



**Chief Municipal Officer
Nagar Panchayat Bhakhara**

Improvement of Existing Water Supply Scheme

Engineering, Procurement, Construction, testing, commissioning of Bhakhara water supply scheme

**TENDER DOCUMENT
Form "F"
(Lump-sum Contract)**

E-Procurement Tender Notice
Portal: <http://eproc.cgstate.gov.in>

(PACRs 1137.98 Lakh)

COST OF TENDER DOCUMENT & BID PROCESSING FEE —Rs. 10,000.00

**OFFICE OF CHIEF MUNICIPAL OFFICER
NAGAR PANCHAYAT, BHAKHARA
DISTRICT-DHAMTARI
CHHATTISGARH**

**Web site: <https://uad.cg.gov.in>
E-mail: cmobhakhara.613@rediffmail.com**

INDEX

CONTENTS	PAGE No.
Notice Inviting Tender	3
Detailed Notice Inviting Tender	5
Pre qualification document (technical and financial)	11
Instructions for using the electronic tendering system and Instruction to bidders	14
Form “F” – Tender for Lump Sum Contract	30
Conditions of Contract	31
Annexure - “A”- Model Rules relating to labour, water supply and sanitation etc.	38
Annexure - “B”- Contractor’s Labour Regulations	39
Annexure “C” - Form of Income Tax Clearance Certificate	40
Annexure “D” - Statement showing the Lead of Materials	40
Annexure “E” Scope of work & technical specifications	41
Annexure “F” -Price Schedule	257
Annexure “G”-Guarantee Bond	299
Annexure “H” Special Conditions of NIT	301
Annexure “I” Information & instructions to the bidders for (e-gps).	312
Annexure – ‘J’ Pre contract Integrity Pact	313
Annexure – ‘K’ Centralised Procedures of The Government of Chhattisgarh For Suspension, Demotion, Non-Renewal & De-Registration of Contractors/Firms, 2014	319
Performance Security for Works & O&M Period of Contract	319
Appendix 1 to 17	321
Tender Drawings: to be attached separately	

**OFFICE OF CHIEF MUNICIPAL OFFICER
NAGAR PANCHAYAT/NAGAR PANCHAYAT, BHAKHARA
DISTRICT-DHAMTARI
CHHATTISGARH**

NOTICE INVITING TENDER

SYSTEM TENDER NO/193594/NIT NO: 1956/JPY/NP/2026-27 Bhakhara/Dated 16.06. 2026

Online tender are invited by the Chief Municipal Officer, Nagar Panchayat, Bhakhara for the following work in Form “F” for lump Sum contract from the contractors registered with Unified Registration System (Single Window) on GoCG PWD & e-Procurement System Portal (<https://cgprocurement.gov.in>) through sub portal <https://uadd.cgprocurement.gov.in> as per the 'key Dates' mentioned below . All other conditions for submission of tenders and criteria for prequalification etc. have been mentioned in the tender documents.

1	Name of Work	Improvement of Existing water supply Scheme including Engineering, Procurement, Construction, testing, commissioning of Bhakhara Water supply scheme including 3-month Trial run 9 months Operation and Maintenance of all Project Components/whole scheme
2	Probable amount of contract	Rs 1137.98/- Lakh
3	Earnest money (EMD)	Rs 5.00 Lakh (Rupees Five Lakh only) TDR/FDR in favour of Chief Municipal Officer, Nagar Panchayat/Nagar Panchayat Bhakhara Note: -The EMD should be valid for at least 6 months in auto-renewal mode. EMD will be returned to unsuccessful bidders after the award of contract to successful bidder. For the successful bidder, the EMD shall only be released upon submission of the modified EMD of the same amount before signing the Contract Agreement. The modified EMD, to be submitted by the contractor in the form of an FDR must remain valid for up to 5 years and shall be retained as a part of security deposit
4	Time allowed for completion (including rainy season)	24 months
5	Cost of Tender document fee	Rs 10000/- (Rupees Ten Thousand only) in the form of DD in favour of favour of Chief Municipal Officer Nagar Panchayat/ Nagar Panchayat Bhakhara
6	Validity of Offer	180 days from the day of opening of financial offer
7	Class of Contractor	Class A
8	Site Visit and Pre bid meeting	1. A Site visit will be organized by the CMO/Nodal Officer, Bhakhara , Chhattisgarh (as per tender Notice) 2. A Prebid meeting in context of this project shall be held in the office of CMO office Bhakhara , Chhattisgarh (as per tender

	Notice)
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For further clarifications, The Bidders may contact **M/s Mjunction Service Ltd.**, on helpdesk Toll free number **1800 419 9140** or through Email ID pro-chips@gov.in they may contact to **Mr. Shailesh Kumar Soni, Sr. Manager, Infotech and Biotech Promotion Society (CHIPS) on Tel. No. 0771-4014158**

The tender documents containing detailed terms & conditions are available for free download on GoC e-Procurement portal <http://cgeprocurement.gov.in> through sub portal of Urban Administration & Development Department <http://eproc.cgstate.gov.in>. Bidders have to quote online their prices along with Technical and Commercial bids in prescribed formats on the above mentioned portal only.

The Bidders intending to participate in this Tender are required to get enrolled on the above-mentioned website and get empanelled on the Sub-Portal of Urban Administration & Development Department. Enrolment on the above-mentioned Portal is mandatory. As the online Bids are required to be digitally signed, Bidders are required to obtain Class – II Digital Signature Certificates (DSCs).

The Bidders are also invited to get themselves trained on the operations of the e-Procurement System. Bidders may get in touch with the Service Provider of the e-Procurement System for confirming the time and date for their training session.

Key Dates- Refer tender Notice

**Chief Municipal Officer
Nagar Panchayat Bhakhara
District -Dhamtari(C.G)**

Copy forwarded to: -

1.
2.
3. Notice Board.

**OFFICE OF CHIEF MUNICIPAL OFFICER
NAGAR PANCHAYAT, BHAKHARA
DISTRICT-DHAMTARI
CHHATTISGARH**

DETAILED NOTICE INVITING TENDER

SYSTEM TENDER NO/193594/NIT NO: 1956/JPY/NP/2026-27 Bhakhara, Dated 16.06.2026

Online tender are invited by the Chief Municipal Officer, Nagar Panchayat, Bhakhara for the following work in Form “F” for lump Sum contract from the contractors registered with Unified Registration System (Single Window) on GoCG PWD & e-Procurement System Portal (<https://cggeprocurement.gov.in>) through sub portal <https://uadd.cggeprocurement.gov.in> as per the 'key Dates' mentioned below . All other conditions for submission of tenders and criteria for prequalification etc. have been mentioned in the tender documents.

S.no.	Name of work	Probable amount of contract (Rs. in Lacs)	Earnest money TDR/FDR in favour of Chief Municipal Officer, Nagar Panchayat Bhakhara	Time allowed for completion (including rainy season)	Cost of Tender Document	Validity of the Offer	Class of the Contractor
1	2	3	4	5	6	7	8
1.	“Improvement of Existing water supply Scheme including Engineering, procurement, construction, testing, commissioning, 3 months trial run of Improvement of Existing Water Supply Scheme at ULB Bhakhara on Lump-Sum basis i. Sump well cum Pump House: - 200 KL with Approach Road, etc with all allied works, accessories and	Rs 1137.98 Lakhs	Rs 5.00 Lakh	24 months (including rainy season)	Rs 10000/- (Rupees Ten Thousand only) in the form of DD in favour of Chief Municipal Officer Nagar Panchayat Bhakhara	180 days	A Class

	equipments						
	<p>ii. (a) Raw Water Pumping machinery with all allied works, accessories and equipments: -</p> <p>VT Pumps, 3 Nos (2W+1S)(10 HP each) Discharge of each pump -55960 LPH (15.55 LPS) Head of each pump-15 m</p> <p>(b) Substation (Intake)- 100 KVA with (1W+1S) transformers and all other allied works</p>						
	<p>iii. Raw Water Pumping Main- DI (class K-9) pipe of 250 mm Dia total length 11674 m with all allied works, accessories and equipments.</p>						
	<p>iv. Rehabilitation of Water treatment Plant, (Conventional Type): -2.0 MLD with all allied works, accessories and equipments</p> <p>(a) Clear Water Pumping Machinery with all allied works, accessories and equipments— Centrifugal Pump - 3 Nos (2W+1S) (20 HP each)</p>						
	<p>v. Discharge of each pump-80454.5 LPH (22.35 LPS) Head of each</p>						

	<p>pump-40 m</p> <p>vi. Clear Water Pumping Mains: - DI (class K-9) pipe of total length 5899m (Dia 250mm-150mm)with all allied works, accessories and equipment</p> <p>vii. 01nos RCC OHSRs with all allied works, accessories and equipmentsof followings capacities and staging height: - a) 160 KL- 20 m</p> <p>viii. Distribution Network with all allied works, accessories and equipments DI (class K-7) pipe of total length 3540 m (Dia 150mm-100mm)</p> <p>ix. Functional House Service connections with all allied works, accessories and equipment-115Job</p> <p>x. Panel room at OHTs- with all allied works, accessories and equipment- 07 nos.</p> <p>xi. Dismantalling of Unserviceable OHT 200 KL-12m</p> <p>xii. PLC- SCADA of whole scheme</p> <p>Note: The quoted lump sum</p>						
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<p>offer by contractor shall be deemed to be included of all the cost required for successful Design, Supply, installation, testing and commissioning of whole scheme including electro-mechanical, Electrical, instrumentations equipments along with any other required accessories. The department will not entertain any extra financial claim on account of extra items; it is solely the responsibility of bidder to ascertain extra items required for successful commissioning of whole scheme and should include the rates in its quoted offer.</p>					
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Note:

1. Registration and subsequent empanelment for e-tendering website (<https://eproc.cgstate.gov.in>) through Sub Portal <https://eproc.cgstate.gov.in> and department's sub-portal is mandatory.
2. The Bidders intending to participate in this Tender are required to get enrolled on the above-mentioned website. Enrolment on the above-mentioned Portal is mandatory. As the online Bids are required to be signed digitally, bidders are required to obtain class II Digital Signature Certificates (DSCs).

The Bidders may contact **M/s Mjunction Service Ltd.**, on helpdesk Toll free number **1800 419 9140** or through Email ID pro-chips@gov.in they may contact to **Mr. Shailesh Kumar Soni, Sr. Manager, Infotech and Biotech Promotion Society (CHIPS) on Tel. No. 0771-4014158.**

3. The Bidders have to digitally sign their bids before submitting the bids hashes online. Thus, the Bidders are advised to obtain Digital Certificates. The registered contractors may obtain information required for issuance of a Class II Digital Signature Certificate from the Controller of Certifying Authorities (www.cca.gov.in) or the Service Provider of eProcurement System for Government of Chhattisgarh.
4. Validity of offer - 180 days from date of opening of financial offer.
5. The Technical offer shall be opened in presence of the Bidders or their authorized representatives, who may choose to be present. The date of opening of financial offer will be intimated to the Bidders subsequently after opening of technical offer.

6. The department reserves the right to change the key dates of the tender process.
7. Sufficient hindrance free space is available for construction.
8. Bidders are advised to visit the site sufficiently in advance of the date fixed for the submission of the tender at his own cost. The Tenderer shall be deemed to have full knowledge of all relevant documents and site conditions, assessment of work etc. whether he inspects it or not.
9. A Prebid meeting in context of this project shall be held as stated in NIT/Tender Notice. The contractors shall give their suggestions and conditions in writing based on which Corrigendum/Amendments/clarifications shall be framed and uploaded which will supercede the original NIT Conditions unless otherwise specified.
10. Cess @ 1 % (one percent) or latest shall be deducted at source from every bill of contractor under "Building and other Construction for workers welfare, cess Act-1996.
11. Bidders/tenderers should have to submit "Envelope A' and "B" Physically (in sealed Envelope) as well as to be uploaded ONLINE also. "Envelope C' shall be uploaded ONLINE only.

Physical Submission of Envelope A and Envelope B (in sealed Envelope) to be submitted by Registered Post/ Speed Post only. Submission through Courier Services and other means shall not be entertained.

Above documents must be submitted on or before the dates and time as indicated NIT/Tender Notice.

a) **Envelope "A"** All the following documents submission are mandatory for opening of Technical Bid.

- (i) The Earnest money as mentioned in NIT original with physical Envelope and scan copy (online). The Earnest money will be returned to the unsuccessful Bidders after the award of contract. The Earnest Money of the Successful Bidder will be retained as part of the Security Deposit.
- (ii) The tender fee as mentioned in NIT in original with physical Envelope and scan copy (online). It is non refundable.
- (iii) Attested copy of Valid Registration Certificates. CG PWD Registration in appropriate Class In Unified Registration System (Single Window) on GoCG e-Procurement System Portal of (<https://cgeprocurement.gov.in>) through sub portal <https://uadd.cgeprocurement.gov.in> and (Partnership Deed, registration amendment certificate as the case may be)
- (iv) Declaration for Not Being Blacklisted (Appendix-13)-Affidavit's in Original. (Non-Judicial stamp in 100 Rs.)
- (v) Declaration as per (Appendix-14) -Affidavit's in Original. (Non-Judicial stamp in 100 Rs.)
- (vi) Appendix 9,10, and 11, - Affidavit's in Original (Non-Judicial Stamp)
- (vii) Attested copy of PAN card issued by I.T. Department.
- (viii) Attested copy of Valid GST/ CGST Registration must be valid up to Bid due date

b) **Envelope- 'B'** (Technical Bid –Submit physically & online) -Also the Envelope B containing the following documents shall be submitted physically and online also. In all cases the submission which is online shall prevail

- (i) Power of Attorney/Letter of authorization to sign the bid(In case of JV)
- (ii) Partnership deed /MOA of company
- (iii) Technical & Financial prequalification documents

- (iv) ITR of last five years (up to 31-03-26)
- (v) Financial Construction work turns over during last five years i.e 2021-22 to 2025-26
- (vi) As per Pre-Qualification Criteria mentioned in PQ document. (Appendix-1 to 17)

c) **Envelop- "C"** - Total Lump sum offer (Cost of works) (including GST, other taxes etc) shall be submitted online only. In addition, breakup of the Lump Sum offer as per the **"Form F"** is required to be submitted/uploaded online only in "ENVELOPE "C" on Bidder's letter head with seal and signature. Physical submission of Envelope C shall not be considered.

Note:

- i. The tenderer who was blacklisted will not be allowed to bid for this tender. The tenderer shall submit an Affidavit in this regard. (In case of JV each members have to furnish the above details separately)
- ii. Contractor has to submit Certificate of Turnover of last 5 years clearly highlighting year wise Construction Turnover, duly signed by a Practicing Chartered Accountant alongwith seal and UDIN of CA issuing the certificate. (For Calculation of Component A in case of Bidding Capacity). In the absence of above requirements, bids shall be rejected.
- iii. In the event of withdrawing his/her offer before the expiry of the period of validity of offer or failing to execute the agreement as required by conditions of the notice inviting tender (N.I.T.) he/she will not be entitled to tender for this work in case of recall of tenders. In addition to forfeiture of his/her earnest money as per provisions of tender condition as may be applicable for the work, the CMONagar Panchayat will restrict the contractor/firm for a period of one year in participation of all tenders. If the tenderer has committed a similar default after restriction period on earlier occasion(s) as well, then CMOWillrecommend for demotion in registration to the committee of 'Unified Registration System' (e-Registration) with chhattisgarh P.W.D. State Governments will be permanently. This special condition will supersede any thing contrary to it in the tender document.
- iv. Bidders are advised to go through the Notice Inviting tenders & the complete tender document /P.Q/Bid Capacity document thoroughly and all Certificates, annexures, enclosures as mentioned in the document will have to be submitted by the bidders strictly in the prescribed format, at the time of submission of Technical bid, failing which the contractor shall disqualify for the work & his financial offer shall not be opened and no representation, appeal or objection, what so ever in this regard shall be entertained by the department

12. Joint Venture – Joint venture is allowed considering following: -

- i. Definition: "Joint Venture (JV)" means an association with or without a legal personality distinct from that of its members, of more than one entity where one member has the authority to conduct all businesses for and on behalf of any and all the members of the JV/consortium, and where the members of the JV/consortium are jointly and severally liable to the Client for the performance of the Contract.

- II. **Pre-qualification of JV:** JV members are “jointly and severally responsible and liable” in a contract. For pre-qualification, the JV should fulfil the criteria specified in the pre-qualification document. The attributes to be evaluated will be the same as for individual contractors; however, certain parameters up to the specified limits have to be essentially met by them collectively, some by the lead partner, and some by the other partner, as briefly described below:

Qualifying factors to be met collectively: (i) annual turnover from construction; (ii) particular construction experience and key production rates; (iii) construction cash flow for the subject contract; (iv) personnel capabilities; and (v) equipment capabilities;

For the purpose of this clause lead partner must meet 100% requirement of financial eligibility criteria required for the bid.

Both the members should submit the required documents like, GST Certificate, Pan Card etc. required to be submitted by the bidder as per the NIT.

Note: Cumulatively the members shall fulfil 100% of the limits and criterions.

III. **Condition for JV:**

- a) The Bidder for participation in the Selection Process, may be a single entity or a group of entities (the “Joint Venture”/ “Consortium”), coming together to execute the project. The term 'Bidder' used herein would apply to both a single Entity and a Consortium.
- b) No Member at any given point of time, may assign or delegate its rights, duties or obligations under the Agreement/Contract except with prior written consent of Client.
- c) No bidder applying individually, or as a member of a Consortium, as the case may be, can be member of other consortia bidding for the project.
- d) Number of members in a JV/consortium shall not exceed 2 (Two) including the Lead Member
- e) The Members of the JV/Consortium shall nominate one member as the Lead Member
- f) The Members of the JV/Consortium shall be responsible for successful implementation of the project throughout the terms of the contract.
- g) The Lead Member shall be authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the Members respectively from time to time in the response to this RFP.
- h) The Lead Member shall be authorized to receive work order and receive the payment on behalf of the JV/consortium and all the deliverables submitted by the JV/consortium is deemed to have been reviewed and approved by the Lead

Member. Experience certificate shall be issued in the name of Lead member first followed by the name of JV/Consortium member.

- i) The Members of the Consortium shall submit a declaration consisting of the following:
- Undertake that each of the members of the Consortium shall have an independent, definite and separate scope of work which was allocated as per each member's field of expertise
 - Commit to the scope of work, rights, obligations and liabilities to be held by each member; specifically commit that the Lead Member shall be answerable on behalf of other members for the performance of obligations under this Agreement,
 - Provide a brief description of the roles and responsibilities of individual members; and clearly define the proposed administrative arrangements (organization chart) for the management and execution.
 - All bidders shall be jointly & severally responsible for complete scope, any change of a JV/Consortium Member other than the Lead Member can be done only under extreme circumstances such as non-performance of the JV/Consortium member, insolvency or bankruptcy of the JV/Consortium member, which shall be done only with the prior written approval of Client. Provided that in the event of any such approved change of JV/Consortium member, the new member (company) replacing outgoing JV/Consortium member shall have same or higher financial, technical and legal qualifications as the outgoing member, and to the satisfaction of Client. In the event Client does not grant approval for the change of the JV/Consortium member other than the Lead Member or suitably qualified replacement member (companies) are not available/ found, the exit of such JV/Consortium member shall constitute a breach of the Contract.
- j) All members of the JV/consortium are required to follow the highest level of work ethics, if any member of the JV/consortium has a Conflict of Interest or indulges in Prohibited Practices; the whole JV/Consortium is liable to be disqualified. Further, in the event any entity has been barred by the Central Government, any State Government, a statutory authority or a public sector undertaking, as the case maybe, from participating in any project or bid, and the bar subsists as on the date of Last Date of Submission, it would not be eligible to submit a Proposal either by itself or as part of a JV/Consortium. The copy of the JV agreement in accordance with the requirements mentioned in Appendix-17

Lead partner shall be nominated as being partner-in-charge and this authorization shall be evidenced by submitting a Power of Attorney signed by second partner. JV/Consortium shall be allowed in this tender up to two partners submitted to fulfilling criteria –

- a. The term Bidder used hereinafter would therefore apply to both as single entity and as JV. JV of companies/organizations/bidders (maximum of two members) registered in India. Both the partners all together should meet minimum qualification criteria experience of **similar nature of work**. For meeting the minimum qualification criteria of experience of similar nature work, every partner must have experience of works as defined in similar nature of works and together shall have the experience of all type of works described in similar nature of works [Appendix-16].
- b. A JV of maximum two (02) members is allowed in this bid including one as lead bidder.
- c. One of the partners of the JV shall act as Lead partner. Both the partners of the JV must have experience of the similar nature of the work and together shall have the experience of all type of the works described in similar nature works.
- d. Member of any JV Firm shall not be permitted to participate either in individual capacity or as a partner of any other Joint Ventures in the same tender. **Submission or participation in more than one bid will cause disqualification of all the bids submitted by the bidder.**
- e. All formalities in respect of submission of tender shall be done only in the name of 'Lead Partner' and not in the name of JV. However, name & other details of both the partners of JV should be clearly mentioned in the bid.
- f. The lead partner of JV shall be solely responsible for any liability, penalty, insurance, O&M and other terms and conditions mentioned in this Tender Document. **In event of default by any partner in the execution of this part of contract, both the partners shall be Debarred/Black listed upto one years for future business with CG UADD, execution of work of CGUADD and registration list of unified registration system of CGPWD.**
- g. Notwithstanding the permission to assigning the responsibilities of defaulting partner above, both the partner of JV will retain the full and

undivided responsibility for the performance of their obligation under the bid.

