the precautions as required for ensuring the safety of the workmen as far as those are applicable to this contract. • The Contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The contractor will make sure that during the construction work all relevant provisions of Building and other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996 are adhered to. • The Contractor will not employ any person below the age of 14 years for any work.	Contractor	PIU TAQAC

B.5.2	Emergency Management	• Emergency numbers will be displayed at the construction sites and campsite, • First boxes will be made available at the construction sites and campsite, • Fire extinguishers for petroleum oil fire and electrical fire will be made available, construction sites, and campsite. • Designated vehicles, which can be used as an ambulance, will be available at the construction site all the time.	Contractor	PIU, TAQAC
B.5.3	Risk Force Measure	• The contractor will make required arrangements so that in case of any mishap during, operation of machinery/ construction vehicles, dismantling, excavation, concrete pouring, and erection of pumps, all necessary steps can be taken for prompt first aid treatment. • Construction Safety Plan for storm water drainage system and construction of new pumping stations (IPSs) at Sempora and Palpora to be prepared by the contractor and will identify necessary actions in the event of an emergency.	Contractor	PIU, TAQAC
B.5.4	First Aid Facility	The contractor will arrange for : • A readily available first aid unit including an adequate supply of sterilized dressing materials, burn ointment and appliances as per the state Factories Rules will be maintained all the time by the contractor. • The availability of first aid trained persons will be ensured at the project site during the construction stage. • The availability of suitable transport will be ensured at all times to take the injured or sick person(s) to the hospital.	Contractor	PIU, TAQAC
B.5.5	Informatory Signs and Hoardings	The Contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environmental Specialist of PIU.	Contractor	PIU, TAQAC

B.6	**Labour Camp and Project Site Management**			
B.6.1	Accommodation for Labourers	• The contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. • The location, layout and basic facility provision of each labour camp will be submitted to the Environmental Expert of PIU prior to their construction. • The construction will commence only upon the written approval of the Environmental Expert of PIU. • The contractor will maintain necessary well ventilated living accommodation, toilets, bathrooms and ancillary facilities in a functional and hygienic manner. • Proper ventilation along with standard exhaust fans will be provided in labor accommodation rooms. • Regular cleaning and sweeping will be ensured at the labor campsite. • Systematic waste collection management at labor camp to be managed as per SWM Rules 2016.	Contractor	PIU, TAQAC
B.6.2	HIV/AIDS Prevention Measures	• Necessary HIV/AIDS prevention measures will be taken at labor camp • HIV/AIDS awareness program will be organized by the contractor's Environment & Safety Officer (ESO).	Contractor	PIU, TAQAC

B.6.3	Potable Water for Workers	• The contractor will construct and maintain labor accommodation in such a fashion that uncontaminated clean water is available for drinking, cooking, bathing, and washing. The contractor will also provide potable water facilities within the precincts of workplace/pump stations in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. • The contractor will also provide the following: a) Supply of sufficient quantity of potable water (as per IS) at construction site/labor camp (site at suitable and easily accessible places and regular maintenance of such facilities) b) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1 meter above the surrounding ground level. c) If water is drawn from any existing well/hand pump, which is within 30 meters of proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for the drinking. • Environmental Expert of PIU will be required to inspect the labor camp once in a week to ensure the compliance of the EMP.	Contractor	PIU, TAQAC

B.6.4	Sanitation and Sewage System at Labour Camp	The contractor will ensure that : • The sewage system for the camp will be designed, built and operated in such a fashion that no health hazard occurs and no pollution to the air, groundwater or adjacent watercourses take place, • Separate toilets/bathrooms, as required, will be provided for men and women, marked in vernacular language, • Toilets will be provided with a septic tank followed by a soak pit. • Adequate water supply will be provided in all toilets and urinals, • Night soil can be disposed of with the help of a municipality or disposed of by putting a layer of it at the bottom of a permanent pit prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for a fortnight.	Contractor	PIU, TAQAC
B.6.5	Waste Disposal	• The contractor will provide garbage bins in the camp & construction site and ensure that these are regularly emptied and disposed of in a hygienic manner according to Solid Waste Management Plan as per Solid Waste Management Rule 2016. • The burning of wastes at the construction site, labour camp and road side will not be allowed. • Solid waste generated at the construction site & labor camp, will be collected in covered waste bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored in empty cement bags and to be sent for recycling through scrap dealers. Biodegradable (food waste, paper, etc) solid waste will be disposed of in the compost pit.	Contractor	PIU TAQAC
B.7	**Environmental Monitoring**			