- h. Lead partner shall be registered in CGPWD unified registration system in appropriate class. **If the second partner of the JV is not registered in CGPWD unified registration system then second partner shall get registered before execution of the agreement, otherwise JV shall be disqualified and lead partner shall be Debarred/Black listed upto one years for future business with CGUADD.**
- i. The bid submitted shall include all the relevant information mentioned in this tender document applicable to JV partner shall be furnished separately for each partner like affidavit as in **Appendix- 15** mentioning information of relatives, Experience certificate etc. **In case of failure to do, bid shall be rejected.**
- j. A copy of Memorandum of Understanding (MoU)/Consortium Agreement (CA) certified by Magistrate/Sub-Judge/Notary Public on 500 Rupees stamp paper, executed between the members of JV shall be submitted along with the tender. The complete details of the members of the JV, their share and responsibility in the JV etc. particularly with reference to financial, technical and other obligations shall be furnished in the MoU/CA.
- k. Once the bid is submitted, the MoU/CA shall not be modified/altered/terminated during the period of execution including any extension thereafter by CGUADD or validity of any letter of award to the said JV. **In case, the Bidder fails to observe/comply with this stipulation, the full EMD shall be liable to be forfeited and bidder shall be Debarred/Black listed upto two years for future business with CGUADD.**
- l. A duly notarized agreement, attested by Magistrate/Sub-Judge/Notary Public on 500 Rupees stamp paper, of JV shall be executed between the 'Lead Partner' and Second partner. **This Agreement shall be submitted in original at the time of agreement.**
- m. **Copy of the original Memorandum of Understanding (MoU)/Consortium Agreement (CA) shall be submitted separately at the time of agreement. In failure to do so bidder shall not be allowed to execute the agreement.**
- n. Duration of MoU and JV Agreement shall be valid during the entire execution period/validity of letter of award and any extension thereafter/currency of the contract including the period of extension, if any.

- o. Any change/modification in constitution of JV Firm shall not be allowed.
- p. Splitting of EMD/fees among the members of JV shall not be permitted.
- q. Partners of the JV Firm shall be jointly and severally liable to CGUADD for execution of the project/Work/Assignment/attending meetings/ Review for the allocated works etc. The JV partners shall also be liable jointly and severally for the loss, damages caused to the CGUADD during the course of execution of any awarded contract or due to non-execution of the contract or part thereof. Governing Laws for JV Firm: The JV Agreement in all respect be governed by and interpreted in accordance with Indian Laws.
- r. In execution of the contract, payment, shall be done exclusively to the Lead Partner.

All correspondence by CGUADD shall be done with the Lead Partner of JV only.

13. PRE QUALIFICATION DOCUMENT (TECHNICAL AND FINANCIAL)

(i) Technical Pre-qualification Criteria	
The minimum eligibility criteria in respect of particular experience to be fulfilled by the applicant are as under: ---	
	The bidder should have executed/completed Procurement Construction / Design-Build / Design-Build-Operate contract including design, installation, supply, construction, testing and commissioning successfully of following works within the last Seven years: -
(i)	Raw water Sumpwell– At least 50% of required Capacity i.e (200KL/2=100KL) with pump house under a single contract.
(ii)	Pipeline– Successfully providing laying, commissioning and testing of At least 50% of total length of desired maximum diameter i.e 250 mm - (13380/2=6690 m) under a single contract. And At least 25% of total desired length i.e. (21113/4=5279 m) under a single contract. Or At least 50% of total desired length i.e. (21113/2=10556.5 m) in multiple contracts (not more than 2 contracts).
(iii)	Over Head Service Reservoir – At least one OHSR of 50 % of desired maximum capacity i.e (160/2= 80 KL) with required staging height i.e(20m) under a single contract.
(iv)	Pumping Machinery – (1.) Raw water VT pumps-At least 50% of total discharge capacity i.e (55960/2=27980 LPH (7.78 LPS)) under a single contract. (2.) Clear Water Horizontal Centrifugal Pumps- At least 50% of total discharge capacity i. e (80454.5/2= 40227.25 LPH (11.17 LPS)) under a single contract.
(v)	Substation – At least 50% of required capacity i.e (100/2=50 KVA) Or The Electrical work shall be executed by Civil contractor who passes proper valid electric licence issued of 'A' class category by competent authority of state government.
(vi)	SCADA - 1. Bidder should be a Manufacturer or an Authorized Dealer or a System integrator of Sensors (Flow, Pressure, level)/ PLC-SCADA Systems/ Water quality monitoring systems. If bidder is Not Manufacturer or an Authorized Dealer or system Integrator of Sensors (Flow, Pressure, level) /PLC-SCADA Systems, Water quality monitoring systems, then the Bidder should form MoU on One Hundred Rupee Non-Judicial Stamp Paper with the Manufacturer/Authorized Dealer/System integrator of Sensors (Flow, Pressure, level)/PLC-SCADA Systems/ Water quality monitoring systems. 2. The Manufacturer/Authorized Dealer/System integrator should have Experience of successful installation and commissioning of automation in single or multiple contracts of water supply with automation at head works and pumping Machinery operations/WTP and water quality monitoring/ESR operations. 3. Manufacturer/Authorized Dealer/System integrator to submit experience certificate from the officer not below the rank of CMO or equivalent in

	<p>PHED/Municipal Corporation/Council.</p> <p>or</p> <p>For Automation, certificates issued by Private listed Organizations/PSU can also be considered if supported by valid documents.</p> <p>4. Experience for the maintenance of Instrumentation including Sensors (Flow, Pressure, and level)/Automation systems for 3 years is must. [Refer (Appendix-09)]</p>
(ix)	<p>Joint venture: -Allowed</p> <p>JV of maximum two (02) members is allowed including one as lead bidder</p>

Note; -

The experience certificate of work executed in Govt./Semi Govt./Public sector undertakings/Municipal Corporations, issued by an officer not below the rank of CMO shall be acceptable. The Experience certificate of successful completion of work in contractor's /firm's/ company's own name indicating name of work, Agreement no. work order no. and date, amount of contract, stipulated period of completion, actual period of completion during last seven years i.e 2019-20 to 2025-26 shall be acceptable.

Any subcontracting work done anywhere in India, during last seven years, with prior approval of competent Authority (Govt/SemiGovt/Corporations), such sub contractor will also get the credit for work towards his experience.

Experience of Work done by way of subletting directly from Prime contractor without prior approval of competent authority will not be considered.

- (ii) **FINANCIAL PRE-QUALIFICATION** -To qualify in the Tender lead member must have financial experience in last Five years

S.No.	PRE-QUALIFICATION CRITERIA
	Experience for lead member of last five years considered.
1	<p>Achieved in "any one financial year" a financial turnover (in all classes of Construction Works (Civil) value of construction work of at least 60% (Sixty percent) the amount equal to the probable amount of contract for which bid has been invited. i.e Rs 682.78Lakh</p> <p>And</p> <p>Satisfactorily completed at least one similar work equal in value 50% (fifty percent) of the Probable amount of contract as on date of submission of financial offer. i.e Rs 568.99 Lakh</p> <p>Or</p> <p>Satisfactorily completed at least two similar works each costing minimum 40% (forty percent) of the probable amount of contract for which the tender is invited as on date of submission of financial offer. i.e., Rs 455.19 Lakh</p> <p>Or</p> <p>Satisfactorily executing at least one similar work having received payment of value not less than 60% (Sixty percent) of the value of probable amount of contract as on date of submission of financial offer. i.e Rs 682.78 Lakh</p>
2	<p>Bid Capacity=(2.5xAxN)-B</p> <p>Where A= Maximum value of works executed in any one financial year during the last 5 years (with 10% compounded rate per year).</p> <p>Where N = Period of completion in years (shown in NIT)</p> <p>Where B = Value of works in hand</p> <p>The bid capacity of contractor/firm/company should be equal or more than the PAC shown in NIT.</p>
	<p>Note: -</p> <ol style="list-style-type: none"> 1. Similar works refers to water supply schemes/works which involves various components such as Intake/Sump, Water Distribution System, WTP, OHSRs, Raw/Clear water Pumping Machineries, Raw water mains and Clear Water Mains either individually or in combination under Govt./SemiGovt. /Public Sector Undertakings/ Municipal Corporations. 2. The turn over shall be indexed at the compounded rate of 10% (ten percent) for each earlier year. <p>The value of completed work shall be updated to the values of current financial year @ compounded rate of 10% (Ten percent) per year from completion year of work. The completion year shall be taken as base year</p>

Note: -

Even though the tenderer meets the above qualifying criteria, they are subject to be disqualified if they have:

Made misleading, incorrect or false representations in the forms, statements, affidavits and attachments submitted in proof of the qualification requirements.

Other condition including qualification and details of work can be seen in the office of the undersigned during office hours and downloaded online directly from the portal <http://eproc.cgstate.gov.in> and shall be submitted online on or before **date mentioned above**. This NIT shall also form the part of agreement. The details can be viewed on the website

<http://eproc.cgstate.gov.in>

INSTRUCTION TO BIDDERS: -

1. “INSTRUCTIONS FOR USING THE ELECTRONIC TENDERING SYSTEM”

For details on tendering procedure through the electronic tendering system, please refer to “instructions for using the electronic tendering system” document available along with the tender documents.

The Bidders are also invited to get themselves trained on the operations of the e-Procurement System. Bidders may get in touch with the Service Provider of the e-Procurement System for confirming the time and date for their training session.

Payment for Service Provider Fees: In addition to the Tender Document Fees, the Contractors will have to pay Service Providers Fees as required through online payments gateway service available on Electronic Tendering System. For the list of options for making online payments, the Contractors are advised to visit the link E-Payment Options under the section E-Tendering Toolkit for Bidders on the Home Page of the Electronic Tendering System

Steps to be followed by Contractors to participate in the e-Tenders

- I. Registration in Class ‘A’ in Unified Registration (Single Window) System on (<https://eproc.cgsstate.gov.in>) and subsequent empanelment for e-tendering website (<https://eproc.cgsstate.gov.in>) and department’s sub-portal is mandatory.
- II. **Online viewing of Detailed Notice Inviting Tenders:**
The Contractors can view the Detailed Tender Notice along with the Time Schedule (Key Dates) for all the Live Tenders on the Portal (<https://eproc.cgsstate.gov.in>) and website of concerned department.
- III. **Download of Tender Documents:**
The Pre-qualification / Main Bidding Documents are available for free downloading. However, to participate in the online tender, the bidder must deposit Bid Processing and tender document fee online by filling up details of Demand Draft.
- IV. **Online Bid Preparation and Submission of Bid Hash (Seal) of Bids:**
Submission of Bids will be preceded by online bid preparation and submission of the digitally signed Bid Hashes (Seals) within the Tender Time Schedule (Key Dates) published in the Detailed Notice Inviting Tender. The Bid Data is to be prepared in the templates provided. The templates may be either form based, extensible tables and / or uploadable documents. In the form-based type of templates and extensible table type of templates, the Contractors are required to enter the data and encrypt the data using the Digital Certificate.
In the uploadable document type of templates, the Contractors are required to select the relevant document / compressed file (containing multiple documents) already uploaded in the briefcase.

Notes:

- A. The Contractors upload a single document or a compressed file containing multiple documents against each unloadable option.
- B. The Hashes are the thumbprint of electronic data and are based on one – way algorithm. The Hashes establish the unique identity of Bid Data.

- C. The bid hash values are digitally signed using valid Digital Certificate issued any Certifying Authority. The Contractors are required to obtain Digital Certificate in advance. **The Bidders may contact M/s Mjunction Service Ltd., on helpdesk Toll free number 18002582502 or through Email ID – helpdesk.eproc@cgswan.gov.in or they may contact to Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech and Biotech Promotion Society (CHIPS) on Tel. No. 0771-4014158 or email- pro-chips@nic.in**
- D. After the hash value of bid data is generated, the Contractors cannot make any change / addition in its bid data. The bidder may modify bids before the deadline for Bid Preparation and Hash Submission as per Time Schedule mentioned in the Tender documents.
- V. **Close for Bidding (Generation of Super Hash Values):**
After the expiry of the cut – off time of Bid Preparation and Hash Submission stage to be completed by the Contractors has lapsed, the Tender will be closed by the Tender Authority. The Tender Authority shall generate and digitally sign the Super Hash
- VI. **Decryption and Re-encryption of Bids (submitting the Bids online):**

After the time for generation of Super Hash values by the Tender Authority has lapsed, the Contractors have to make the online payment of Rs.towards the fees of the Service Provider.

After making online payment towards Fees of Service Provider, the Contractors are required to decrypt their bid data using their Digital Certificate and immediately re-encrypt their bid data using the Public Key of the Tendering Authority. The Public Key of the Tendering Authority is attached to the Tender during the Close for Bidding stage.

Note: The details of the Processing Fees shall be verified and matched during the Technical Opening stage.

At this time, the Contractors are also required to upload the files for which they generated the Hash values during the Bid Preparation and Hash Submission stage.

The Bid Data and Documents of only those Contractors who have submitted their Bid Hashes (Seals) within the stipulated time (as per the Tender Time Schedule), will be available for decryption and re-encryption and to upload the relevant documents from Briefcase. A Contractor who has not submitted his Bid Preparation and Hash Submission stage within the stipulated time will not be allowed to decrypt / re-encrypt the Bid data / submit documents during the stage of Decryption and Re-encryption of Bids (submitting the Bids online).

2. Bid Opening and Evaluation

Bid Opening

- i. Chief Municipal Officer Nagar Panchayat will open the bids received (except those received late). In the event of the specified date for the

submission of bids being declared a holiday for ULB, the Bids will be opened at the appointed time and location on the next working day.

- ii. The files containing the technical bid shall be opened. The document marked “cost of bidding document” will be opened first and if the cost of the bidding documents is not there, or incomplete, the remaining bid documents will not be opened, and bid will be rejected.
- iii. In all other cases, the amount of Earnest Money, forms and validity shall be announced. Thereafter, the bidders' names and such other details as the CMO may consider appropriate, will be announced by the CMO at the opening.
- iv. Evaluation of the technical bids with respect to bid security, qualification information and other information furnished in the bid in pursuant to relevant Clause of ITB, shall be taken up and completed and a list will be drawn up of the responsive bids whose financial bids are eligible for consideration.
- v. Chief Municipal Officer shall inform, by email or eprocurement, the bidders, whose technical bids are found responsive, date, time and place of opening as stated in the Notice Inviting Bid.
- vi. In the event of the specified date being declared a holiday for the CMO, the bids will be opened at the appointed time and location on the next working day Bidders or their representative, may attend the meeting of opening of financial bids.
- vii. At the time of the opening of the 'Financial Bid', (**Envelope ‘C’**) the names of the bidders whose bids were found responsive in accordance with relevant clause of ITB will be announced. The financial bids of only these bidders will be opened. The responsive bidders' names, the Bid prices, the total amount of each bid, and such other details as the may consider appropriate will be announced by the at the time of bid opening.
- viii. **Process to be Confidential** Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any attempt by a Bidder to influence the Chief Municipal Officer ULB/or his representatives processing of bids or award decisions may result in the rejection of his Bid
- ix. Clarification of Bids and Contacting the CMO ULB-
No Bidder shall contact the on any matter relating to its bid from the time of the bid opening to the time the contract is awarded.
- x. Any attempt by the bidder to influence the Nagar Panchayat officials/representatives during bid porcess by any means, bid evaluation,

bid comparison or contract award decision may result in the rejection of his bid.

3. Examination of Bids and Determination of Responsiveness

- 1) During the detailed evaluation of "Technical Bids"(**Envelope ‘B’**), the Chief Municipal Officer ULB will determine whether each Bid
 - (a) meets the eligibility criteria defined relevant Clauses.
 - (b) has been properly signed;
 - (c) is accompanied by the required securities; and
 - (d) is substantially responsive to the requirements of the bidding documents.

During the detailed evaluation of the "Financial Bids"(Envelope ‘C’), the responsiveness of the bids will be further determined. To assist in the examination, evaluation and comparison of Bids, the Employer may at his discretion, ask any Bidder for clarification of his Bid including breakdown of unit rates. The request for clarification and the response shall be in writing or vide email.

- 2) A substantially responsive "Financial Bid" is one, which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one
 - (a) which affects in any substantial way the scope, quality, or performance of the Works;
 - (b) which limits in any substantial way, inconsistent with the bidding documents, the rights or the Bidder's obligations under the Contract; or
 - (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.
- 3) If a "Financial Bid"(Envelope ‘C’) is not substantially responsive, it will be rejected by the CMONagar Panchayat Bhakhara, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

1.1 Corrections of Errors

(1) Bids determined to be substantially responsive, will be checked by the CMO ULB for any arithmetic errors. Errors will be corrected by the ULB as follows:

- a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and
- b) where there is a discrepancy between the unit rate and the line-item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

(2) The amount stated in the Bid will be adjusted by the CMO ULB in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount, the Bid will be rejected, and the Earnest money shall be forfeited in accordance with relevant Clause of ITB.

1.2 Evaluation and Comparison of Bids

(1) CMONagar Panchayat will evaluate and compare only the bids determined to be substantially responsive in accordance with relevant Clause of ITB.

(2) In evaluating the bids, the CMO will determine for each Bid the evaluated Bid price by adjusting the Bid price by making correction, if any, for errors pursuant to relevant Clause of ITB.

(3) If the Bid of the successful Bidder is seriously unbalanced **in relation to the PAC of work** to be performed under the contract, CMO may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, CMO may require that the amount of the performance security set forth in relevant Clause of ITB be increased as described in relevant clause.

4. Earnest Money

I. FORM OF EARNEST MONEY:

To be deposited as stated in NIT

II. EARNEST MONEY IN SEPARATE COVERS: -

The Earnest Money should be deposited as mentioned in NIT/DNIT. If the Earnest Money is not found in accordance with the prescribed mode, the tender of the tenderer shall not be opened.

5. IMPLICATION OF SUBMISSION OF TENDERS: -

- I. Bidders are advised to visit the site sufficiently in advance of the date fixed for the submission of the tender. The tenderer shall be deemed to have full knowledge of all relevant documents and site conditions etc. Whether he inspects it or not.
- II. The submission of a tender by a contractor implies that he has read the notice, conditions of the tender and all the contract documents and has made himself fully aware of all the standards and specifications in this respect laid down in the relevant specifications, IRC specifications, manual on water supply and treatment, and Annexure-E having the scope and the specification of the work to be done. The contractor will be deemed to have seen the site of works.
- III. The contractor shall make his own arrangement for supply of water for construction, purposes. No lead and lift for any material including water will be paid. The tender offer should be inclusive of all leads and lifts for the materials. The contractor should himself verify the leads & royalty charges of different materials before submitting his tender.

6. LIST OF WORKS IN PROGRESS: -

Tenders must be accompanied by a list of Contracts already held by the tenderer at the time of submitting the tender, in the Department and elsewhere showing therein.

- (i) The amount of each contract.
- (ii) Balance of work remaining to be done.
- (iii) The amount of solvency-certificate produced by him at the time of enrolment in the department.

7. RELATIONSHIP:

The contractor shall not be permitted to tender for works in the corporation, (responsible for award and execution of contract) in which his near relative is posted. He shall intimate the names of his near relative working in State and concerned Nagar Panchayat. He shall also

intimate the name of person working with him in any capacity or subsequently employed by him and who are near relatives to any Gazetted Officer in the State and Nagar Panchayat. Any breach of this condition by the contractor would render him self liable to be removed from the approved list of contractors of the UADD department.

NOTE: - By the term “near relative” is meant wife, husband, parents and son, Grand son, brothers, sisters, brothers in laws, father-in-law and mother-in-law.

8. OPENING AND ACCEPTANCE OF TENDERS:

PLACE AND TIME OF OPENING: -

The tenders shall be opened at Nagar Panchayat Bhakhara

Bid Opening & Evaluation of NIT. In the first instances, the envelope containing the earnest money shall be opened. If the earnest money is found proper and scan copy of documents required as minimum qualification to bid shall be opened. If the tenderer found qualified as per minimum qualification, the online Envelope B containing the terms and conditions will be opened in the presence of such contractors, who choose to be present.

After short listing of prequalified contractors, their online financial offers shall be opened. The contractor having quoted lump sum offer in prescribed online proforma with minimum cost shall be declared as the **lowest bidder**.

(I) POWER OF THE CMO:

The Chief Municipal Officer does not bind himself to accept or recommend for acceptance to the higher authority, the lowest or any tender or to give any reasons for his decision.

(II) CONDITIONAL TENDER:

Conditional tenders are liable to be rejected.

(III) CANVASSING: -

Canvassing for support in any form for the acceptance of any tender is strictly prohibited. Any tenderer doing so will render himself liable to penalties which may include removal of his name from the Register of approved contractors of penal action under section 8 of Chhattisgarh Vinirdishta Bhrashtacharacharan Nivaran Vidheyak, 1982.

(IV) ONLINE SUBMISSION OF TENDER: -

No Sealed envelopes unless otherwise stated in the Bid document will be accepted only the bids submitted online will be opened.

(V) AUTHORITY OF CMO: -

The authority competent to accept a tender, reserves the right for accepting the tender for the whole work or for a distinct part of it, or distributing the work between two or more Bidders.

All works to be executed under this contract shall be executed under the direction and subject to the approval in all respects of concerning Engineer-in Charge/Nodal officer of concerned Nagar Panchayat under which the work is executed, for time being who shall be entitled to direct at what point or points and what manner they are to be commenced and from time to time carried out.

9. VALIDITY OF OFFER: -

Tender shall remain valid up to 180 days from the date of opening of Envelope - C and in the event of the Bidders withdrawing the offer before the aforesaid date for any reason whatsoever, Earnest Money deposited with the tender shall be forfeited by competent authority/Nagar Panchayat.

10. TIME OF COMPLETION:

The time allowed for carrying out the work as stated in NIT/DNIT including rainy season shall be strictly observed and shall be reckoned after 30 days from the **date of issue of work order** to commence the work. Delay beyond the specified time limit will be subject to liquidated damages according to relevant clause of Form “F” of Lump sum contract

11. TIME SCHEDULE: -

The work shall be done by the contractor according to the schedule fixed in consultation with the competent authority. BAR/PERT/CPM chart showing detailed programme shall have to be submitted and adhered to by the contractor.

12. TRIAL RUN AND DEFECT LIABILITY PERIOD

3(Three) months Trial run and 09 months Defects Liability period: Trial run will start after completion of all the works under this contract except installation of pending Consumer Meters if any, however all consumer meters installed up to valid completion of other works, shall also be under trial period. Defect liability period start after 12 month of completion of work i.e. completion of 3 months trial run and 9 months O&M.

13. 3 MONTHS TRIAL RUN AND 9 MONTH O&M OF COMPLETE WORK AFTER COMPLETION OF WORK:

- a) The tender must be inclusive of operation of the plant for the 3(three) months trial run period free of charge by contractor's trained and qualified Engineers who should be completely familiar with the equipment supplied and erected and they shall train the Departmental Staff in operation & maintenance of the plant within that period. Detailed operation manual as well as the drawings of equipment supplied should also be supplied by the contractor free of cost. The cost of electrical energy, Chlorine Gas, and pay to departmental staff will be paid by the Department and cost of all chemicals, Consumables and Contractor's staff etc shall be borne by the contractor including replacement and warranty of any item component/spares during the period of trial run.

Performance Guarantee must be demonstrated within the test run for the period of twelve months after successful completion of trial run period of 3 months.

- b) Period of construction shall be reckoned **after 30 days** from date of issue of work order to time of completion. Defect liabilities, tests, guarantee etc will be as per tender document.

After satisfactory completion of the complete work including testing, installation, commissioning and trial run of 3 months, the Engineer-in-charge will issue the Completion Certificate. Trial run at full load will be carried out during trial run period. Any non-compliance in terms of running, delivery and performance of each component of the complete work will be maintained and recorded by the Engineer-in-Charge. Record of the incoming raw water quality (physical, chemical and biological parameters) and that of the treated water rendered from the existing and proposed WTP shall be maintained.

Each day/part of the day when raw water Intake structure or the Water treatment Plant does not deliver as per the norms of Contract Agreement and CPHEEO Manual means that the trial run will be extended by that many days without any extra cost to concerned Nagar Panchayat/department.

14. PAYMENTS BY CHEQUES/ONLINE ACCOUNTING SYSTEM: -

The running payments shall be made in accordance with the Break up schedule of payment as per “**Annexure F**”.

15. PRICE ADJUSTMENT/ESCALATION: -

The scope of work includes all costs and no claim for price adjustment/Esxalation or on account of any reason whatsoever shall be entertained.

16. SPECIFICATIONS: -

The detailed specifications for the work have been given in the enclosed Annexure-E. However, the following order of priority regarding specifications shall be followed by the contractor.

- (i) Specifications given in the Annexure-E are enclosed.
- (ii) Specifications for pipes, valves, specials, rubber, gaskets RCC and other civil works and materials shall be governed by the relevant **latest IS codes, IRC specifications and National Building code of India (latest revision), Indian Electricity Rules.**
- (iii) Manual on water supply and treatment (latest edition) published by CPHEEO, New Delhi.
- (iv) Any other specifications, not covered under the above said standards, shall be decided by the Engineer-in-Charge

CHANGE IN SPECIFICATIONS: -

Nothing in earlier clause shall, however, curtail the right of the Engineer-in-Charge to alter the specifications for any part or whole of the work if he considers it necessary in the interest of work. On all matters where there is difference of opinion, between the contractor and the Engineer-in-Charge, the matter will be decided by the CMO which shall be binding to the bidders.

17. SUB-LETTING WORK: -

The contractor shall not without the prior approval of the authority who has accepted the tender in writing, sublet or assign to any other party or parties, any portion of the work under the contract. Where such approval is granted, the contractor shall not be relieved of any obligation or duty or responsibility, which he undertakes under the contract. However, such subletting in no case be more than 25 % of contract value. But if required can be increased up to 50 (fifty) % with the prior permission of the next higher authority accepting the tender or the Government as the case may be.

Before subletting the Engineer in Charge shall verify the technical & financial capacity of the sublettee.

The sublettee shall be a registered contractor in appropriate class under unified registration system (e-registration) of Chhattisgarh or elsewhere in similar capacity, as recognized by public works department and shall also have a technical and financial capacity corresponding to the work proposed to be subletted.

The contract may be rescinded and security deposit forfeited for subletting the work beyond permissible limits as mention above or if the contractor becomes insolvent.

The contract shall not be assigned or sublet without prior sanction of the competent authority in writing. And if the contractor assigns or sublet his contract for more than permissible limits as per clause above or attempt to do so, or become insolvent commence any insolvency proceeding or make any composition with his creditors, or attempt to do so or if any gratuity, gift, loan, perquisite, reward of and advantage pecuniary or otherwise, shall either directly or indirectly be given. promised or offered by the contractor, or any or his servants or agents or to any public officer or person in the employ of Government in any way relating to his office or employment, or if any such officer or person shall become

in any way directly or indirectly interested in the contract the CMO may there upon by notice in writing rescind the contract, and the S.D of the contractor shall there upon stand forfeited and be absolutely at the disposal of Government and the same consequences shall ensure as if the contract had been rescinded under clause 3 thereof, and in addition the contractor shall not be entitled to recover or be paid for any work thereto for actually performed under the contract.

Any such assignment/subletting within the limit of 25% by the authority who has accepted the tenders or 50 % by the next higher authority accepting the tender or Government as the case may be, shall not diminish or dilute the liability/ responsibility of the contractor.

If the contractor gets item/items of work executed on a task rate basis without materials this shall not amount to subletting of the contract.

Any subcontracting work done anywhere in India, during last five years, with prior approval of competent Authority (Govt/Semi Govt/Corporations), such sub contractor will also get the credit for work towards his experience.

Experience of Work done by way of subletting directly from Prime contractor without prior approval of competent authority will not be considered.

The authority accepting the tender shall be empowered to terminate any contract if the contractor sublets the work to some other person on the basis of power of attorney.

Subletting of work shall result in reduction in experience of the main contractor to extent of the sublet.

18. INSURANCE

The Contractor shall take such insurance in connection with the work in accordance with the tender condition as acceptable to CMO. The cost of the insurance premium shall be paid by the Contractor.

19. LEGAL JURISDICTION

All the disputes regarding this contract will be subjected to the Chhattisgarh High Court Jurisdiction.

20. BLASTING: -

In case limited/suppressed blasting resorted to by the contractor in excavation of trenches, it will be the responsibility of the contractor to observe all rules and regulations permission licence, procurement, preservation and storage of Explosive material etc. Permission for blasting shall be obtained in writing form the competent Authority.

21. TAXES: -

The rates quoted by the contractor shall be deemed to be inclusive of all taxes. All charges regarding taxes including the IGST, CGST & IR SGST and any other taxes, royalties and other levies which are legally levied on the contract work by Govt., local bodies or private individuals will be payable by the contractor executing the work, CMO Nagar Panchayat/Competent Authority will not entertain any claim on this account. It will be the contractor's duty to ascertain the above taxes and include in his Lump sum offer. No separate claim shall be entertained on this account by the department.

However, during the currency of project, if there is any decrease in the existing taxes of State/Central Government, then the recovery will be made from the contractor's payment as certified by the CA as appointed by the State Govt.

22. ROYALTY: -

Minerals extracted for works carried out on behalf of the government, from the quarries in possession of and controlled by the State Government or otherwise is subject to payment of

Royalty by the contractor to whom it shall not be refundable.

If the Contractor fails to produce the Royalty clearance certificate from concerned department within 30 days, then CMO/EE/Nodal will be at liberty to deduct the royalty charges from his bills as per the prevalent Govt orders/rates.

23. Model rules related to labour, water supply and sanitation in labour camps.

The contractor will be bound to follow the Model Rules, relating to layout Water Supply and sanitation in labour camps, as per Annexure - A and the provisions of the National Building Code of India, in regard to construction and safety.

24. FAIR WAGES: -

The contractor(s) shall pay not less than the fair wages to labour engaged by him on the work (copy of the Rules enclosed as Annexure - 'A')

25. WORKS IN THE VICINITY: -

The CMO, reserves the right to take up Departmental work or to award works on the contract in the vicinity without prejudice to the terms of contract.

26. BEST QUALITY OF QUARRIED MATERIALS: -

If the quarry material of more than one quality is found, the material approved by the CMO will only be used by the contractor. If the materials of required Specification are not available in the near by area/quarry, the contractor shall have to arrange the same from the place where it is available.

27. REMOVAL OF UNDESIRABLE PERSONS: -

The contractor shall on receipt of the requisition from the CMO, at once remove any person employed by him on the work who in the opinion of the CMO is unsuitable or undesirable.

28. AMOUNT DUE FROM CONTRACTOR: -

Any amount due to Government from the Contractor on any account of concerning work may be recovered from him as arrears of Land Revenue.

29. TOOLS & PLANTS: -

The contractor shall arrange at his own cost all tools and plants required for proper execution of work. Certain plants may however be issued to the contractors by the Department, as special case as per provision of W.D. Manual Vol. 1 if available and can be spared

30. RIGHT TO INCREASE OR DECREASE OF QUANTUM OF WORK:

The competent authority reserves the right to increase or decrease any item of work during the currency of the contract and the contractor will be bound to comply with the order of the competent authority without any claim for compensation or higher rates for additions and alterations.

31. LABOUR REPORT: -

Contractor will submit a report on labour engaged to local employment office and copy of same may be attached with the running account bill, failing which Rs.50/- will be deducted from each running bill. Total recovery on this account may be affected on the final bill.

32. LABOUR LICENCE: -

Every contractor who employs on any day of the preceding 12 months, twenty or more workers on contract is required to obtain license from the Licensing Officer or the Contract

as per provision contained under Sub-section 4 (b) of section 2 of the Contract Labour (Regulation and Abolition) Act 1970 as per provision contained in Section 12 of Act. No, contractor shall execute any work without obtaining licence, contravention of above is punishable and contractor is liable to be prosecuted. The successful tenderer is liable to produce licence as and when demanded by the CMO, obtained from labour Department as laid down in chapter 4 of Contract labour (Regulation and abolition) Act 1970.

LABOUR HUTMENT: -

The contractor shall make arrangement, at his own cost, for housing his staff and stores for the work and Model Rules relating to labour Water supply and sanitation shall be followed.

33. NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP: -

The contractor shall give not less than five days notice in writing to the Engineer- in-Charge or his subordinate in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of measurement and shall not cover up or place beyond the reach of measurement any work without the consent in writing of the Engineer-in-Charge or subordinate-in-charge of the work, and if any work shall be covered or placed beyond the reach of measurement without such notice having been given or consent obtained the same shall be uncovered at the contractor's expense or in default thereof no payment or allowance shall be made for such work or materials with which the same was executed.

34. SITE ORDER BOOK: -

An order book, to be called, as site order book shall be kept at the Site office of Nagar Panchayat where the work has been going to be executed or as per the direction of Engineer in Charge. As far as possible, all orders regarding the work are to be entered in this book. All entries shall be signed and dated by concerned Nagar Panchayat/PMC officers in direct charge of the work and noted by the contractor or his accredited representative. The site order book shall not be removed from work site, except with the written permission of the Engineer-in-Charge.

35. CONTRACTORS PROJECT MANAGER AND CONTRACTORS STAFF: -

The contractor shall in his own absence keep constantly on the works a competent and well qualified and experienced Project Manager, and any direction or explanations given by the Superintending Engineer or his staff to Contractor's Project Manager shall be held to have been given to the contractor. The contractor shall further provide all staff that is necessary for the supervision, execution and measurement of the work to ensure full compliance with the terms of contract.

36. PRODUCTION, SUBMISSION AND APPROVAL OF ENGINEERING DOCUMENTS:

The production, submission and approval procedure for design & drawings and documents shall comply with the following requirements.

Meaning:

The following meanings shall apply:

"Preliminary drawings" means drawings which the Contractor submits to the Engineer-in-Charge through PMC for approval and any drawings returned by the Engineer-in-Charge marked "Preliminary" or not marked "Approved".

"Approved Drawings" means drawings which the Engineer-in-Charge has marked

"Approved" and returned to the Contractor. Approval in this context means that the work described thereon may proceed.

"Preliminary" and "Approved" as applied to designs and documents shall have the same meanings as applied above to drawings. A drawing which forms part of an approved design or document shall not be considered as approved drawing unless it has been marked "Approved".

Numbering and Titling:

The Contractor shall institute a reference numbering system for designs, drawings and documents so that each number used is unique. The numbering and title information on designs, drawings and documents shall be designed so that management, transmittal and communication therewith can be carried out expeditiously.

Submission Procedure:

Every drawing submitted by the Contractor to the Engineer-in-Charge through Project Development and Management Consultants for checking and approval shall be based on previously approved designs or documents. Interrelated drawings shall be submitted at the same time in a complete and self-sufficient set.

In the case of first submissions by the Contractor to the Engineer in charge for approval, each design, drawing and document shall reach the Engineer's review office in time to allow 30 working days (excluding weekends and national holidays) for checking by the Engineer-in-Charge before return to the Contractor.

Manufacturer's and Contractor's Certificate:

Where certificates are required by the Specification or relevant Reference Standard, the original and one copy of each such certificate shall be provided by the Contractor.

Certificates shall be clearly identified by serial or reference number where ever possible to the material being certified and shall include information required by the relevant Reference Standard or Specification Clause.

The instruction manuals shall describe the installation as a whole and shall give a step-by-step procedure for any operation likely to be carried out during the life of such item of Plant, including the erection, commissioning, testing, operation, maintenance, dismantling and repair.

Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer intervals to ensure trouble-free operation. Where applicable, fault location charts shall be included to facilitate tracing the cause of malfunction or breakdown.

A section dealing with procedures for ordering spares shall also be included in the instruction.

Three draft copies of the manual shall be submitted to the Engineer's Representative prior to commissioning the works. Five final copies of the amended and corrected manuals and drawings shall be provided at the commencement of the period of Maintenance.

All the electrical and mechanical equipments shall be subjected to approved third party inspection at place of manufacture, at contractor's cost.

Transit insurance of all equipments shall be the contractor's responsibility.

Contractor shall have to take the certificate from the Electrical Inspector for regarding all electrical equipments before commissioning of plant.

Important instructions charts shall be framed and fixed at appropriate and prominent places

Maintenance Instructions:

A maintenance manual shall be provided as supporting documents to the equipment manufacturer's instructions.

(i) Maintenance Manual

Checking, testing and replacement procedures to be carried out on all mechanical and electrical plant items on a daily, weekly and monthly basis or at longer intervals to ensure trouble free operations.

Fault location and remedy charts to facilitate tracing the cause of malfunctions or breakdown and correcting faults.

A complete list of recommended lubricants, oils and their charts.

A spares schedule, which shall consist of a complete list of item wise spares for all electrical and mechanical plant items with ordering references and part numbers.

A complete list of manufacturer's instructions for operation and maintenance of all bought-out equipment. The list shall be tabulated in alphabetical order giving the name of the Supplier/Manufacturer, identification of the plant item giving the model number and the literature provided including instruction leaflets and drawing numbers.

Preventive maintenance details.

Record Drawings:

The Contractor shall provide record drawings including those drawings submitted by the Contractor to show the whole of the plant as installed and all civil works as built. These shall include all such drawings, diagrams and schedules as are necessary for a complete understanding of the works. Information given on record drawings shall include tolerance, clearances, loadings, finishes, materials and ratings of Plant and associated civil works. The Contractor shall ensure that the approved and completion drawings are marked up, to show the condition of plant as installed and associated Civil Works, as built and two copies of such marked up prints shall be submitted to the Engineer-in-Charge for approval prior to the preparation of Record Drawings. Submission to and approval by the Engineer-in-Charge of Record Drawings shall be pre-requisite for the last taking over certificate. All the Record Drawings shall be of A2 size, in five copies, out of which 3 sets shall be plastic laminated for long-life. In addition, one set of Microfilm of all the Record Drawings also shall be furnished. The text of all the reports shall be prepared on a widely used IBM compatible MS Word / MS Excel, and all the Drawings shall be prepared using AutoCAD Software and in .pdf form. When reports, drawings are furnished to Nagar Panchayat, two copies of the processor files together with 2 copies of a descriptive memorandum linking these files to the text, drawings etc., shall also be provided to the Nagar Panchayat on CDs, Pen drive, data base preferable on MS office and AutoCAD latest versions and in .pdf form.

37. PROGRAMME OF WORK: -

The works to be carried out under this Contract form an important part of the execution of this Water Supply Project, Satisfactory progress of the entire project as a whole depends upon the timely completion of these works. For this reason, great importance needs to be attached for proper programming for the works with adequate provision for guarding against all the delays normally encountered in execution of various activities.

The contractor shall include with his tender a critical path network diagram which commences from the date of issue of Order of Commencement and includes inter alia the various activities as per the programme of works, furnished as specified in Schedule.

- Activity duration in months and event times should be in months from the first event on the network and event numbers;
- A tabulation of months from the starting date of the network to enable earliest and latest event dates to be read off; duration in months to be the last day of the month and the monsoon months of 15th June to 15th October to be specially indicated in the Table;
- The timing of events shown in the programme of work to be adhered to and shown in the network;
- The erection programme shall be shown in detail (with not more than 15 activities) with durations in weeks shown in brackets behind the duration in months on the network diagram wherever considered necessary;
- The programme for setting-up, treating, delivery, storage (if necessary) and placing of filter media (where appropriate) the
- Placing being a part of the erection programme referred to in (iv) above; and
- Programme for submission of Instruction Manuals and Record Drawings;

As soon as practicable, and in any case not later than four weeks, after acceptance of his tender the Contractor shall submit to the Engineer-in-Charge for his approval a programme showing the order of procedure in which he proposes to carry out the works.

Particulars to be shown on the programme shall include:

- Submission of drawings;
- Placing of work orders;
- Stages of manufacture;
- Tests at place(s) of manufacture;
- Deliveries to Site;
- Construction of Civil works ready for erection of Plant;
- Mechanical completion of erection at site;
- Tests at site;
- Finishing and completion of civil and electrical works.