B.7.1	Environmental Monitoring- Construction Stage	• The PIU will carry out environmental monitoring for Ambient Air Quality, Noise levels, and Water Quality on a six monthly basis as per environmental monitoring plan and in accordance with the instruction of Environmental Specialist of PMU.	PIU	PMU TAQAC
B.7.2	Compensatory Plantation	• Trees affected will be compensated by 1:3 ratio (i.e. for loss of 1 tree 3 trees will be planted or greater including transplantation of the same trees/ saplings in the in the open spaces in consultation with the Environmental Specialist of PMU.	PIU	PMU, TAQAC
C.	**Contractor's Demobilization**			
C.1	Clean-up Operations, Restoration and Rehabilitation	• The contractor will prepare a project and labor campsite restoration plan, which will be approved by the PIU-Environmental Expert. The clean-up and site restoration operations are to be implemented by the contractor prior to demobilization from the construction site and labor camp. The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in an environmental sound manner. • All disposal pits or trenches will be filled in and effectively sealed off. • Construction places including camp and any other area used/affected due to the project operations will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU.	Contractor	PIU, TAQAC

C.2	Land Rehabilitation	• All surfaces hardened due to construction activities will be ripped & imported materials thereon removed. • All rubbles to be removed from the site to an approved disposal site. Burying of rubble on-site is prohibited. • Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the Engineer. • All embankments are to be trimmed, shaped and replanted to the satisfaction of the PIU. • Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the PIU regarding these requirements.	Contractor	PIU, TAQAC
D.	**Operation Stage**			
D1 Management and Maintenance of Storm Water Drainage				
D1.1	Public Awareness-Storm Water Management on Efficient lines	The SMC with support from JTFRP-PMU would need to carry out education and awareness campaigns on efficient stormwater drainage management through periodic visit to Zone-2 areas /Pumping station (IPS) at Sempora and Palpora by way of announcement, sharing of pamphlets, Radio/ FM programs, regarding their 'responsible' activities in relation to drainage management, and discourage solid waste dumping, disposing of wastewater in the drainage system.	SMC	PMU by rendering technical support

D1.2	Public Health	• SMC to ensure that no household wastewater connections are connected with the stormwater drainage man-holes/ network. SMC will ensure that the drains carry only the stormwater. • Drains are designed as closed/ covered in RCC type with cover on top which will curtail dumping of solid waste in drains. • The stormwater drains would need to be periodically de-silted in-order to maintain its carrying capacity. • SMC to go for periodic checking and source of waste generation and its identification, and additional bins in critical locations will be provided and frequent collection and disposal of waste will be ensured. This exercise will minimize the contamination from leaching solid/ liquid waste into the SWD system. • All structures comprising the construction camp/ ancillary sites are to be removed from the sites to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • PIU/ SMC to ensure that the stormwater drains are not clogged and correct operation and maintenance of drains and waste screen. • The drains will require regular inspection and maintenance with clearance of any accumulated silt or waste, and the waste screen will need regular removal of waste, the clearance interval will be shorter in the wet weather flow than in the dry weather flow. • Drains will be regularly inspected and cleaned especially prior to the rainy season. • SMC to ensure muck and silt that are removed from the drainage system will not be left alongside the drain and will be immediately disposed in the designated waste collection vehicles of SMC and subsequently ensure that it will be disposed at an approved municipal solid waste site in Srinagar	SMC	PMU