Any approval of or consent to the Contractor's programme by the Engineer-in-Charge shall not relieve the Contractor of his duties and responsibilities under the Contract.

38. PROGRESS:

The Contractor shall submit to the Engineer-in-Charge during the first week of each month a "Monthly Progress Report" with weighted activities all in an approved format so that actual progress at the end of the preceding month may be compared with the Contractor's programme. The progress report shall also include status report on the following approved individual formats:

- Drawings;
- Supplies of Plant Items;
- Construction programme;
- Construction Progress;
- Overall Progress Curve;

From time to time the CMO or Engineer-in-Charge of concerned ULB will call meetings in their office or at the Engineer's Site Office, as they deem necessary for the purpose of control of the Contract, a responsible representative of the Contractor shall attend such meetings.

The Contractor shall regularly review his programme in the light of the progress actually achieved and shall submit for approval updated PERT/CPM network and bar charts at intervals to be agreed with the Engineer-in-Charge. If progress falls behind that needed to ensure timely completion of the various parts of the works, the Contractor shall submit proposals for improving his methods and pace of working to the satisfaction of the Engineer-in-Charge shall carry out such measures as are needed to ensure that the works are completed on time.

39. AGREEMENT:

The Notes and specifications given in the detailed notice inviting tenders and its annexure are to be read in conjunction with conditions given in the short notice inviting tenders and the conditions of Contract. These have been intended to supplement the provisions, in the NIT and the conditions of the Contract. All these will be binding on the contractor and shall form part of the agreement. However, in case of any contradiction between the common set of conditions and the NIT, the common set of conditions will supersede.

40. EXECUTION OF AGREEMENT:

The Tenderer whose tender has been accepted shall have to execute the agreement within a fortnight of the communication of the acceptance of his tender by the competent authority. Failure to do so will result in the Earnest Money being forfeited to Govt. and tender being cancelled.

41. ANNEXURE:

Other than Form 'F', condition of contract, Special conditions of contract, if any following documents are appended as annexures with this N.I.T. and these shall be part of contract agreement.

Annexure-“A”	Model Rules relating to labour, water supply and sanitation etc
Annexure-“B”	Contractor's Labour Regulations
Annexure-“C”	Form of Income Tax Clearance Certificate
Annexure-“D”	Statement showing the Lead of Materials
Annexure-“E”	Scope of Work and Technical Specification
Annexure-“F”	Price Schedule including payment breakup in concerned annexures
Annexure- “G”	Revised form of Guarantee Bond
Annexure-“H”	Special Conditions of NIT
Annexure-“I”	Information & Instructions to the Bidders for Online Electronic Government Procurement System (e-GPS).
Annexure-“J”	Pre-contract Integrity Pact
Annexure-“K”	Centralised Procedures of the Government of Chhattisgarh For Suspension, Demotion, Non-Renewal & De-Registration of Contractors/Firms, 2014

Appendix '1' Qualification Information

Appendix '2' Information regarding minimum one similar work

Appendix '3' Work performed on all classes of construction Works over last 05 years

Appendix '4' Existing commitments and ongoing all classes of Civil Engineering

construction works

Appendix ‘5’ Availability of major items of Contractor’s Equipment proposed to carry out the works

Appendix ‘6’ Qualifications of each Technical Personnel of Contractor proposed for the Contract

Appendix ‘7’ Financial reports for the immediate previous 05 years

Appendix ‘8’ Information on current claims, Arbitration, Litigation in which Bidder is involved

Appendix ‘9’ MOU SCADA

Appendix ‘10’ DELETED

Appendix ‘11’ MOU with registered Substation Contractor

Appendix ‘12’ Contact persons

Appendix ‘13’ Affidavit (Declaration for Not Being Blacklisted)

Appendix ‘14’ Declaration (Declaration for complete knowledge of project etc.)

Appendix ‘15’ Declaration of conflict of Interest

Appendix ‘16’ Information regarding Similar works

Appendix ‘17’ Joint Venture Agreement

**Chief Municipal Officer
Nagar Panchayat Bhakhara
DISTRICT-DHAMTARI (C.G)**

FORM-F
IMPROVEMENT OF WATER SUPPLY SCHEME
Tender for a Lump - Sum Contract

(To be submitted online in Envelope-C on Bidder's Letter head with seal and signature)

Sr. No.	Particulars	Lump – Sum Cost
A	Lump Sum offers for Engineering, Procurement, Construction of Existing Water Supply scheme at Bhakhara including testing, commissioning, 3months trial run&9 months O&M.	Rs.

Grand total Rs.....

(Rupees.....)

Note: Offer is inclusive of GST and all other applicable taxes etc

For Evaluation purpose sum total of A shall be considered

Online offer shall be considered only

“We do hereby tender to execute the whole of the work described in the Scope of work and according to the annexed specifications for the sum of Rs. -----
(Rupees -----) as per breakup given above:

and should this tender be accepted I/We do hereby agree and bind myself/ourselves to abide by and fulfil all the conditions annexed to the said specification or in default thereof to forfeit and pay to the Nagar Panchayat_____, the penalties of sums of money mentioned in the said conditions, viz.

Dated:

Tenderer's Signature

Witness:

Address:

Address:

The above tender is hereby accepted by me on behalf of the Nagar Panchayat_____.

The _____/20__

Signature of the authority by whom the tender has been accepted.”

CONDITIONS OF CONTRACT

Definitions

- A.** The contract means the documents, forming the notice inviting tenders and tender documents submitted by the tenderer and the acceptance thereof including the formal agreement executed between the **CMO Nagar Panchayat/Nagar PanchayatBhakhara** and the **Contractor**.
- B.** In the contract the following expressions shall unless otherwise required by the context have the meanings hereby respectively assigned to them: -
- (a) The expression “works” or “work” shall unless thereby mean something either in the subject or context repugnant to such construction be construed and taken to mean the works or by virtue of the contract contracted to be executed whether temporary or permanent and whether original, altered, substituted or additional.
- (b) The “site” shall mean the land and/or other places on, into or through which work is to be executed under the contract or any adjacent land path or street through which work is to be executed under the contract or any adjacent land, path, or street which maybe allotted or used for the purpose of carrying out the contract.
- (c) The “CMO ULB” means Chief Municipal officer of the concerned Nagar Panchayat, where work will be executed and who shall sign the contract on behalf of the Nagar Panchayat.
- (d) Deleted
- (e) Competent Authority means CMO Nagar Panchayat where work is going to be executed
- (f) The term “Chief Engineer” means the Competent Authority from UADD
- (g) The term "Superintending Engineer" means the Superintending Engineer of the concerned Division (i.e. Raipur Division)
- (h) The term "CMO" means the CMO of concerned Division (i.e Raipur Division)
- (i) The term "Assistant Engineer" means the Assistant Engineer of concerned Division/ ULB
- (j) The word "Sub Engineer" shall mean "Sub Engineer" of the concerned ULB
- (k) The term “TIA” means tender inviting Authority means CMO Nagar Panchayat
- (l) The term “ULB” means Nagar Panchayat, where the work will be executed

NOTE: “Words” importing the singular number include plural number and vice-versa,

CONDITIONS OF CONTRACT

1. The person(s) whose tender may be accepted (hereinafter called the contractor(s), which expressions shall unless excluded by or repugnant to the context include his heirs, executors, administrators' representatives and assigns) shall permit Govt at the time of making any payments to him for the value of work done under the contract to deduct Security deposit as under.

The Security Deposit to be taken for the due performance of the contract under the terms & conditions printed on the tender form will be the earnest money plus a deduction of 5 percent from the payment made in the running bills, till the two together amount to 5 percent of the cost of work put to tender or 5 percent of the cost of the works executed when the same exceeds the cost of work put to tender.

2. The Contractor(s) is/are to provide every-thing of every sort and kind (with the exception noted in the schedule attached) which may be necessary and requisite for the due and proper execution of the several works included in the contract according to the true intent and meaning of the drawings and specifications taken together, which are to be signed by Engineer in Charge/CMO and the contractor(s) whether the same may or may not be particularly described in the specification or shown on the drawings, provided that the same are reasonably and obviously to be inferred therefrom and in case of any discrepancy between the drawings and the specification the Engineer in Charge/ CMO is to decide which shall be followed.
- 2 (a) The Contractor(s) is/are to set out the whole of the works in conjunction with an officer to be deputed by the CMO/ CMO and during the progress of the works to amend on the requisition of the CMO/ CMO any errors of which may arise therein and therein and provide all the necessary labour and materials for so doing. The contractor(s) is/are to provide all plant, labour and materials (with the exceptions noted in the schedule attached) which may be necessary and requisite for the works. All materials and workmanship are to be the best of their respective kinds. The contractor(s) is/are to leave to works in all respects clean and perfect at the completion thereof.
- 2(b) All inspection charges will be payable by the Contractor.
3. Complete copies of the drawings and specification signed by the CE, UADD are to be furnished by him to the contractor(s) for his/their own use, and the same or copies thereof are to be kept on buildings incharge of the Contractor(s) agent who is to be constantly kept on the ground by the contractor(s) and to whom the instructions can be given by the CMO. The Contractor(s) is/are not to sublet the works or any part thereof without the consent in writing of the competent authority
4. The Engineer in Charge/CMO is to have at all times access to the works which are to be entirely under his control. He may require the contractor(s) to dismiss any person in the Contractor(s) employ upon the works that may be incompetent or misconduct himself and contractor(s) is/are forthwith to comply with such requirements.
5. The Contractor(s) is/are not to vary or deviate from the drawings or specifications or execute any extra work of any kind whatsoever unless upon the authority of CMO to be sufficiently shown by any order in writing by any plan or drawings expressly given and signed by him as an extra or variation or by any subsequent written approval signed by him. In cases of daily labour all vouchers for the same are to be delivered to the Engineer in Charge/CMO or the Officer-In-charge at least during the

week following that in which the work may have been done and only such day work is to be allowed for as such as may have been authorized by the CMO to be so done unless the work cannot from its character be properly measured and valued. The drawings in respect of which this contract is drawn up provide for a minimum depth of foundations for good soil. Any extra depth will not be measured as an extra when the foundation trenches have been opened up and will not be paid for in addition to the sum contracted for the completed work.

6. Any authority given by the CMO for any alterations or additions in or to works is not to vitiate the contract, but all additions, omission or variations made in carrying out the works are to be measured and valued and certified by the Engineer in Charge/CMO and added to or deducted from the amount of the contract, as the case may be, at rates in force in the CGPWD/UADD/CGPHED/CGPWD Department. In such cases in which rates do not exist, the CMO/Engineer in Charge of concerned Division office/ULB will fix the rates to be paid.
7. All work and materials brought and left upon the ground by the Contractor(s) or his/their orders for the purpose of forming part of the works are to be considered to be the property of Nagar Panchayat and the same are not to be removed or taken away by the Contractor(s) or any other without the special license and consent in writing of the CMO of ULB is not to be in any way answerable for any loss or damage which may happen to or in respect of any such work or materials either by the same being lost or stolen or injured by weather or otherwise.
8. The CMO has full power to require the removal from the premises of all materials which, in his opinion, are not in accordance with the specification and in case of default the CMO is to be at liberty to employ other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The CMO is also to have full power to require other proper materials to be substituted and in case of default the CMO may cause the same to be supplied and all costs which may attend such removal and substitution are to be borne by the contractor(s).
9. If in the opinion of the Engineer in Charge /CMO any of the works are executed with improper materials or defective workmanship, the contractor(s) is/are when required by the CMO forthwith to re-execute the same and to substitute proper materials and workmanship and in case of default of the contractor (s) is so doing within a week the CMO is to have full power to employ other persons to re-execute the work and the cost thereof shall be borne by the contractor(s).
10. Any defects, shrinkage or other faults which may appear within 12 months performance period, from the completion of the work arising out of defective or improper materials or workmanship are upon the direction of the CMO/ Engineer in Charge to be amended and made good by the contractor(s) at his/their own cost unless the CMO/ Engineer in Charge shall decide that he/they ought to be paid for the same and in case of default the CMO may recover from the contractor(s) the cost of making good the works.
11. From the commencement of the works to the completion of the same they are to be under the contractor's(s) charge. The contractor(s) is/are to be held responsible for and to make good all injuries, damages and repairs, occasioned or rendered necessary to the same by fire/ Natural Calamity or other causes and they are to hold the Nagar Panchayat/Govt of C.G harmless from any claims for injuries to persons or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractor(s) or any one in his/their employ

during the execution of the works

12. The CMOs to have full power to send workmen upon the premises to execute fittings and other works not included in the contract for whose operation the contractor(s) is/are to afford every reasonable facility during ordinary working hours, provided that such operations shall be carried in such a manner as not to impede the progress of the work included in the contract but the contractor(s) is/are not to be responsible for any damage which may happen to or be occasioned by any such fittings or other works.
13. The works comprised in this tender are to be commenced immediately upon receipt of order of commencement given in writing by CMO. The whole work, including all such addition and variations as aforesaid (but excluding such, if any, as may have been postponed by an order from the CMO) shall be completed in every respect within **24 months** from the reckoned date (The period will be reckoned from the 15 days after the date of Work order in case of completion period is up to six months and 30 days in case of completion period is more than six months). The work shall throughout the stipulated period of contract be proceeded with all due diligence, keeping in view that time is the essence of the contract. The contractor shall be bound in all cases, in which the time allowed for any work exceeds one month, to complete 1/8th of the whole work before 1/4th of the whole time allowed under the contract has elapsed, 3/8th of the work before 1/2 of such time has elapsed and 3/4th of the work before 3/4th of such time has elapsed. In the event of the contractor failing to comply with the above conditions, the CMO shall levy on the contractor, as compensation an amount equal to: 0.5% (zero-point five percent) of the value of work (contract sum) for each week of delay, provided that the total amount of compensation under the provision of the clause shall be limited to 6% (six percent) of the value of work. (Contract sum)

Provided further that if the contractor fails to achieve 30% (thirty percent) progress in 1/2 (half) of original or validly extended period of time the contract shall stand terminated after due notice to the contractor and his contract finalised.

If the contractor shall desire an extension of time for completion of work on the ground of his having been "UNAVOIDABLY" hindered in its execution or on any other ground, he must apply giving all and complete details of each of such hindrances or other causes in writing, to the CMO positively within 15 days of occurrence of such hindrance(s) and seek specific extension of time (period from.....to.....). If in the opinion of CMO, such reasonable grounds are shown, the CMO shall himself grant extension of time, if the extension of time sought by the contractor is for one month or 10% (ten percent) of the stipulated period of completion, whichever is more. If the extension of time sought is more than above period mentioned, then the CMO shall refer the case to the Superintending Engineer with his recommendation and only after his decision in this regard, the CMO shall sanction extension of such time as decided by the Superintending Engineer.

Once the CMO has decided the case of extension of time with reference to the particular application of the contractor, it will not be competent for them to review/change such a decision later on. However, the Superintending Engineer of the concerned Division, UADD shall give the contractor an opportunity to be heard (orally and or in writing), before taking any final decision either of granting extension of time or permitting the contractor to complete the work by the delayed date or before refusing both.

Provided further where the CMO has recommended grant of extension of particular time of the contract or has refused to recommend extension of time but has

recommended permitting the contractor for delayed completion, the contractor shall continue with the work till the final decision by Superintending Engineer of the concerned zone.

Failure on the part of the contractor for not applying extension of time even within 30 days of the cause of such a hindrance, it shall be deemed that the contractor does not desire extension of time and that he has "Waived" his right if any, to claim extension of time for such cause of hindrance.

Once the CMO has heard (oral and or in writing) the contractor on this subject matter of extension of time and if CMO/Superintending Engineer fails to communicate his decision within a period of 30 days of such hearing, it shall be deemed that the contractor has been granted extension of time for the period as applied by him. Provided that the Contractor(s) shall not be entitled to any extension of time in respect of the extra work involved in the extra depth of foundation mentioned clause 5.

13.1 Compensation Events for consideration of extension of time without penalty: -

The following mutually agreed Compensation Events unless they are caused by the contractor would be applicable;

- (a) The CMO does not give access to a part of the site.
- (b) The CMO modifies the schedule of other contractor in a way, which affects the work of the contractor under the contract.
- (c) The CMO orders a delay or does not issue drawings, specification or instructions /decisions/approval required for execution of works on time.
- (d) The CMO instructs the contractor to uncover or to carry out additional tests upon work, which is then found to have no defects.
- (e) The CMO gives an instruction for additional work required for safety or other reasons.
- (f) The advance payment and or payment of running bills (complete in all respect) are delayed.
- (g) The CMO unreasonably delays issuing a Certificate of Completion
- (h) Other compensation events mentioned in contract if any

14. Action when the work is left incomplete abandoned or delayed beyond the time limit permitted by the CMO:

- (i) The CMO may terminate the contract if the contractor causes a fundamental breach of the contract.
- (ii) Fundamental breach of contract shall include, but not be limited to, the following: -
 - a) The contractor stops work for four weeks, when no stoppage of work is shown on the current programme or the stoppage has not been authorised by the CMO.
 - b) The CMO gives notice that failure to correct a particular defect is a fundamental breach of contract and the contractor fails to correct it within reasonable period of time determined by the CMO in the said notice.
 - c) The contractor has delayed the completion of work by the number of weeks [12 (Twelve) weeks] for which the maximum amount of compensation of 6% of contract sum is exhausted.
 - d) If the contractor has not completed at least thirty percent of the value of construction work required to be completed in half of the completion period (Including validly extended period if any).
 - e) If the contractor fails to appoint the technical staff and if appointed do not function properly for 4 weeks even after due written notice by the CMO.
 - f) If he violates labour laws.

g) Any other deficiency which goes to the root of the contract Performance

(iii) 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.

(iv) The Engineer in Charge shall cause recording and checking of measurements of all items of work done (taking in to account quality and quantity of items actually executed) and prepare the final bill after adjusting all pervious outstanding dues. Such recording of measurements shall be done after due notice regarding time and date of recording measurement and directing the contractor to either remain present himself or his authorised representative so as to satisfy himself that the recording of measurement is just and proper. Failure on his parts either to attend and or refusing to acknowledge the measurement so recorded in the department measurement book, shall be at his sole risk and responsibility.

The CMO shall forfeit the earnest money and or security deposit and further recover/deduct/adjust a compensation @ 10% (ten percent) of the balance value of work left incomplete either from the bill, and or from available security/performance guarantee or shall be recovered as "Arrears of land revenue"

15. Deleted

16. A certificate of the CMO or an award of the referee hereinafter referred to, as the case may be showing the final balance due or payable to the contractor(s) is to be conclusive evidence of the works having been duly completed and the contractor(s) is/are entitled to receive payment of the final balance, but without prejudice to the liability of the contractor(s) provision of clause 10.

17. **ARBITRATION CLAUSE:** Except as otherwise provided in this contract all question and dispute, relating to the meaning of the specifications designs, drawings and instructions herein before mentioned and as to thing whatsoever, in any way, arising out of or relating to the contract, designs, drawings, specifications, estimates, concerning the works, or the execution or failure to execute the same, whether arising during the progress of the works or after the completion abandonment thereof shall be referred to the CMO shall give his written instructions and/or decisions within a period of 60 days of such request. This period can be extended by mutual consent of the parties.

Upon receipt of written instructions or decisions, the parties shall promptly proceed without delay to comply such instruction or decision, If the CMO fails to give his instructions or decisions in writing with in a period of 60 days or mutually agreed time after being requested or if the parties are not satisfied with the decision of the CMO, they may within 60 days refer and appeal to the Competent Authority appointed by State. who shall afford an opportunity to the parties of being heard and to offer evidence in support of his appeal. The Competent Authority appointed by State will give his decision within 90 days. If any party is not satisfied with the decision of the Competent Authority appointed by State, he can, refer such dispute for arbitration governed as per "The Chhattishgarh Madhyastha Abhikaran Raipur"

18. If at any time before or after the commencement of the work, CMO shall for any reason whatsoever: -

18.1 Cause Alterations, omissions or Variation in the drawings and specification involving any curtailment of the works as originally contemplated; OR

18.2 Not required the whole of work as specified in the tender to be carried out,

The contractor(s) shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he/they might have derived from the execution of the work in full as specified in the tender but which he/they did not derive in consequence of the curtailment of the works by reason of alterations, omissions or variations or in consequence of the full amount of the work not having been carried out.

But the contractor(s) shall be entitled to compensation for any loss sustained by him/them by reason of his/their having purchased or procured any materials or entered into any engagements or made any advances to labour or taken any other preliminary or incidental measures on account of or with a view to the Execution of the works or the performance of the contract.