D2. Maintenance of Pumping Stations at Sempora and Palpora Zone 2				
D.2.1	Operation of Pumping Stations (IPS at Sempora and Palpora)	• Standard Operating Procedure (SOP) for pump operation will be displayed at pumping stations at Sempora and Palpora • Pump stations will be maintained clean and do's and don'ts for pumping station will be displayed. • Earthing and earth resistance of the earth pits will be checked every year. • Dry Chemical (ABC) type fire extinguisher for electrical fire will be kept in the pump station. • DG set will be fitted with an acoustic enclosure. • Stack height to DG set will be provided as per CBCB guidelines to vent out stack gases into the atmosphere. • Proper ventilation will be maintained in the pump station. • First Aid Box will be kept ready at the pump station. • Necessary personal protective equipment like electrical resistance hand gloves, safety shoes, helmet, mask, etc will be kept ready in the pump station. • Waste collection bin will be provided, which will be cleaned daily and collected wastes will be disposed of at designated places by Srinagar Municipal Corporation.	SMC	H&UDD
D.2.2	Maintenance of Pumping Station	• Predictive and preventive maintenance schedules will be prepared as per manufacturer recommendation. • Checklist will be prepared by SMC for maintenance for pumping station • During maintenance, necessary personal protective equipment will be used by workers.	SMC	H&UDD

D.2.3	Monitoring of sewage to be pumped	• SMC will ensure the monthly monitoring of wastewater to be pumped by pump stations. The monitoring parameters will be in line with discharge standards of CPCB *i.e.* Temperature, pH, Turbidity, Total Suspended Solid (TSS), T. Alkalinity, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil & Grease (O&G), Faecal Coli form, Total Nitrogen, and Total Phosphate. The records of environmental monitoring will be maintained.	SMC	H&UDD
D.2.4	Pumping strategy for wastewater into Receiving Water body	Wastewater at pumping stations has considerable variation in flow rates, concentration of pollutants and characteristics during various segments of a day. Usually, in the morning and evening hours flow rates and concentration of water pollutants remain high. The incessant pumping of wastewater into receiving water body has the possibility that the concentration of pollutants in wastewater at pumping might be exceeding discharge standards. Therefore, it is suggested that based on hourly wastewater monitoring, SMC should ensure equalization of wastewater of drain to bring down the concentration of water pollutants like BOD below the discharge standards before discharge into the spill channel. It is highly recommended that SMC to ensure that "No Household Connections" should be linked/ connected with the Storm Water Drainage system and the "Pure Concept of Storm Water Drainage System" will be maintained by the SMC". In this context, it is observed that the number of existing drainage systems in Srinagar and adjoining areas, are connected with the household wastewater connections resulting in the conversion of stormwater drainage into sewer drainage and disposed of directly into receiving water body causing odour nuisance and contamination of water bodies. This mixed wastewater comprises of high oxygen demanding (BOD) waste, surfactants, higher nutrients (nitrate-phosphates), suspended solids and prevailing anoxic condition result into sulfate precipitation which leads to the formation of *Hydrogen Sulphide* (which is an obnoxious H_2S gas/odor in drainage network, sumps & outfall discharge channel). This has a long-term impact in a given community along with sensitive receptors like schools, religious places, residents, etc due to the bad engineering practices and decision making. One of the common problems with the SWD system is suspended solids from surface runoffs during peak storm events and dry weather flow. Suspended solids are typically the pollutant of concern, primarily because solids tend to settle down. For this purpose, DWS should be designed in such a way to arrest suspended solids in order to check the flow of sediments into a receiving water body.	SMC	H&UDD

1.6. Clause for Non-conformity to Environmental Management Plan (EMP) - Protection of the Environment

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Health, Safety & Environment (HSE) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, **the amount withheld shall be forfeited.**

Section X - Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security, ESHS performance security if applicable, and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Letter of Acceptance

[letterhead paper of the Employer]

[The Letter of Acceptance shall be the basis for formation of the Contract as described in ITB Clause 40. This Standard Form of Letter of Acceptance shall be filled in and sent to the successful Bidder only after evaluation of bids has been completed, subject to any review by the World Bank required under the Loan Agreement.]

[insert date]

Identification No and Title of Contract: *[insert identification number and title of the Contract]*

To: *[insert name and address of the Contractor]*

This is to notify you that your Bid dated *[insert date]* for execution of the *[insert name of the Contract and identification number, as given in the PCC]* for the Contract Price ……. *[insert amount in numbers and words]* as corrected and modified[38] in accordance with the Instructions to Bidders is hereby accepted by our Agency.