19. Death or permanent invalidity of the contractor-If the contractor is an individual or a proprietary concern, partnership concern, dies during the currency of the contract or becomes permanently incapacitated, where the surviving partners are only minors the contract shall be closed without levying any damages/ compensation as provided for in clause 14 of the contract agreement. However, if the competent authority is satisfied about the competence of the surviving, then the competent authority shall enter into a fresh agreement for the remaining work strictly on the same terms and conditions, under which the contract was awarded.

Dated: Signature of the Contractor

**Chief Municipal
Officer
Nagar Panchayat Bhakhara
DISTRICT-DHAMTARI (CG)**

Annexure- "A"

Model Rules relating to Labour, Water Supply and Sanitation in Labour Camps

NOTE:

These model rules are intended primarily for labour camps which are not of a permanent nature. They lay down the minimum desirable standard which should be adhered to standards in permanent or semi permanent labour camps should not obviously be lower than for temporary camps.

LOCATION:

The camp should be located in elevated and well drained ground in the locality. Labour huts to be constructed for one family of 5 persons each. The layout to be shown in the prescribed sketch.

HUTTING:

The huts to be built of local materials. Each hut should provide at least 20 sqm of living space.

SANITARY FACILITIES:

Latrines and urinals shall be provided at least 15 mtrs away from the nearest quarters separately for men and women and specially so marked in the following scale.

LATRINES:

Pit provided at the rate of 10 user of families per seat. Separate are required as the privacy can also be user for this purpose.

DRINKING WATER:

Adequate arrangements shall be made for the supply of drinking water. If practicable filtered and chlorinated supplies shall be arranged when supply is from intermittent sources over head storage tank shall be provided with a capacity of five liters a per son per day. Where the supply is to be made from a well it shall conform to the sanitary standard laid down in the report of the rural sanitation committee. The well should be at least 30 meters away from any latrine or other source of pollution. If possible, the and pump should be installed for drawing the water from well. The well should be effectively disinfected one every month and the quality of the water should be got tested at the Public Health Institution between each work of disinfecting.

BATHING AND WASHING:

Separate bathing and washing plan shall be provided for men and women for every 25 persons in the camp. There shall be one gap and space of 2 sq. for washing and bathing Proper drainage for waste water should be provided.

WASTE DISPOSAL:

Dustbin shall be provided at suitable places in camp and the residence shall be directed to throw all rubbish into those dustbins. The dustbin shall be provided with cover. The contents shall be removed every day and disposed off by trenching.

MEDICAL FACILITIES:

a) Every camp where 1000 or more persons reside shall be provided with whole time doctor and dispensary. If there are women in the camp a whole time Nurse shall be employed.

b) Every camp where less than 1000 but more than 250 persons resides shall be provided with a dispensary and a part time, Nurse/Midwife. If there are less than 250 persons in any camp a first aid kit shall be maintained in charge of whole-time persons trained in first aid. All the medical facilities mentioned above shall be for the all residents in the camp, including a dependent of workers, if any, free of costs. For each labour camp there should be qualified sanitary inspector and sweepers should be provided in the following scales: -

For camps with strength over 200 but not exceeding 500 persons - One sweeper for every 75 persons above the first 200 for which 3 sweepers will be provided.

For camps with strength over 500 persons - One sweeper for every 100 persons above first 500 for which 6 sweepers should be provided.

Annexure- "B"

Contractors Labour Regulations

The contractor shall pay not less than fair wage to labours engaged by him in the work:

EXPLANATION:

- A. "FAIR WAGES" means whether for time of piece work as notified on the date of inviting tenders and where such wages have not been so notified the wages prescribed by the competent authority for division in which the work is done.

The contractor shall, notwithstanding the provision of any contract to the contrary, cause to be paid a fair to labours indirectly engaged on the work including any labour engaged by his sub-contractor in connection with the said work as if labourers had been immediately employed by him.

In respect of all labour directly or indirectly employed on the works or the performance of his contract, the contractor shall comply with or cause to be complied with the labour Act. Enforce.

The CMO/Assistant Engineer shall have the right to deduct from the money due to the contractor any sum required or estimated to be required for making good, the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of the workers non payment of the wages or of deductions made from his or their wages which are not justified by their terms of contract or non-observance of regulations.

The contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity form his sub-contractor.

The Regulations aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this conduct.

The contractor shall obtain a valid license under the contract (Regulation & Abolition) Act, in force and rule made there under by the competent authority from time to time before commencement of work and continue to have a valid license until the completion of the work.

Any failure to fulfill this requirement shall attract the penal provisions of this contract arising out of the resulted non execution of the work assigned to the contractor.

Special Additional Condition: -

- Cess@1% (one percent only) shall be deducted at source, from every bill of contractor by ULB under "Building and other Construction for workers welfare, cess Act-1996"

It is mandatory for the contractor(s) to get him self/them selves registered with "Chhattisgarh Building and other Construction Welfare Board" for work amounting to Rs. 10.00 Lacs (Ten Lacs) and above and enclose a true copy of such registration certificate within one month of award of contract.

Annexure-"C": Form of Income Tax Clearance Certificate

Not required

ANNEXURE – “D”

Statement showing the Lead of Materials

S.No.	Description	Lead
1.
2.
3.
4.
5.

Note - This statement is only for guidance of the contractor. The tenderer should satisfy himself regarding the availability of the required quality and quantity of materials.

ANNEXURE - “E”
SCOPE OF WORK & TECHNICAL SPECIFICATIONS

Scope of Work: -The entire scope of work involves, but not limited to followings: -

1. Major components of water supply scheme are shown under table below: -

Sr. No.	Components	Details
1)	Source of water	Surface water from Canal
	Details of Head works	
2)	Sump well cum Pump house including all allied works	Surface water from Canal Capacity – 200KL Dia-8m dia
	Details of Connecting Main	
3)	Proposed Raw water pumping Main Proposed Sump well to Proposed WTP	Total length DI-K-9 Dia-250 mm- 11674m
	Details of Raw Water Pumping Machinery	
4)	Proposed Raw Water Pumping Machinery and Substation	VT Pumps set -3nos (2W+1S) Discharge of each pump-55960LPH Head of each pump-15 m Pumping Hours-22 hrs Substationfor Intake-100 KVA with (1W+1S) Transformers including all allied works
	Details of Water Treatment Plant	
5)	Rehabilitation of Water Treatment Plant	Existingconventionalwater treatment plant of capacity 2.0 MLD with clear water sump and Pump houseand all other allied works
	Details of Clear Water Pumping Machinery	
7)	Proposed Clear Water Pumping Machinery	For WTP HSC pumps set-3nos (2W+1S) Discharge of each pump-80454.5 LPH Head of each pump-40 m Pumping Hours-22 hrs

Sr. No.	Components	Details
	Details of Clear Water Pumping Mains	
8)	Proposed Clear Water Pumping Main from Proposed WTP to OHSRs(proposed and Existing)	Total length DI-K-9-5899.00 m Dia-150 mm- 3975 m Dia-200 mm- 218 m Dia- 250 mm-1706 m
09)	Details of Over Head Service Reservoirs (OHSR) Existing and proposed	1Nos(Proposed) and 6nos Existing
1	Ward-15 (proposed)	Capacity – 160 KL Staging Height –20 m Material-RCC
2	Ward-1(Existing)	Capacity – 220 KL Staging Height –15 m Material-RCC
3	Ward-14(Existing)	Capacity – 200 KL Staging Height –18 m Material-RCC
4	Ward-8(Existing)	Capacity – 150 KL Staging Height –15 m Material-RCC
5	Ward-8(Existing)	Capacity – 100 KL Staging Height –12 m Material-RCC
6	Ward-2 (Existing)	150 KL 12 Staggering Staging Height –12 m Material-RCC
7	Ward-7 (Existing)	200 KL 21 Staggering Staging Height –21 m Material-RCC
10)	Details of Distribution Network	
(i)	Proposed Distribution Network	Total length DI-K-7-3540 m Dia-100 mm- 3140 m Dia-150 mm- 400 m
(ii)	Existing Distribution Network	Total length DI-K-7-18466 m
	Details of House Service	

Sr. No.	Components	Details
	Connections and water meters	
11)	House Service Connections along with allied works	115 Nos.
12)	Dismantalling of Unservicable OHT	1 No 200 KL, 15 m Staggering
13)	Construction of Panel Room At OHT	07 Nos with Allied Works
14)	PLC & SCADA	For Complete existing and Proposed water supply scheme

1. Engineering, Procurement, Construction, testing and commissioning of all components as mentioned above in scope of works and other allied/associated works required for successful completion of Augmentaion of water supply scheme at Bhakhara including 3 months trial run and 9months O&M,thanafter 12 months Defect Liability period
2. **Trail run period is three months and after O&M period nine months.Defect laibility period will be 12 months after successful completion of agreement i.e,after expiry of O&M period.**
3. The bidder/s is/are particularly advised to inspect the site(s) of work by making prior appointment with Engineer in Charge/CMO,Nagar Panchayat, so as to acquaint himself with regard to the nature and conditions of sites/works, conditions of access and all other cognate matters concerning the execution, successful completion commissioning,O&M of the whole scheme. When a contractor submits his bid for this work, it will be considered that he has acquainted himself with full and complete knowledge of the site. prevailing conditions etc, and no claim or extra charges consequent on misunderstanding or otherwise will be allowed and no additional compensation shall be entertained whether he actually inspects the site or not. Any items/components which may not be mentioned in the tender document/scope of work, but are necessarily required for successful commissioning of the Plant/system with desired outputs and complete functions in all respects will be deemed to inclusive in quoted cost by the bidder and nothing extra shall be paid by ULB. In this connection, bidders have to provide declaration as per Appendix-14 along with bids; otherwise, their bids will be disqualified.
4. The rates quoted by the bidder shall be the 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 and successful commissioning of the entire scheme including surveying, setting out, plant, labour, supervising, materials, carriage of materials from source to site, erection, maintenance, insurance, profit, taxes and duties together with all general risks liabilities and obligations set out or implied in the Contract. The Charge for any obligation of the Contractor for proper/satisfactory completion of work for which apparently no corresponding item is given in the scope of work/ Bills of Quantities/Price or Payment Schedule shall be deemed to be included. No extra payment shall be made.

5. Contractor shall arrange at his cost for the space required for storage of the materials, equipments and pipes, specials and valves etc supplied for transmission and distribution networks along with its watch and ward.
6. Extra safety precautions must be ensured during construction/laying/erection and O&M period, so as to avoid any damage/theft/hampering to any existing infrastructures, utilites, and materials procured, completed /under completion structures/pipelines etc. In case of any damage/theft/hampering to any of them contractor shall solely be held responsible for it and the rectification of the defects will be carried out on the risk and cost of contractor only. Decision of Engineer in Charge/CMO of concerened ULB about rebuilding / rectification depending upon the quantum of damage occurred will be deemed as final and the contractor has to abide by the instructions with no extra financial implication to the department.
7. The Contractor shall provide, construct and maintain at his own expense the site office (at WTP/INTAKE), material testing laboratory, stores and shall make his own arrangements for water, sanitation, access roads, electrification and cleanliness required for proper and efficient execution of work. The site offices should be suitable for accomadating ULB and PMC or any representaitives of CMO Nagar Panchayat for monitoring the progress of the project work. The site offices should be with attached toilet and sanitary holding tank along with one attendant and a sweeper. Room should be able to accommodate 3to 5 persons and equipped with office furniture (table, chair, file rack, almirah), computers with printer with internet connection, electricity (light, fan etc.), AC,water, sanitary facilities etc and as per the direction of Engineer in Charge.
8. The Contractors will have to make their own arrangements for drawing electric power from the nearest power line after obtaining permission from the Chhatisgarh State Electricity Board at his own cost. In case of failure of electricity, the Contractor has to make alternative arrangements for supply of electricity by Diesel Generator sets of suitable capacity at place of work. If the supply is arranged by the Department / Authority, necessary Tariff rates shall have to be paid based on the prevailing rates. The contractor will pay the bills of Electricity Board for the cost of power consumed by him. The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act 1910 and under rule –45(I) of the Indian Electricity Rules, 1956 as amended from time to time and other pertinent rules
9. The contractor shall provide at his own cost all materials, machinery, tools & plants as require for completion of work. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement or examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the

expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

10. TECHNICAL SUPERVISION: -

The Contractor is requiring to ensure the compliances on account deployment which shall take place immediately after the commencement of work. Prior to deployment the CVs of all key/technical personels shall be submitted for the approval to Engineer in Charge with a copy to PMC. Only after obtaining the approval the staff shall be mobilised.

The technical staff should be available at site whenever required by the CMO to give instructions. In case the contractor fails to employ a Graduate Engineer as aforesaid Deptt. shall have the right to take suitable remedial measures. The contractor should give the names and other details of the Graduate Engineer/Diploma holder Sub-Engineers when he intends to employ or who is under employment, before he commences the work. The contractor should give a certificate to the effect that the Graduate Engineer is exclusively in his employment.

It is not necessary for the contractor (or partner in case of firm/company) who is himself an engineer to employ engineer for the supervision of the work so long as the Contractor/partner works similar to what would have been done by and Employed Engineer.

The retired Engineer who is holding Diploma in Civil Engineer or a Diploma holder having 5 years or more experience will be treated as Graduate Engineer.

Position	Numbers	Professional Qualification	Total Experience years	In similar works (years)	Experience of similar works in the present position (Years)	Requirement of Staff
	Minimum	Minimum	Minimum	Minimum	Minimum	
Project Manager	1	BE in Civil/Public Health/Environment	15 years	10 years	05 years	Full time
Quantity Surveyor cum billing	1	BE in Civil Engineer	10 years	07 years	03 years	Full time
Mechanical Engineer	1	BE in Mechanical Engineer	05 years	03 years	02 years	On need basis
Electrical Engineer cum Instrumentation	1	BE in Electrical/Instrumentation Engineer	05 years	03 years	02 years	On need basis

Quality Control Engineer	1	BE in Civil Engineer. (The applicant must possess complete knowledge of QA/QC, BIS and relvent IS codes)	05 years	03 years	02 years	Full time
Supervisory Staff						
Safety Engineer	2	Degree in relvent field	05 years	03 years	02 years	Full time
Site Engineer	5	BE/Diploma in civil	05 years	03 years	02 years	Full time
Supervisors	3	Diploma/ITI	03 years	02 years	01	Full time

The above-mentioned list for technical person requirements, Positions Qualification & Experience are indicative. Engineer-in-Charge/Nodal Officer/CMO Nagar Panchayat can increase/reduce the above list as per actual requirements at project.

In case of the contractor fails to employ the desired technical staff as aforesaid, the department has liberty to deduct an amount of Rs 50,000/- per month from Contractor's running bills for the period the Enginner/Staff is not deployed.

11. LEAD AND LIFT FOR WATER-

The contractor shall make his own arrangement for supply of water for construction, testing and other purposes. No lead and lift for water will be paid.

12. LEAD AND LIFT OF MATERIALS-

No lead and lift for any material will be paid. The tendered amount should be inclusive of all lead and lift for the materials. The contractor should himself verify the lead of different materials before submitting his tender.

The contractor will have to arrange for the temporary electric connection at site of work at his own cost for dewatering, curing, vibrator, testing and internal and outside electric fittings, etc

13. DEWATERING-

The lump-sum offer shall include dewatering, bailing foundation water, river water and rain water if any, which shall be required to be done by the contractor at his own cost and for which no payment will be admissible under any circumstances. The tenderer shall assess the work of dewatering that may be required for execution of work and include in his lump- sum offer. No dewatering shall be payable separately under any circumstances whether natural, artificial or man-made.

14. CEMENT: -

The Contractor shall procure minimum 43 grade, unless otherwise stated separately confirming to BIS Specifications, ordinary Portland cement, as required in the work only from the manufacturers as per approved make list provided in the tender document, and they must have production capacity of one million tones per annum or more, and as approved by Employer,

Ministry of Industry, Government of India and holding license to use BIS certification mark for their product, whose name shall be got approved from Engineer-in-Charge. Supply of cement shall be taken either in silos or in 50 kg bags bearing manufacturer's name and BIS marking. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. Cost of such tests shall be borne by the contractor. In case test results indicate that the cement arranged by contractor does not conform to be relevant BIS codes the same stand rejected and shall be removed from the site by the Contractor at his own cost within one week time of written order from the Engineer-in-charge.

The cement shall be brought at site in bulk supply of approximately 50 tonnes from the manufacturer direct, or as decided and approved by the Engineer-in-charge, as the case may be.

The cement godown of the sufficient capacity should be constructed by the contractor and at all time it should have a stock of minimum of 2000 bags. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-Charge at any time. Storage of cement shall be as per CPWD specification.

Cement brought at site and cement remaining unused after completion of work shall not be removed from site without written permission of Engineer-in-Charge.

15. Approval of Designs & Drawings:

All design calculation & detailed drawing of all components (Electrical, Mechanical, automation, instrumentation and Structural etc) of the project shall be got approved by Govt. Engg College in Chhattisgarh/National Institute of Technology [NIT], Indian Institute of Technology IIT at the cost of contractor and then submitted to ULB for approval and the ULB will follow the necessary procedures for approval as directed by the competent authority.

Concrete Design Mix to be used shall be got designed by Govt Engineering College, C.G./National Institute of Technology [NIT], keeping in mind the **Target Mean Strength** as per **clause 9.2 of IS-456[2000]**.

Clause 9.2.2 of IS-456[2000]: The mix shall be designed to produce grade of concrete having the required workability & a characteristic strength not less than appropriate values given in Table -2. The Target Mean Strength of Concrete Mix should be equal to characteristic strength plus 1.65 times the Standard Deviation.

Ready Mixed Concrete: The contractor shall use Ready Mixed Concrete prepared at established Concrete Batching & Mixing Plant. Batching and Mixing Plant with a minimum 20 cum/hour capacity shall be used to comply with the compressive strength criterion given in clause 16 of IS-456[2000].

Clause 16 ACCEPTANCE CRITERIA of IS-456[2000]:-

16.1 Compressive Strength: --

The concrete shall be deemed to comply with the strength requirements when both the following condition are met:

- a. The mean strength determined from any group of four consecutive test results compiles with the appropriate limits in col 2 of Table 11 of IS-456—2000.
- b. Any individual test result complies with the appropriate limits in col 3 of Table I of IS-456-2000).

The contractor can use RMC OR mixing of concrete can be done in a mechanical mixer (proportioning of aggregates to be used shall be done using a weigh batcher at site) as per the site conditions on prior approval of Engineer- In –in-charge.

After written order to commence the work, contractor; will have to submit the all details, design and drawings of the entire components including allied works within 75 days from the written order regarding acceptance of his offer.

16. Accident -Hoardings - Lighting Observations:

When there is any Likelihood of accidents, the contractor shall comply with any requirements of law on the subject, and shall provide suitable hoarding, lighting and watchman as necessary or directed by Engineer-in charge.

It shall be contractor's sole responsibility to protect - the public and his employees against accident from any cause and he shall indemnify ULB against any claims for damages for injury to person or property, resulting, from any such accidents; and shall where the provision of the workmen's compensation Act apply, take steps to properly insure against any claims there under.

On the occurrence of an accident which results in the death of any of the workman employed by the contractor or which is so serious as to be likely to result in the death of any such workman, the contractor shall, within 24 hours of the happening of such accident, intimate in writing to ULB /Police the facts of such accident. The contractor shall indemnify ULB against all losses or damage sustained by ULB resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by ULB as consequence of failure to give notice under the Workmen's Compensation Act.

In the event of an accident in respect of which compensation may become payable under the workman's compensation act VIII of 1923 whether by the contractor or by the Government as principal it shall be lawful for the Engineer-in-Charge to entertain out of monies due and payable to the contractor such sum or sums of money as may in the opinion of the said Engineer-in-Charge be sufficient to meet such liability. The opinion of ULB shall be final in regard to all matters under this clause.

17. HYDRAULIC TESTING

3% amount shall be withheld from each bill for hydraulic testing of pipeline work and shall be released after successful hydro static testing of that particular section of Pipeline.

18. USE OF DI FITTINGS:

Provision of laying & jointing of DI fittings P.N. 1.6 conforming to IS: 9523:2000 duly inspected and approved by RITES/IRCLASS as per tender. DI specials shall be manufactured as per IS: 9523 and shall be ISI marked. In case of flanged joints, the flanges shall be at right angles to the axis of the pipe machined on the face. The bolt-hole circle shall be concentric with the bore and bolt holes shall be located off the centre lines as per IS: 9523. Fittings shall be tested as per IS: 9523.

19. HINDRANCE FREE ALIGNMENT OF PIPELINE ETC:

ULB will provide hindrance free alignment. The bidders should inspect the whole alignment and should make himself conversant with site conditions, strata, nallah crossings, road crossings, railway crossings, canal crossings etc completely at his own cost. Nothing extra shall be paid by the ULB.

20. DEPTH OF EXCAVATION FOR LAYING OF PIPELINE:

The crown of the pipeline will be kept minimum 1.0 m below the firm GL.

21. Order of Priority: -

- i. Specifications as per NIT
- ii. Specifications as per SOR
- iii. Specifications mentioned in CPHEEO manual 1999 (including current revision) for various water supply and treatment Components.
- iv. Relevant IS codes.

22. STATUS OF ENVIRONMENTAL CLEARANCE:

Since this being a Water Supply Project involves neither displacement /rehabilitation of people nor any pollution of water body, hence no Environmental Clearance is required.

23. VALVES WITH ACTUATORS:

All the valves (Sluice, Butterfly and Gate Valves) shall be provided with electrically operated actuators from source up to outlet of OHSR including for By-Pass arrangement. The cost of providing & fixing electrically operated actuators compatible shall be inclusive in the Lumpsum offer.

24. LAYOUT PLAN OF WATER TRANSMISSION AND DISTRIBUTION NETWORK:

Location of valves marked on the L-section will be prepared by the contractor for the approval of Engineer-in-Charge

25. PERMISSION FOR INSTALLATION OF CONSUMER WATER METERS:

ULB will provide the permission for fixing of consumer water meters.

As regards the provision of HSC including the installation and commissioning of consumer water meters the onus lies on department to provide the site to the contractor. In case six months after the completion of the entire Lump Sum Contract work except the provision of HSCs the ULB fails to hand over the balance complete site of HSCs to the contractor, the contractor is at liberty to apply for extension of PDC(probable date of Completion) or he can request for determination of the contract.

26. PREPARATION OF GIS BASED MAP:

Contractor has to prepare a entire layout plan of indicating the complete integrated water supply scheme including canal/river intake works, raw water sump-cum pump house, WTP, GLSR and all OHSRs (existing and proposed) , pumping stations, all rising mains, gravity feeders , distribution network (existing and proposed) including all Bulk Flow meters, FVC, pressure gauges & valves etc on GIS platform. This will be put on the web site of the ULB and monthly updated indicating the progress achieved.

27. GENERAL REQUIREMENTS FOR BUILDING WORKS: -

Unless otherwise specified, all the building works shall generally comply with the following Employer's Requirements:

(a) All buildings shall have reinforced concrete framework.

(b) 75 mm thick PCC Damp Proofing Course in M15 shall be provided to all building walls.

28. TOPOGRAPHIC SURVEY: -

The contractor will carry out the Topographic survey work by using Total station or DGPS/any latest technology of the entire site where the intake, raw water sump cum pump house, proposed and existing WTP's, existing & proposed OHSRs and proposed raw water and clear water rising main and proposed water distribution network are required to be constructed/laid. This is mandatory to confirm the levels and the lengths. Only after this exercise is carried out, contractor should prepare the detailed drawings, plans of Distributions networks, Lsections of pumping mains/Gravity mains.

29. PROCUREMENT OF PIPES & VALVES:

Contractor shall take written procurement clearance for the specified quantities of pipes, valves, specials etc from Engineer-in-Charge before taking procurement action. The payment shall be made for the actual work executed. In case secured advance is granted the materials which are not used in the work, the recovery of secured advance will be recovered from upcoming RA Bill/Final bill of the Contractor.

30. CONSUMER WATER CONNECTION:

a) Length of pipe to be provided for each consumer water connection is 6m upto the property

line. Variations if any arises shall be payable/deducted as per Clause 6 of conditions of contract.

- b) Road breaking and its reinstatement will be carried by the contractor as per tender.
- c) Reinstatement of floor/surface for provision of HSC connection will be done with PCC.
- d) Number of Specials/ compression fittings as required shall be provided by the contractor

31. **INTERCONNECTIONS OF RISING MAINS AND DISTRIBUTION PIPELINE:-**The Contractor is expected to visit the site of work and make his own assessment of quantum of work required to be carried out. Further before actual implementation of work the drawing of interconnections will have to be got approved from the Engineer-in-Charge. The interconnections of rising mains of all OHSRS (existing and proposed) with the distribution mains (Interconnection of all the Existing & New Pipeline as per direction of Engineer Incharge) is included in the scope of work of this Contract. Bidder's Lump sum offer shall be all inclusive and no extra payment shall be made.

32. **INTERIOR LIGHTING AND RECEPTACLES IN PUMP HOUSE & WTP:**

Each panel shall be provided with a LED lighting fixture rated for 20 watts, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each panel section shall be provided with separate lighting.

33. **Installation of CCTV:** -During execution also, CCTV-Should be installed as per instructions of Engineer-in- charge at all structural units' access to view and monitor progress in real time for officials of (4 nos.) with provision of internet and software of recording / monitoring and or any other associated requirements. This shall be deemed to be included in the Lumpsum offer of the Contractor and nothing shall be paid extra.

34. **GIS :-**Digitization of satellite image includes collection of DGPS points of important level marks geo referencing of satellite image, creation of base map by interpretation & digitization from the satellite data creating road network, rivers, water bodies, building land use etc in different layer cleaning of digitized map topology building overlaying of water supply features such as pipes, nodes, valves, tanks, reservoirs, pump etc. generating unique ID's for each properties / features which has been mapped. Generation of hard copy plot for consumer survey / field survey work handing over the two sets of soft copies of maps created from satellite image in shape file format as per direction of Engineer-in charge.

35. Carrying out door to door consumer survey in order to collect identification details, socio economic characteristics details of consumers connection details of consumption of water usage, preparing database systems including all the attribute tables of consumers data, matching of consumer survey data with billing data, integration of consumer survey with GIS layer, showing coverage of water supply scheme on digitised map using different annotations, attaching the attribute tables to the point feature representing consumer in appropriate GIS software etc complete as per prescribed format as per direction Engineer-in charge and detailed specification etc complete.

36. For execution/laying of pipelines works, drawings (3 copies, A(Zero) size) need to be submitted by Contractor alongwith each RA bills, depicting (i) complete approved network (RED), (ii) Claimed till last RA bill (GREEN) (iii) Claiming in current RA bills (Blue) with one set of colored photos of each component/ laying restoration & barricading clicked Time Stamp (showing lat- log and real time. This deems to be included in the Lumpsum offer of the Contractor and nothing shall be paid extra.

ANNEXURE - “E-1”

SCOPE OF WORK AND SPECIFICATION FOR RCC SUMP WELLWITH PUMPHOUSE: -

The entire scope of work and technical Specifications involves, but not limited to followings: -

1. General: -

- 1.0 Engineering, procurement, construction, testing, commissioning, trailrun, DefectLiablity Period & Nine months operation & maintenance ofSump wellwith pump house including all other civil, structural, electrical, mechanical, SCADA, instrumentation, automation works etc
- 1.1 The job implies all works from preliminary investigation to the final commissioning of the structure including all ancillary works such as dewatering, bailing out of water, etc. all. The quoted lump sum offer shall be deemed to be included of all the cost required for successful installation and commissioning of all the electro-mechanical equipments along with any other required accessories. The department will not entertain any extra financial claim on account of extra items, it is solely the responsibility to bidder to ascertain that extra items required for successful commissioning of whole scheme and should include the rates in its quoted offer.
- 1.2 The tenderer is required to arrange complete construction of civil work, until the whole structure is handed over to the Nagar Panchayat. Testing will also have to be carried out at contractor’s cost and it will be the responsibility of tenderer to ensure that respective guarantees are achieved.
- 1.3 The Sumpwell is required to house vertical turbine pumps. Therefore, contractor should have adequate technical know-how to decide the arrangement of pumps installation concealed cabling and control panel etc. The contractor will have to carryout modification, addition and alteration in the design of structure to meet such requirements, if needed without causing any extra cost of Lump sum offer. He will therefore design the Sump well cum pump house in such a manner that it should meet the hydraulic requirements of pumps to be installed in it.
- 1.4 Preliminary investigation: -It will be necessary for the tenderer to depute technical personnel to visit the site and contact the office of the Engineer-in-charge to collect all relevant data for designing the entire construction work of said structure. However, the preliminary geological, hydrological and topographical details, taken by Department are as below: -
 - i. All permission shall be obtained from the repective department for required of construction.
 - ii. Geological data: -The Contractor has to take trial bore at the proposed site and the details of trial bore shall be submitted to ULB. On the basis of the trial bore data all the structural designs shall be prepared.
 - iii. All necessary surveys and investigations are in the scope of contractor and deemed to be included in its Lump sum offer.
- 1.5 Preparation of technical details: -The tenderer shall prepare the technical report for design and construction of the said work incorporating complete information, specification and data.

- 1.6 Tender drawing: -Succesful bidder shall have to submit an outline plan and section of the proposed work showing different components, arrangement of motors, panel boards, capacitors, remote control desk & cabling etc.

1.7 **Design data and specifications for design and construction of Sump well**
(For purpose of guidance)

1.	Details of Sump well cum pump House	:	Internal Dia -11.3m
2.	<u>Location of site</u>	:	
i	Name of river/canal	:	Rudri barrage left canal
3.	<u>Hydraulic data</u>		
ii	HFL	:	As per approved design
iii	Min W L	:	As per approved design
iv	River bed level	:	As per approved design
4.	<u>Important Levels :</u>		
i	Motor floor level	:	As per approved design
ii	Top slab level of Pump House	:	As per approved design
iii	Foundation level	:	As per approved design
5.	<u>Invert Levels of Inlet port:</u>		
i	Ist Inlet port	:	As per approved design
ii	IIInd. Inlet port	:	As per approved design
iii	IIIrd. Inlet port	:	As per approved design
6	<u>Minimum Dimensions</u>		
i	Inner Diameter of well	:	As per approved design
ii	Balcony at Discharge /Motor floor	:	1.2 m width
7.	<u>Minimum Head room at Various Floors</u>		
i	Headroom Motor floorto Roof	:	7 m
8.	<u>Minimum staining thickness</u>		
i	Upto discharge flow level	:	As per approved design
ii	Above DF Level	:	As per approved design
iii	RCC Column	:	As per approved design
9	<u>Design Loadings</u>		
i	<u>On discharge/Motor floor</u> Live load Concentrated load No. of delivery mains Common manifold Concentrated load of each motor No. of Motors	: : : : : :	1500 kg/sqm 4.0 T As per approved design As per approved design As per approved design 3 Nos.
ii	For stairs inside the well	:	500 kg/sqm
iii	For stair case from bridge to Motor floor	:	500 kg/sqm
iv	Gantry support	:	Minimum 2 Tones + Load of crane
iv	Roof slab of Sump Well	:	150 kg/sqm

v	For Approach Bridge		High level Bridge IRC Class “A” Loading + 250-300 mm dia Raw water pumping main made of DI K-9
10	<u>Seismic Zone:</u>	:	Zone-II Importance factor 1.5
11.	Mechanical items		
	(a) Inlet ports	:	D.I.D.F, class B as per IS:7181-1974 or CI Single flanged in case of RCC caisson or MS with minimum thickness 12 mm
	(b) Crane		
	1. Type	:	Single Girder, electrically operated Circular Traveling gantry
	2. Capacity	:	2 MT
	3. Operation level	:	Motor Floor
	(c) Mud Pumps	:	2 Nos (1W+1S)
	(d) Control valves on Inlet ports		
	1. Type	:	Sluice valves as per IS: 14846:2000
	2. Operational level	:	Discharge floor level
	3. class	:	PN 1.6
	(e) M.S Stariners		
	1. For 2 lowest inlet ports	:	The perforation area will be thrice the inlet area
	2. Top inlet port	:	The perforation area will be three times the inlet area.
12	Details of Opening and Gates		
	(a) <u>On Discharge floor/Motor floor</u>		
	1. For silt removal	:	As per approved design Sufficient opening for lowering/ removal of mud pumps shall be provided in discharge floor
	2. For stairs towards bottom of well	:	1.2 m x 2.50 m (Opening)
	3. For Pumps	:	As per approved design
	4. One gate towards approach bridge	:	3.00 m x 3.00 m x 1 No.
	5. For silt removal (with channel gate)	:	As per approved design
	6. For delivery main	:	As per approved design
	7. For material handling	:	As per approved design
	8. For Motors	:	
	(b) <u>Pump House</u>		
	1. For stairs	:	1.5 m x 2.40 m x 1 no.
	2. To watch flood	:	1.5 m x 2.40 x 1 No.
	3. Min. Opening area of windows and ventilators.	:	20% of floor area
	4. Opening for exhaust fans	:	4 nos.

Note: -

- Respective tender drawings should also be read/referred in Conjunction with scope of work, technical Specifications etc.
- All levels/details, design parameters as mentioned above and in Tender document, drawings etc are indicative and minimum only. Contractor has to verify the same actual from the site and concerned department before taking up detailed design of all components of project at his own cost.

2. Detailed scope of work: -

2.0 Location of Sump well: -The Sump well should satisfy pre and post flood/submergence conditions. Its successful functioning should be ensured at H.F.L. condition of source as well as at minimum draw down level.

2.1 Detail design: -After written order to commence the work, contractor; will have to submit the structural details, design and drawings of the entire structure including allied works within **75** days from the written order regarding acceptance of his offer. Contractor will also submit the arrangement for installation of vertical turbine pumping sets location of their starters, control panels, main switch boards, cable, PLC SCADA arrangements etc. Detail design will include calculations for the following components: -

- i. Design of Inlet ports to be provided in Sump well suitable for a flow of three times the Ultimate discharge at 0.6 m/s Velocity
- ii. Design of scour depth and stability of well
- iii. Design of foundation and bottom floor slab
- iv. Design of steining
- v. Designing of discharge/ motor floor, plan of delivery pipes and control valves.
- vi. Design of discharge / motor floor, for live load & load of pumping machinery & vibration due to pumps.
- vii. Design of Pump Foundation
- viii. Plan of motors location & panel boards, remote control desks etc.
- ix. Design of Pump house wall.
- x. Design of Gantry column and ring beam
- xi. Design of roof slab
- xii. Design of bearings
- xiii. Design of load test
- xiv. Design of stairs.
- xv. Design of Form work required for construction
- xvi. Design of roof slab
- xvii. Design of bridge pier
- xviii. Design of bridge foundations
- xix. Design of bridge abutment
- xx. Design of slab of approach bridge

Note: -Requisite total station survey will be carried out by contractor to verify above details & collect all water resources related data from EE WRD Division/Concerned Division on its own expenses. Nothing extra shall be paid by ULB.

2.2 The firms/contractors are directed to submit the detail designs, plan and elevation of complete structure showing the dimensions of all components and other details as per the specifications attached here. Detailed physical survey, sanitary survey, Hydrological survey, Geological investigation including trial bores for soil investigation / test for preparation of river cross section, fixing of HFL, structural design, approach bridge, coffer

dametc complete as directed by the Engineer-in-charge. Collection of data regarding design of complete item of Sump well from relevant department etc. all level will be with reference to mean sea level including following work: -

Preparation of Contour plan general arrangement drawing, layout of site, cross-section of site on proper scale as directed by the department.

Architectural/ Structural drawing having following items: -

Layout plan. Elevation, cross-section i/c details of cofferdam, Approach Bridge, Sumpwell, and different small element relevant to complete item of Sumpwell.

- 2.3 Drawings: - Detail working drawings each in 6 sets will be submitted for record of Department. The detail designs will also be submitted in three copies duly well bound. In addition to above drawings in 5 sets will be given to the Engineer-in-charge for the execution of the work. The responsibility for designs, constructions, structural stability and water tightness in all R.C.C. structure shall rest solely with contractor and nothing extra shall be paid by Department. The contractors shall have to submit four sets of completion drawings (As built) immediately after completion of work.

- 2.4 **Foundation of well:** -The foundation of Intake will be designed and constructed keeping in view the strata met in foundation, maximum scour depth, weight of superstructure, velocity forces, wind forces, live load of pumps, motors, pipes, dynamic forces due to vibrations of pumps, water thrust, seismic force, other live loads over structures, including uplift pressure etc. complete. The bottom plug will be capable of with standing up lift pressure when the water level is at invert level of top most inlet pipe and inside is empty. Any other forces required to be taken for safe design which are not mentioned here will also be taken into consideration for the design. The stability of Sump well will also be checked for seismic forces.

The foundation of the Sump well shall be kept below scour level. The depth of foundation should also be sufficient from consideration of bearing capacity, settlement, and suitability of strata at foundation level and stability of structure as a whole against overturning and sliding.

The scour depth shall be calculated from maximum discharge of river. The depth of scour for Sump well shall be taken as 2.0 times the mean depth of scour for the maximum discharge. The mean depth of scour shall be calculated from formula as given in IRC 78-1983. In case, if it is required to rest foundation on erodible strata, the depth of foundation below the scour line shall not be less than 1.2 m. In case of foundation resting on rock, the minimum embedment of foundation into rock below shall be 1.5 m in soft & 1.0 m in hard rock. The depth of embedment shall exclude that portion of rock which is weathered or fissured. The foundation shall be designed for worst combination of loads and forces. For laying foundation concrete under water, it shall be done by skip boxes or termite pipe. Pumping out of water shall not be permitted from the time of placing of concrete up to 72 hrsthereafter. The foundation of Sump well will be laid over lean concrete of minimum M20 concrete, 200 mm thick. The minimum grade of concrete used in structure will be Cement concrete M-30 and stresses in concrete will be taken from IS:3370.

Use of explosive will be avoided for foundation excavation which will be done by dropping heavy chisels. If at all breaking of rock is not possible by chisel only then explosive will be used with responsibility of contractors to no damage to surroundings existing structures.

On completion of Sump well above rock level, the annular space will be filled with cement

concrete M-10 except top 300 mm depth (below rock top) will be filled with cement concrete M-20.

- 2.5 **Well Steinning:-** The thickness of staining of Sump well will be designed keeping in view the various stresses developed due to self load of staining, super structure live load, due to pumps motors and pipe column assembly of six pumping sets water forces due to river floods, velocity forces, wind force, dynamic forces, due to vibration of motors, water thrust in discharge pipe, due to water hammer and other live loads over slabs, roofing, balconies (as specified in forth coming pars), other loads due to buoyancy effect and any other forces required to be taken for safe design will also be taken into consideration which are not mentioned here. The staining will be designed for the various combinations of forces. Its stability will be checked for the worst condition including the conditions when the river water at HFL & Sump well is empty.

The entire construction will be in R.C.C M-30. The minimum thickness of well from the bottom floor to discharge floor level will not be less than 750 mm even if it comes on lower side at the designing it. From discharge & motor floor to roof of the pump house the thickness will not be less than 300 mm even if it comes on lower side after designing

- 2.6 Providing and fixing of inlet ports: -Twin or single inlet ports shall be shall be provided at various levels (minimum 3) to draw water from river during maximum draw down level and at the time of highest flood.

The location and R. L of these inlet ports will be decided during the time of execution. However, levels and location of Inlet ports as shown above or in tender drawings are indicative and tentative. During design of Inlet port, at Sump well, Contractor shall ensure that the top of the bottom port shall be kept atleast 1 m below LWL

M.S Strainers: -Minimum 12 mm thick Mild Steel strainers will be provided on outer side of every inlet port. It will have flanges to bolt with inlet port in 2 nos. In two lower strainers area of perforation (holes of 40 mm dia each) will be thrice the inlet port area, while for other one inlet port it shall be 3.0 times the inlet area. Since these strainers will be submerged hence it will be coated with epoxy paint after sand blasting. Epoxy paint and primer shall be coal tar epoxy as per I.S. specifications.

The contractor will have to design size and no of Inlet port, however minimum 3 no of Inlet ports with minimum diameter (as per deisgn) will have to be provided with strainer and operating sluice valves gate operated from discharge floor.

- 2.7 **Sluice valve gates:** -Sluice gate valves will be provided on all connecting mains/ inlet ports conforming to IS 14846-2000 with connecting rods for operation at discharge floor level. Also connecting rod shall be supported by MS Clamping. Also connecting rod shall be supported by MS Clamping.

- 2.8 **Electrification:** - Electrification of pump house inside and outside will be done in such a manner that standard level of illumination is obtained at all places. Proper earthing arrangements as per relevant IS specifications are to be provided. The wiring shall be concealed or as per IS only. The total number of light points shall not be less than 30 nos. inside pump house, Eight Power points, 15 Amp, four each at motor and discharge floor will be provided. The inside of the Sump well below discharge floor will be illuminated with the help of 4 or more sodium vapors/ LED lamps. On the outside of pump house also, sodium vapors/ LED lamps, 4 or more nos., will be provided. On Approach Bridge and Approach Road, decorative street lighting with poles and all accessories will be provided on each side. Illumination level & quantity shall be as per the direction of Engineer in Charge, as per approved design and drawings, which shall not be less than the standard specifications.