[insert one of the following (a) or (b) options]

(a) We accept that *[insert name proposed by bidder]* be appointed as the Adjudicator.[39]

(b) We do not accept that *[insert name proposed by bidder]* be appointed as Adjudicator, and by sending a copy of this Letter of Acceptance to *[insert name of the Appointing Authority]*, we are hereby requesting *[insert name]*, the Appointing Authority, to appoint the Adjudicator in accordance with GCC 23.[40]

We note that as per your bid, you do not intend to subcontract any component of work.

[OR]

We note that as per your bid, you propose to employ M/s. …… as sub-contractor for executing ……..

[38] *Delete "corrected and" or "and modified" if not applicable. See Notes on Standard Form of Agreement, next page.*

[39] *To be used only if the Contractor disagrees in the Bid with the Adjudicator proposed by the Employer in the Instructions to Bidders, and has accordingly offered another candidate.*

[40] *To be used only if the Contractor disagrees in the Bid with the Adjudicator proposed by the Employer in the ITB, has accordingly offered another candidate, and the Employer does not accept the counterproposal.*

[*Delete whatever is inapplicable*]

You are hereby requested to furnish Performance Security, plus additional security for unbalanced bids in terms of ITB clause 35.5, and ESHS Performance Security ***[Delete ESHS Performance Security if it is not required under the contract]*** in the form detailed in ITB Clause 42 for amounts[41] of Rs. ____ and Rs. _____ within 21 days of the receipt of this letter of acceptance, and visit this office to sign the contract, failing which action as stated in ITB Clause 42.2 will be taken. The securities shall be valid upto 28 days from the date of completion i.e. upto ……. and shall be as per the Performance Security Form and the ESHS Performance Security Form ***[Delete reference to the ESHS Performance Security Form if it is not required under the contract]***, included in Section X - Contract Forms, of the bidding document.

We have reviewed the construction methodology submitted by you alongwith the bid in response to ITB Clause 16 and our comments are given in the attachment. You are requested to submit a revised Program including ESHS requirements as per Clause 26 of General Conditions of Contract within 14 days of receipt of this letter of acceptance.

Yours faithfully,

Authorized Signature……..

Name and Title of Signatory……

Name of Agency……..

[41] *Insert amounts for (i) Performance Security, plus additional security for unbalanced bids; and (ii) ESHS Performance Security respectively.*

Issue of Notice to proceed with the work

(letterhead of the Employer)

_____ (*date*)

To

_____ (*name and address of the Contractor)*

_____

_____

Dear Sirs:

Pursuant to your furnishing the requisite securities as stipulated in ITB clause 42.1, insurance policy as per GCC 13, construction methodology as stated in letter of acceptance and signing of the contract agreement for the construction of_____@ a Bid Price of Rs._____, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made the . . . . . day of . . . . . ., ..., between . . . . . ***[name of the*** Employer***]***. . . . . (hereinafter "the Employer"), of the one part, and . . . . . ***[name of the Contractor]***. . . . .(hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as . . . . . ***[name of the Contract]***. . . . .should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents**.**

(a) this Agreement

(b) the Letter of Acceptance

(c) the Contractor's Bid including completed schedules and priced bill of quantities,

(d) the Addenda No's . . . . . ***[insert addenda numbers if any]***. . . . .

(e) the Particular Conditions of contract

(f) the General Conditions of contract;

(g) the Specifications

(h) the Drawings*;* and

(i) Construction Program, Methodology, Quality Assurance Program, ESHS Management Strategies and Implementation Plans, and Code of Conduct (ESHS)

(j) Joint Venture Agreement [for JVs only]

(k) Any other document listed in PCC as forming part of the Contract

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract

Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of India on the day, month and year indicated above.

Signed by: .....
for and on behalf of the Employer

in the presence of: .....
Witness, Name, Signature, Address, Date

Signed by: .....
for and on behalf the Contractor

in the presence of: .....
Witness, Name, Signature, Address, Date

Performance Security - Bank Guarantee

[including Additional Performance Security for unbalanced bids]

[Guarantor letterhead or SWIFT identifier code]

Performance Guarantee No…….*[insert guarantee reference number]*
Date…….*[insert date of issue of the guarantee]*

To: _____ *[name of Employer]*
_____ *[address of Employer]*

WHEREAS _____ *[name and address of Contractor[42]]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ *[name of Contract and brief description of Works]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, upto a total of _____ *[amount of guarantee[43]]* _____ *[in words]*, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ *[amount of guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any

[42] *In the case of a JV, insert the name of the Joint Venture*
[43] *An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract less provisional sum if any, plus additional performance security for unbalanced bids if any, and denominated in Indian Rupees.*

liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until …… [44], and any demand for payment under it must be received by us at this office on or before that date.