Supply, Installation, Testing & Commissioning of Solar-Photovoltaic (SPV) Garden Lamp Post system, LED based 18 watts as per MNRE specification and as per the drawings and including 5 years warranty including replacement and warranty. Illumination level, quantities and locations shall be as per the direction of Engineer in Charge, as per approved design and drawings, which shall not be less than the standard specifications.

2.9 Pump house (Discharge/Motor) Floor Level-Single Floor

- i. **Pumphouse (discharge/motor) floor level:** -Pumphouse floor will be provided to house the motors of 2 turbine pumping sets, its starters, control panels, bus bar channels, all discharge pipes and vertical column assembly pipes for 2 nos. vertical turbine pumping sets. The floor slab will be designed for a uniformly distributed live load of 1500 kg/sqm and in addition to it, the point loads of concentrated load 4.0 T at each opening of pumps will be taken into account. Self load of pumps, water load and water thrust due to water hammer effect will also be taken into account and suitable opening will be provided for passing column pipes through the slab. Flooring with cement concrete will be provided.
- ii. All the civil works involved for installation of motor and its foundation, cable trench, opening in floor slab and walls or well to lay electric cables of motor shall be provided. On motor floor; Industrial flooring with cement concrete will be provided. The discharge/motor floor shall be constructed in RCC M-30. A balcony of 1.2m width shall be provided all around the wall at discharge /motor floor level with railing as per specifications.
- iii. **Super structure:** - The entire construction of pump house will be R.C.C M 30. The Pump House shall be circular in shape. The R.C.C. wall of pump house shall not be less than 300 mm thick. The details of floor and cantilever balcony have already been mentioned earlier. Cantilever chajjas on the outer side of pump house will be provided over doors/window/ventilators. Good architectural appearance will be provided to pump house. A main entrance of size 2.1 m (W) x 2.4m (H) is provided with rolling shutter facing towards the stair case. The railing as per the specification given earlier will be provided all around the balcony. Sufficient doors with Aluminum frames and fully paneled, ventilators and windows with aluminum frames & paneled fully glazed shall be provided in the pump house which will be at least 30% of motor floor area for light and ventilation. The height of pump house shall be at least 7.0 M from motor floor level to roof level. One door of 2.4 m x 1.0 m wide fully glazed with aluminum frames shall be provided towards river side for watch the floods and water level of river. Doors & window are fitted with steel wire mesh arrangement to restrict the entry of birds. Four Nos. exhaust fans will be provided for effective room temperature control with steel wire mesh arrangement to restrict the entry of birds & insects.
- iv. **Glazed windows:** -Providing & fixing glazed windows & fabricated from 0.6mm cold rolled low carbon steel of deep drawing quality, primer coated upto 5 microns with thermosetting epoxy resin, painted with polyester powder coating 50 microns thick. The size of profiles for external frame shall be 46x52mm, for internal shutter frame 46x46mm and for mid and bottom cross bar of doors 23x100mm, joints mitred at corners, brackets made of 1.2mm thick CRCA steel strips, styles frame to be fitted to concrete/masonry walls by means of self expending screws.
- v. **M.S. Ladder:** -Providing and fixing in position M.S. ladder 0.50 M wide consisting of 75x10mm M.S. flats as stringers and 16 mm dia M.S. bars in double rows as steps placed at 25 cm/c.MS Ladder is provisioned for O&M of Inlet ports and Sluice Gates.

- vi. Providing and fixing M.S. chaquered plate flooring of following thickness supported on M.S. angles (25 x25 x 5 mm size) including welding, cutting and fabricating the plate to the required square or round shape, making holes in the plate, including providing and applying 3 coats of anticorrosive paint etc. complete as directed by Engineer-in-charge.
- vii. **Rolling shutter:** -Providing and fixing rolling shutter of M.S laths interlocked together through their entire length and jointed together at the end-by-endlocks, mounted on specially designed pipe shafts with brackets, side guides and arrangements for inside and outside locking with push and pull arrangements complete etc 80x1.25 mm M.S Laths
- viii. Providing and fixing in position CI/MS Rose pieces in Sump well including all allied works.
- ix. **Stone pitching:** -Providing 30 cm thick hard packed stone pitching with 59% of the individual stones of 30 cm depth including laying, finishing etc. and including slope cutting of embankment and as directed Engineer In Charge, Stone/Boulder on slopes laid over prepared filter media including boulder apron laid dry in front of toe of embankment complete as per drawing and technical specifications as per clause 2504 of MORTH.
- x. **Embankment:** - Construction of embankment with Material Obtained from Borrow Pits/ Borrow Area (Construction of embankment with approved material/ selected soil having C.B.R.>5 (unless specified otherwise in the contract) obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement)
- xi. Roof slab: -The roof slab of pump house shall be R.C.C. M-30 and it will be designed for live load of 150 kg/sqm.
- xii. Arrangement of gantry girder: - Cantilever projection not less than 0.5 M will be provided all around on the inner side of the pump house wall; at 5.0M height from motor floor level, to support gantry girder crane through columns. Rails of suitable size will be provided all around this projection over which the gantry girder crane will move along the circumference.
- The Circular traveling Gantry Crane of 2 T. capacity will be provided with cross travel trolley and chain pulley block. It will be operated from motor floor level.
- xiii. Mud Pump for intake/Sump well desilting: -
- Contractor shall provide 3-phase submersible mud pump (1W+1S) on bottom of the Sump well. It will remove silt from inside the Sump well and through it outside the Sump well. The Contractor shall provide manufacturers published pump curves, system curves and the necessary hydraulic calculations. The Contractor shall provide the following shop drawings:
- Impeller diameter
 - Maximum impeller diameter
 - Minimum impeller diameter
 - Velocity of liquid in pump suction at duty point
 - Velocity of liquid in pump delivery at duty point
 - Velocity of liquid in the pump casing or impeller eye at duty point
 - Net positive suction head (dry well submersibles only)

- The materials of construction shall be specified in detail and itemized against a sectional drawing of the pump proposed.
- xiv. **Stairs & railings:** -RCC Staircase from Discharge/motor floor to Roof and bottom of Intake shall be 1.2 m width designed for a live load of 500 kg/sqm will be provided, on the inner circumference of the staining. The stairs shall be provided in such a way that there is no obstruction due to connecting mains or operating rods etc. The intermediate landings will be provided at 3.0 M vertical intervals in stairs. 1000 mm height railing with R.C.C. posts of 125 mm dia having minimum four nos 8 mm dia TMT bars @ 1.2 m C/C embedded in cement concrete with 3 rows of 25 mm dia medium class G.I. Pipes will be provided on stairs. The stairs shall be cast in situ in RCC M30. The vertical bars of the posts shall be welded with the main reinforcement at slab.
- xv. Providing, constructing coffer dam in river basin/dam storages as per type design including excavation, filling the middle portion with B.C. soil (in gunny bags if required). Providing impervious/semipervious materials on both side of B.C. soil (in gunnybags if required) including ramming, compacting to the satisfaction of Engineer-in-charge till the completion of work including dismantling of coffer dam after completion of works and disposing off the material as directed by the Engineer-in-charge.
- xvi. Approach Road: -**
Approach Road shall be provided from Existing Road to Sump well Pump Station.
- 2.10 **Lightening arrestor:** Aluminum lightening arrestor with all accessories shall be provide as per IS specification for safety of structure. One no. of lightning conductor at the highest elevation shall be provided suitably for the entire area. It shall consist of but not limited to followings: -
- I. Solid copper rod with upper terminal 25mm dia, 1.5 m long with a knob at the end and the conical spikes on top.
 - II. Suitable clamps to fix the conductor to the walls.
 - III. Aluminum tape conductor 25 mm x 3mm.
 - IV. The earthing shall be done as per IS 3043.
- 2.11 **Water level indicator:** -Water level indicator shall be provided at suitable location it shall comprise of copper float, guide, pulley, with a pointer on the enamel painted indicator plate which shall be calibrated to indicate the water level in Sump well.
- 2.12 **Painting: -** Weather proof Exterior painting including good architectural appearance of plant should be provided. Two coats of finishing with acrylic premium emulsion (plastic) inside of pump house and acrylic smooth exterior paints on outside of pump house and Sump well. Two coats enamel oil paint over primer shall be done on doors, windows, ventilations and all steel fabrication work i.e., railing, gantry girder etc. including cleaning washing of surface etc. Complete.
- 2.13 Providing and constructing Approach Road (CC) with all allied works. The concrete roads shall be of M-30. The wearing coat will be 300 mm thick cement concrete in M30 grade of concrete over 100 mm thick PCC in M15 grade and for surface-300 mm of M-30.
- 2.14 Provision of SDV 3 KW Solar System Smarten Superb 4000 VA Solar MPPT PCU, Luminous 150 Ah Solar Tall Tubular Battery 4 Nos & Luminous 380 W Solar Panel 4 Nos
- 2.15 **Concrete:** - Entire concrete used in the structure will be “Design Mix” controlled concrete only. In case of controlled concrete theoretical consumption will be the actual consumption. However minimum cement contain and maximum water cement ratio shall

be as per IS:456-2000. Contractor will have to setup concrete Batching and Mixing plant duly approved by Engineer in charge.

- 2.16 **Steel for reinforcement:** - The steel for reinforcement shall be ISI mark thermo mechanically treated bars conforming to ISS. HYSD steel bars confirming to relevant IS will be used for all RCC work. Contractor to produce test certificates as obtained from manufacturer at the time of procurement for each lot of delivery at site sample steel rods will be got tested for tensile strength at Government approved laboratory in C.G. Similarly, all M.S. steel works including angle T iron & all sections shall confirm to IS 2062 all welding and fabrication works will be carried out by qualified welders
- 2.17 **Steel specification:** -Minimum 10 mm to 12 mm diameter bar shall be considered as a main bar for design of each component of Sump well.
No extra payment for dewatering required for natural, artificial or manmade reason or rock excavation will be payable for any depth or for repetitive work.
- 2.18 The bearing capacity of the foundation should be ascertained by the firm/contractor for which a test certificate will have to be submitted by the firm/contractor to the ULB, before submitting the design.
- 2.19 Surplus excavation earth should be filled and leveled in the area as per the direction of Engineer-in-charge and in no case disposed off near the site.
- 2.20 The pump house should have adequate space for free movement after installation of all pump, machinery, pipes and accessories.

ANNEXURE - "E-2"**(Electro Mechanical works)****Scope of work & specification of work at for Raw water Vertical turbine Pumpsets (at Sump well) & clear water pump sets at WTP and Electric Substations etc at Intake**

1. Design, Supply, Erection/installation, testing, Commissioning, trial run, Defect Liability period including replacement and warranty for following works under Improvement Water Supply Scheme for Nagar Panchayat Bhakhara
 - i. **Raw water Pumping Machinery at Sump well: -**
 - a. 3 Nos. Raw water vertical turbine pumping sets (2W+1S), each of Discharge 16 LPS against 15m head each including entire assembly for suction, delivery manifold along with non-return valve and sluice valve, suitable motor, controls, cables, protection devices and all mechanical and electrical works including testing and commissioning etc. complete.
 - ii. **Clear Water Pumping Machinery at WTP**
 - a. 3 Nos. clear water centrifugal pumping sets (2W+1S), each capable Discharge 22.35 LPS against 40 m head each including suction assembly, delivery manifold along with non-return valve and sluice valve, suitable motor, controls, cables, protection devices and all mechanical and electrical works complete.
 - iii. Electric substations at (Raw Water Sump Well) including all allied works and accessories
 - a. Substation with 2 nos. 11/0.415 KV, 100 KVA (1W+1S) Transformers including all allied works for Intake.

Detailed specification of Raw Water pump set**1.1 General Design Consideration:**

The pumps shall be vertical turbine wet pit type non-pull-out design with multi stage bowl assembly, directly coupled through vertical hollow shaft motor without speed reduction gear. These pumps are to be installed in the pump house in Raw Water Pumping Station to pump the turbid water.

Pumps shall be designed so as to have a maximum flow capacity of not less than 120% of the rated flow capacity. The pumps shall be designed so as to have a stable non over loading characteristic. The shut off head should not exceed 120% of duty point head on higher side and 80 % on lower side.

The impeller adjustment shall be designed in such a way that impellers run free in any installed condition in spite of the extension of line shaft caused by hydraulic down-thrust and the weight of shafts and impellers.

The pump should be of efficiency of 80% or above at duty point.

1.2 General specifications: -

The pumps shall be complete with bowl assembly, column pipe, sub floor discharge head, line shaft, foundation plate/sole plate, basket strainer, motor foot stool and all other necessary accessories. The pumps should generally comply with the requirements of following standards.

- i) I.S. 1710 - Vertical turbine pumps for raw water.
- ii) I.S. 5120 - Technical requirement of rotor dynamic Special purpose pumps.

1.3 Impeller shaft: -

The impeller shaft shall be of stainless steel with renewable stainless-steel sleeves at bearing portion. The impeller shaft shall be guided by bearings provided in each bowl. The butting faces of the shaft shall be machined square to the axis and the shaft shall be chamfered on the edges. The shaft shall have a surface finish of 0.75 micron as per I.S. 3073-1967.

1.4 Impellers:

The impeller may be of closed type made of CF8M material statistically and dynamically balanced. The impeller shall be free of any casting defect and shall be properly machined. All the water passages shall be smooth finished and coated. The impellers shall be fastened with shaft thrust collar and keys.

1.5 Bowls:

The bowls shall be made of cast iron smoothly finished and free from any casting defects. The bowls shall be capable of withstanding hydrostatic pressure equal to twice the pressure at rated capacity or 1.5 times of the shut off head whichever is greater. The bowls shall be equipped with replaceable seal rings on the suction side of impellers in case of closed impellers. The water passage in the bowls shall be smooth.

1.6 Line shafts:

The line shaft shall be made of SS410 and shall be finished with inter changeable section, have a length of .75 m, 1.5 m or 3 m. The butting faces of shafts shall be machined square to shafts axis and the shafts ends shall be chamfered on the edges. To ensure the correct alignment of shafts, they shall be straight within 0.125 mm for 3 m length total dial indicator reading. The shaft shall not have the surface roughness more than 0.75 micron as per IS 3073-1967. The shaft coupling shall be designed with a minimum factor of safety two for shafts and shall have left hand or right-hand threads depending on the direction of rotation of pump to tighten during the pump operation. The outside diameter of the coupling shall be concentric with the bore and with a small transverse hole in the middle. The shaft shall have the adequate strength to withstand all the forces at $\pm 20\%$ of the critical speed of shaft.

1.7 Column pipe:

The columns pipe shall be manufactured from the Heavy series of mild steel tube conforming to relevant Indian Standard Specifications. The column pipes shall be flanged and bolted and shall be complete with nuts and bolts the length of column section shall depend upon the design of sump well cum pump house and the installation. However, for handling, the length of each column pipe shall not exceed 1.50 m.

1.8 Line shaft Bearings:

The bearing shall be designed to be for proper lubrication. The line shaft bearing shall be of cut less rubber.

1.9 Discharge head:

The discharge head should be sufficiently strong to support the weight of the pump having outlet size as given in **scope of work**

1.10 Motor Foot Stool

The motor foot stool shall be of fabricated mild steel and shall be designed to take care of all the static and dynamic loads on it.

1.11 Sole plate:

Each pump shall be provided with a heavy structural steel sole plate. Sole plate shall be provided and grouted with foundation. The sole plate shall be designed to permit removal of entire pump without disturbing sole plate.

1.12 Bolts nuts & washers: -

All bolts, nuts and washers shall be of superior quality and should be made of high tensile Carbonsteel conforming to relevant Indian Standard Specifications.

1.13 Testing: -

The department can depute the Engineer-In-Charge or its representatives to witness inspection for routine test at manufacturer's place with respect to their characteristic and performance at the cost of Contractor.

1.14 Field test: -

The field test shall be carried out as per IS: 1520-1972 & 5120-1965.

1.15 Guaranteed Performance & Technical particulars: -

The contractor shall submit the details of guaranteed performance & technical particulars as desired in the Performa enclosed vide schedules with the tender along with the preliminary out line drawing indicating principal dimensions & weight of pumping equipments and cross-section drawing indicating the assembly of pumps & major parts thereof with materials of constructions and special features. Complete descriptive and illustrated literature on the equipment and accessories offered.

1.16 Pressure indication devices: -

Each pump shall be provided with pressure gauges along with siphon tube and cork of best quality. The pressure gauges should be of Aluminium casting body with glycerin field. The dial size shall be of 100mm.

2. Specifications for 415-v induction vertical hollow shaft motors:**2.1 Type:**

The VHS motor shall be Induction type suitable to operate on 415 V, 3 phases, 50 cycles A.C. supply directly coupled to turbine pump having nominal speed of 1450 RPM generally conforming to IS: 12615

Variation in supply voltage

The motors shall be capable of delivering rated output and rated power factor with following variations: -

Voltage	=	± 10%
Frequency	=	± 5%
Combined	=	As per relevant IS

2.2 Rated capacity:

The minimum conditions rated capacity of motors shall be such that it meets the power requirements of pumps in the complete range of its operation. It shall also provide on additional power requirement on the motor. By 10% at the duty point of operation or 5% of maximum power drawn by pump or as specified, whichever is higher among the three options.

2.3 Acceleration characteristics:

The acceleration characteristics of motor shall be matched with the driven equipment so that acceleration is obtained without over heating of motor.

2.4 Method of starting:

The motors shall be designed for star/delta starting at full voltage with starting current not exceeding four times the rated full load current. The motor shall also be designed for a minimum pull out torque of 200%.

2.5 Number of starts:

Motor when started with the drive imposing its full starting torque under the specified supply voltage variation shall be capable of withstanding at least one successive start from hot condition two start from cold condition without damage to the winding.

2.6 Class of insulation:

The motor winding shall be provided with insulation conforming to thermal class "H". The maximum temperature rise of the winding shall not exceed the limits specified for class "H". The insulation shall be given tropical and fungicidal treatment for successful operation of motor in hot humid tropical climate. It shall be of thermos setting type and shall remain unaffected by heat. The coils shall be highly uniform with uniform insulation strength and uniform dielectric losses.

2.7 Motor construction:

The motor construction shall be suitable for easy dismantling and reassemble at site with the help of simple overhead crane. The motor shall be of core pack construction attached to the stator frame to facilitate easy removal and replacement of the winding for maintenance purpose. The overhead for winding at both ends of the core shall be accessible for usual inspection without resorting to major dismantling.

2.8 Motor frame:

Motor frames shall be of rigid fabricated steel they shall be suitably annealed to eliminate any residual stresses introduced during process of fabrication and machining

2.9 Stator laminations: -

Stator laminations shall be made from suitable grade sheet steel varnished on higher side and shall be adequately designed to overheating during starting and running conditions stipulated above.

2.10 Rotor Short Circuiting Rings:

Rotor short circuiting and rings shall be such that it is free to move with expansion of bars without distortion. The connections of the bars to the end rings shall be made by brazing.

2.11 Locking Rotor with stand time: -

Locked rotor with stand time under hot conditions at 110% voltage shall be more than starting time at minimum permissible voltage by at least two seconds.

2.12 Type of Enclosure & Degree of protection.

The degree of protection provided by the enclosures of motor shall conform to IS:4691. The enclosure for the motors shall be TEFC (IP44).

2.13 Shaft insulation:

Suitable insulation shall be provided on shaft/bearing housing to prevent shaft current. The insulation provided shall be such that it shall retain its dielectrical properties even after it's handled for number of times during dismantling and reassemble.

2.14 Bearing Assembly:

Bearing assembly shall be such that it prevents dust getting to the bearing. Further, bearing lubricant shall not find access to the motor winding. The bearing assembly shall be provided with proper lubricating nipples.

2.15 Earthling: -

The motor body shall have two separate earthling terminals for earthling in compliance

with I.E. Rules.

2.16 Dimensions of motors: -

Motors shall be properly dimensioned to have greater stability and low vibration limit.

2.17 Testing: -

All the motors shall be routine tested at manufacturer's workshop and test certificate shall be provided with motors.

Note: All the motors shall have the temperature & vibration sensors and shall have SCADA compatibility

3. SLUICE VALVES:

3.1 Design requirement:

3.1.1 Sluice valves shall be I S I mark and conforming to IS 14846-2000, additionally, they should also meet specific requirement as stated. Sluice valves shall be used for Pipe diameters upto 300 mm. butter fly valves may be used for higher diameter valves.