Signature and seal of the guarantor _____

Name of Bank _____

Address _____

Date _____

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[44] *Insert the date twenty-eight days after the expected completion date as described in GC Clause 53.1. The Employer should note that in the event of an extension of this date for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.*

Environmental, Social, Health and Safety (ESHS) Performance Security - Bank Guarantee

[Guarantor letterhead or SWIFT identifier code]

ESHS Performance Guarantee No…….*[insert guarantee reference number]*
Date…….*[insert date of issue of the guarantee]*

To: _____ *[name of Employer]*
_____ *[address of Employer]*

WHEREAS _____ *[name and address of Contractor[45]]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ *[name of Contract and brief description of Works]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with Environmental, Social, Health and/or Safety (ESHS) obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, upto a total of _____ *[amount of guarantee[46]]* _____ *[in words]*, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ *[amount of guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

[45] *In the case of a JV, insert the name of the Joint Venture*
[46] *An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract less provisional sum if any, and denominated in Indian Rupees.*

This guarantee shall be valid until …… [47], and any demand for payment under it must be received by us at this office on or before that date.

Signature and seal of the guarantor _____

Name of Bank _____

Address _____

Date _____

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[47] *Insert the date twenty-eight days after the expected completion date as described in GC Clause 53.1. The Employer should note that in the event of an extension of this date for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.*

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Advance Payment Guarantee No…….*[insert guarantee reference number]*

Date…….*[insert date of issue of the guarantee]*

To: _____ *[name of Employer]*
_____ *[address of Employer]*
_____*[name of Contract]*

Gentlemen:

In accordance with the provisions of the Conditions of Contract, Sub-clause 49.1 ("Advance Payment") of the above-mentioned Contract, _____ *[name and address of Contractor[48]]* (hereinafter called "the Contractor") shall deposit with _____ *[name of Employer]* a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of _____ *[amount of guarantee[49]]* _____ *[in words]*.

We, the _____ *[bank or financial institution]*, as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ *[name of Employer]* on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding _____ [amount of guarantee] _____ *[in words]*.

We further agree that no change or addition to or other modification of the terms of the Contract or of Works to be performed thereunder or of any of the Contract documents which may be made between _____ *[name of Employer]* and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ *[name of Employer]*

[48] In the case of a JV, insert the name of the Joint Venture

[49] An amount shall be inserted by the bank representing the amount of the Advance Payment, and denominated in Indian Rupees.

receives full repayment of the same amount from the Contractor. Consequently any demand for payment under this guarantee must be received by us at this office on or before that date.

Yours truly,

Signature and seal: _____

Name of Bank: _____

Address: _____

Date: _____

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

Retention Money Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

_____ *[Bank's name and address of issuing branch or office]*

Beneficiary: _____ *[Name and Address of Employer]*

Date: **_____**

RETENTION MONEY GUARANTEE NO.: _____

We have been informed that _____ *[name of contractor[50]]* (hereinafter called "the Contractor") has entered into Contract No. _____ *[reference number of the contract]* dated _____ with you, for the execution of _____ *[name of contract and brief description of Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment, payment of _____ *[insert* the second half of the Retention Money*]* is to be made against a Retention Money guarantee.

At the request of the contractor, we _____*[name of Bank]* hereby irrevocably undertake to pay you the sum or sums not exceeding in total an amount of _____ *[amount in Rupees]* (_____) *[amount in words[51]]* upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract without cavil or argument.

It is a condition for any claim and payment under this guarantee to be made that the payment of the second half of the Retention Money referred to above must have been received by the Contractor on its account number _____ at _____ *[name and address of Bank]*.

This guarantee shall expire, at the latest, 21 days after the date when the Employer has received a copy of the Defects Liability Certificate issued by the Project Manager.

[50] *In the case of a JV, insert the name of the Joint Venture*

[51] *The Guarantor shall insert an amount representing the amount of the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security.*

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

_____
[Signature(s) and seal of the guarantor]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.