3.1.2 Spindle, thrust collar and operating arrangement including hand wheel should be designed in such a way that one adult male is able to operate the valve against full differential pressure by exerting no more than 16 kgf effort (Pull and push) on the hand wheel.

3.1.3 Features of construction:

- a. Valves shall have inside screw, non rising spindle.
- b. Valves shall be with appropriate bushing arrangement for replacement of packing without leakage (300 NB and above)
- c. Valves 300 mm dia & above shall be provided with an antifricition device/ ball trust bearing arrangement to minimize friction between spindle collar and casting. These should be housed away from wet chamber and should have facility for periodic greasing.
- d. Valves of size 350 mm dia and above shall be provided with enclosed, grease packed spur/ worm gear box.
- e. Valves 450 mm dia and above shall be provided with a drain and air plug.
- f. Valves shall be fitted with gunmetal channel and shoe arrangement in case these are electrically operated, the clearance being controlled between 2 to 3 mm throughout the door travel. The channels should be fixed from inside puncturing the body for fixing of channels is not allowed.
- g. All valve doors when fully closed would ensure door faces are riding on body seat ring by at least 50% of the width of seat ring and there is sufficient room for wear travel.
- h. All face and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.
- i. Nominal size of the valve shall be cast on the body of the valve:

j. DATA

–	Rating (Kg/sq.mm)	:	PN 1.6
–	Drilling	:	IS 1538 Table 4 & 6

k. SHOP TESTING:

1. HYDRO TEST

–	Seat leakage	:	16 Kg/cm ² (5 min) – for PN 1.6
–	Back seat leakage	:	8 Kg/cm ² (2 min) – for PN 1.6
–	Body	:	24 Kg/cm ² (5 min) – for PN 1.6

- Each pump shall be provided with Sluice valve to be provided on delivery side of size as per approved design.
- On manifold pipe line one numbers of sluice valves is to be provided of size as per approved design.

4. **NON-RETURN VALVES:**

- 4.1 The valves shall be I S I mark and conforming to IS 5312 Part 1 (Single Door Type) for sizes 80 to 600 mm dia and IS 5312 Part II (Multi Door Type) for sizes above 600 mm dia.
- 4.2 The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.
- 4.3 Valves shall have in built quick closing non-slam characteristics achieved by suitable disposition of weight on door and the hydraulic passage. No spring loaded/ spring return action or external dampening arrangement is acceptable.
- 4.4 Valves of multi door type shall be additionally provided with a supporting foot.
- 4.5 All faces and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.

DATA:

1. Size :
2. Rating (Kg/sq.cm) : PN 1.6
3. Drilling : IS 1538 Table 4 & 6
4. Accessories :
- By-Pass Arrangement : Required

SHOP TESTING:

4.6 HYDRO-TEST

- | | | |
|--------------|---|--------------------------------------------|
| Seal Leakage | : | 16 Kg/cm ² (5 min) – For PN 1.6 |
| Body | : | 24 Kg/cm ² (5 min) – For PN 1.6 |

- Each pump shall be provided with non-Return valve to be provided on delivery side as per approved design.
- On manifold pipe line one numbers of non-Return valve is to be provided of size as per approved design.

5. **BUTTERFLY VALVES:**

5.1 DESIGN REQUIREMENT:

- a. Butterfly valves shall be I S I mark and conforming to BS 5155 and must also meet the following requirement.
- b. Cone-sphere eccentric design.

- c. Generously designed disc, shaft and cotter pins, ensure that actual working stress at designed pressure never exceeds 40% of the yield strength of material.
- d. Gear box must be generously designed and must be rated for at least 25% more than the torque required to crack open the valve at designed pressure. Also, one adult male is able to operate the valve against full differential pressure by existing not more than 10 kgf pull and push on the hand wheel.
- e. Valves should be drop tight and designed for flow in either direction.

5.2 FEATURES OF CONSTRUCTION:

- a. Valve shall be U – section wafer long/ double flanged short body type.
- b. Valves to have two stub shafts, extending at least 2 times their dia, within a robust housing on either side fitted with PTFE bearing.
- c. The valve seat on the body should be integral with it to preclude any leakage from beneath the ring/ “O” ring when the disc is closed.
- d. The synthetic rubber seal ring should be of ample proportion; “T” shaped and must be fastened to the disc by a one piece retaining ring in such a way that the seal ring does not become loose in service.
- e. In addition to providing end of travel stops in the gear box, an integral stopper in the body is provided to prevent over travel of disc during closure.
- f. Gear box must be self locking type, with a continuous indicator. Travelling nut and screw type of gear boxes are not acceptable.

5.3 Nominal size of the valve must be cast on the valve body.

DATA

– Rating (Kg/sq.mm)	:	PN 1.6
– Drilling	:	IS 1538 Table 4 & 6

5.4 SHOP TESTING:

- Seat leakage : 16 Kg/cm² (5 min) – for PN 1.6
 - Body : 24 Kg/cm² (5 min) – for PN 1.6
- Each pump shall be provided with Butterfly valve to be provided on delivery side of size as per approved design.

6. VALVE ACTUATOR

Providing, erecting electric Valve actuators totally enclosed, weather-proof and dust proof construction with IP-68, protection class suitable for installation in any position without lubrication, leakage or other operational difficulty with special grease filled gear box and hand wheel for emergency manual operation which will automatically dis-engage on restoration of power to motor and with 10 watt single phase space heater and continuous local mechanical position indicator and individually replaceable counter gear assembly and with two torque and four limit switches with S.S. flap and operated with gear driven cams and of rating 250 Volt, 5 Amp. AC/DC, torque switch dial and with TEFC squirrel cage induction motor working on 440Volt +/- 10%, 3 phase, 50Hz AC of intermittent duty rating S-2, insulation class “F” and temp rise restricted to class “B” with IP-68 protection class suitable for DOL starting and with three thermostat and 30% over load margin. The torque rating of reduction gear box shall be at least 1.5 times max. Torque required for opening and closing of valve.

7. DELIVERY PIPES:

Providing, laying & jointing of D/F, M.S. Delivery pipes of lengths as per site requirement and size of pipe as per approved design.

8. DISMANTLING JOINT:

Each pump delivery pipe line and one number on manifold pipe line shall be fitted with D/F dismantling joint of size as per approved design. The dismantling joint shall be designed in such manner so that gap is created in pipe line for easy removing of pump, valves, pipes etc for maintenance.

9. COMMON MANIFOLD PIPES:

All the pumps delivery pipeline shall be connected to common manifold pipe which is to be provided as per approved design.

10. CABLES:

Providing, and laying of be I S I mark LT Cable for 415 Volts, of Aluminium conductor of 3½ core, having PVC Insulated, colour code, wrapped with appropriate filler and care binder and single layer galvanized steel wire armouring for multi-core and overall PVC Jacket. Cable shall be lying, fitted with Lugs, Gland, etc., as required from Transformer to Panel.

1 x 3½ core x of size as as per approved design.

Providing, and laying be I S I mark LT Cable for 415 Volts, of Aluminium conductor of 3½ core, having PVC Insulated, colour code, wrapped with appropriate filler and care binder and single layer galvanized steel wire armouring for multi-core and overall PVC Jacket. Cable shall be lying, fitted with Lugs, Gland, etc., as required from Panel to Motor.

1 x 3½ core x of size as as per approved design.

For Star side = 3.5 core and for Delta side = 3 core to be considered.

11. **FLOWMETER:** -On manifold pipe line one number of flow meter will have to be installed having of size as per approved design, flow meter shall be electromagnetic type having additional display in pump house also through cable.

TECHNICAL SPECIFICATION FOR ELECTROMAGNETIC FLOW METER SHALL BEASUNDER: -

The diam. of electromagnetic flow meter should be equal to the Header size of pipe line to be erected between pipe lines with two sides flanged. The meter should provide with 25 mtr. Cable and signal convertor should be mounted separately on the nearest wall in the pump house.

Electromagnetic Flow Sensor

Type	: Pulsed DC
Flow tube	: SS 304
Coil housing Material	: CS
Liner	: PPTE
Electrodes	: HC
Grounding type	: Rings
Grounding ring material	: SS 316
Process connection	: Flanged PN1.6.
Flanges	: CS
Area classification	: Non-Hazardous
Protection class	: IP 68

DS cable length :25 Mtrs

Electromagnetic Signal Converter

Mounting : Separate Version (Remote)

Type : Microprocessor Based

Output : 4-20mA, HART +1 Pulse +1 Status

Accuracy : $\pm 0.5\%$ of measured value >0.5 m/s

Max load : approx..500 Ohms,

Power consumption : 10 VA

Display : Large back lit 2-line LCD Display

Parameters : Actual flow rate, totalized flow (8 digit), flow direction, flow Velocity.

Diagnostics : Empty pipe detection

Local indication : Programmable from front fascia

Power supply : 230 VACS

Housing : Die cast Aluminum with PU finish

Cable entry : M20 x 1.5 polyamide cable glands.

Area classification : Non-Hazardous

Protection class : IP 68

Interchangeability : Fully Interchangeable with all sizes of flow sensors

12. CONTROL PANEL BOARDS:

The LT A.C. Switch Board shall be of 440 Volts, 3 Phase and neutral, 50 Hz. Distribution board, indoor type, sheet clad by 1.5mm thick CRC sheet over M.S. Channel structure frame, floor mounted free-standing type, cubical pattern, dust & vermin proof, and shall comprise of following.

2 Nos. of Incoming feeders each comprising of: -

- 1 No. 630 AnAmps ACB (SCADA compatible)
- 1 No. of 96sq.mm flush type ampere meter with selector switch.
- 1 No. of 96sq.mm flush type volt meter with selector switch.
- 1 Set. of Indication Lamps for all three phases, ON/OFF, Auto Trip.
- 1 Set. of CTs for protection and metering.
- 1 No. of over current and earth fault protection.
- 1 No. Multifunction meter.
- The bus bar shall be suitable for full load current of ACB of incomer.

1 No. Bus coupler between 2 incoming feeders comprising of 1 No. 630 Amp ACB interlocking arrangement both electrical as well as mechanical.

Outgoing feeder with front operated rotary handles facilities shall be provided as under:

- 2 Nos. of ACBs for out going with overload and short circuit protection
- 1 No. of 32 Amps 4P MCCB for auxiliary loads.
- 1 No. of 63 Amps 4P MCCB for auxiliary loads.

- 2 Set. of Ampere Meter for motor with selector switch.
- 2 Sets. of Capacitor of required KVAR with MCCB/MCBs. (Each capacitor shall have separate MCB/MCCB and contactor along with APFC relays)
- 4P MCBs for valve actuators.

Note: Above mentioned instruments raings and details are minimum and indicative only and will be finalised after approval of SLD/Detailed design as per actual.

The bus bar shall be suitable for 3 phases, 4 wire and shall be of 250 amps. The bus bars shall be with colored insulated sleeves. The supports shall be suitably spaced to give mechanical rigidity for with standing stress due to system fault. The panel compartments shall have adequate space for termination of incoming and outgoing feeder cables equipped with gland, lugs etc. The contractor shall also provide rubber hand gloves, rubber mattings in front of panel boards.

13. **SOFT STARTERS**

The soft starter shall be suitable on operating voltage $415V \pm 10\%$ 3ph, 4 wire and 240 V AC $\pm 10\%$ control supply voltage at $50Hz \pm 5\%$ to be provided on line side of motor for pump application as per IS 5553 (part 3) of 2mm thick CRCA sheet, with IP 41 protection, natural air cooled, duly epoxy power coated, with bottom side removable cable gland plates of non magnetic material.

The Estaster should limit the starting current of motor between 3 to 3.5 of fault load current, with Start/Stop/Reset – Push buttons, Bus bar shall be of Electolytic Copper Conductor, of suitable capacity with ‘H’ class insulation with temperature rise limit upto class ‘B’ & 50° Amp tempreture.

The starter should have powe contactors as a by pass device having follosing protection relay (O/L, SP, EF, LR, UC) 1) U/O voltage relay. Indications by LED type indicating lamps.

The softsattrters shall have microprocessor based and compatible with SCADA operation

- L.T. Panel board incorporating ammeter, voltmeter, Multi meter, switches, starter, earth leakage, circuit brakers, single phasing preventer, Motor Protection relays, capacitor, APFCrelays, annunciator, Temperature &vibrating sensors display unit etc. EOT Crane, Tools, Spares and lifting arrangement will also be provided by the contractor

14. **Civil work for erection and commissioning of entire job.**

- 14.1 Foundation as per site condition of pump set, valves support, etc with help of 1:2:4 Cement Concrete.
- 14.2 Installation of all above supplied items as per rules along with earthing of all electrical equipments as per IE rules.

A. Detailed specification of clear water pumpset (proposed)

1. **PUMP: -**

The pumping capacity of each pump will be as given in scope of work

1.1 **GENERAL DESIGN CONDITIONS: -**

- The pumps shall Horizontal split casing type of Single/Two Stage Centrifugal type. The pumps shall be designed to operate satisfactory while handling positive or negative suction as as per approved design, lift from all caused, the rotating elements of pumps will be dynamically balanced and over stressing should not occur due to sudden failure of power. Reverse rotation should not damage the pumps,

Pumps shall be designed so as to have a maximum flow capacity of not less than 120% of the rated flow capacity. The pumps shall be designed so as to have a stable non over loading characteristic. The shut off head should not exceed 120% of duty point head on higher side and 80 % on lower side.

The pump should be designed for minimum efficiency 75% at duty point.

1.2 **MATERIAL OF CONSTRUCTION OF PUMP.**

1.2A **PUMP CASING: -**

The casing shall be Cast Iron ensuring smoothness of hydraulic passages resulting in high efficiency. The delivery flange is vertical.

1.2B **IMPELLERS: -**

The impeller shall be enclosed type. It is hydraulically balanced by its inherent design. The impeller is statically and dynamically balanced. The materials **of impeller shall be of CF8M and casing ring shall be of BR-BSEN-1982-CC480K**

1.2C **PUMP SHAFT: -**

The pump shaft shall be manufactured from high tensile carbon steel and provided with sleeves.

1.2D Facilities for gland drainage shall be provided and gland lubrication shall be suitably arranged by means of providing connections from the discharge volute of the pump casing.

1.2E **BOLTS NUTS & WASHERS: -**

All bolts, nuts and washers shall be of superior quality and should be made of high tensile Carbonsteel conforming to relevant Indian Standard Specifications.

TESTING: -

The department can depute the Engineer-In-Charge of work to witness inspection for routine test at manufacturer's place with respect to their characteristic and performance.

FIELD TEST: -

The field test shall be carried out as per IS: 1520-1972 & 5120-1965.

GUARANTEED PERFORMANCE & TECHNICAL PARTICULARS: -

The contractor shall submit the details of guaranteed performance & technical particulars as desired in the Performa enclosed vide schedules with the tender along with the preliminary out line drawing indicating principal dimensions & weight of pumping equipments and cross-section drawing indicating the assembly of pumps & major parts thereof with materials of constructions and special features. Complete descriptive and illustrated literature on the equipment and accessories offered.

2. **PUMP COUPLING: -**

This shall be of flexible pin type equipped with a suitable coupling guard.

3. **BASE PLATE.**

Each pump shall be provided with a heavy structural base plate & foundation bolt. Base plate shall be provided and grouted with foundation and shall be designed to permit removal of entire pump without disturbing base plate.

4. SPECIFICATIONS FOR 415-V INDUCTION MOTORS:**4.1 TYPE:**

The motor shall be Induction type suitable to operate on 415 V, 3 phase, 50 cycle A.C. supply directly coupled to pump having nominal speed of 1450 RPM Generally confirming to IS:12615

4.2 VARIATION IN SUPPLY VOLTAGE

The motors shall be capable of delivering rated out put and rated power factor with following variations: -

Voltage	=	± 10%
Frequency	=	± 5%
Combined	=	As per IS 325

4.3 RATED CAPACITY:

The minimum conditions rated capacity of motors shall be such that it meets the power requirements of pumps in the complete range of its operation. It shall also provide on additional power requirement on the motor. By 10% at the duty point of operation or 5% of maximum power drawn by pump.

4.4 ACCELERATION CHARACTERISTICS:

The acceleration characteristics of motor shall be matched with the driven equipment so that acceleration is obtained without over heating of motor.

4.5 METHOD OF STARTING:

The motors shall be designed for star/delta starting at full voltage with starting current not exceeding four times the rated full load current. The motor shall also be designed for a minimum pull out torque of 200%.

4.6 NUMBER OF START:

Motor when started with the drive imposing its full starting torque under the specified supply voltage variation shall be capable of withstanding at least one successive start from hot condition two start from cold condition without damage to the winding.

4.7 CLASS OF INSULATION:

The motor winding shall be provided with insulation conforming to thermal class "H". The maximum temperature rise of the winding shall not exceed the limits specified for class "H" insulation of the winding shall not exceed the limits specified as per class "F" insulation. It shall be of thermos setting type and shall remain unaffected by heat. The coils shall be highly uniform with uniform insulation strength and uniform dielectric losses.

4.8 MOTOR CONSTRUCTION:

The motor construction shall be suitable for easy dismantling and reassemble at site with the help of simple over head crane. The motor shall be of core pack construction attached to the stator frame to facilitate easy removal and replacement of the winding for maintenance purpose. The over head for winding at both ends of the core shall be accessible for usual inspection without resorting to major dismantling.

4.9 MOTOR FRAME:

Motor frames shall be of rigid fabricated steel they shall be suitably annealed to eliminate any residual stresses introduced during process of fabrication and machining

4.10 STATOR LAMINATIONS: -

Stator laminations shall be made from suitable grade sheet steel varnished on higher side and shall be adequately designed to over heating during starting and running conditions stipulated above.

4.11 **ROTOR SHORT CIRCUITING RINGS:**

Rotor short circuiting and rings shall be such that it is free to move with expansion of bars without distortion. The connections of the bars to the end rings shall be made by brazing.

4.12 **LOCKING ROTOR WITH STAND TIME: -**

Locked rotor with stand time under hot conditions at 110% voltage shall be more than starting time at minimum permissible voltage by at least two seconds.

4.13 **TYPE OF ENCLOSURE & DEGREE OF PROTECTION.**

The degree of protection provided by the enclosures of motor shall conform to IS: 4691. The enclosure for the motors shall be TEFC.

4.14 **SHAFT INSULATION:**

Suitable insulation shall be provided on shaft/bearing housing to prevent shaft current. The insulation provided shall be such that it shall retain its dielectric properties even after it's handled for number of times during dismantling and reassemble.

4.15 **BEARING ASSEMBLY:**

Bearing assembly shall be such that it prevents dust getting to the bearing. Further, bearing lubricant shall not find access to the motor winding. The bearing assembly shall be provided with proper lubricating nipples.

4.16 **EARTHING: -**

The motor body shall have two separate earthing terminals for earthing in compliance with I.E. Rules.

4.17 **DIMENSIONS OF MOTORS: -**

Motors shall be properly dimensioned to have greater stability and low vibration limit.

4.18 **TESTING: -**

All the motors shall be routine tested at manufacturer's workshop and test certificate shall be provided with motors.

5. BUTTERFLY VALVES:

1. Design requirement:

- a. Butterfly valves shall be I S I mark and conforming to BS 5155 and must also meet the following requirement.
- b. Cone-sphere eccentric design.
- c. Generously designed disc, shaft and cotter pins, ensure that actual working stress at designed pressure never exceeds 40% of the yield strength of material.
- d. Gear box must be generously designed and must be rated for at least 25% more than the torque required to crack open the valve at designed pressure. Also, one adult male is able to operate the valve against full differential pressure by exerting no more than 10 kgf pull and push on the hand wheel.
- e. Valves should be drop tight and designed for flow in either direction.

2. FEATURES OF CONSTRUCTION:

- a. Valve shall be U – section wafer long/ double flanged short body type.
 - b. Valves to have two stub shafts, extending at least 2 times their dia, within a robust housing on either side fitted with PTFE bearing.
 - c. The valve seat on the body should be integral with it to preclude any leakage from beneath the ring/ “O” ring when the disc is closed.
 - d. The synthetic rubber seal ring should be of ample proportion; “T” shaped and must be fastened to the disc by a one-piece retaining ring in such a way that the seal ring does not become loose in service.
 - e. In addition to providing end of travel stops in the gear box, an integral stopper in the body is provided to prevent over travel of disc during closure.
 - f. Gear box must be self locking type, with a continuous indicator. Traveling nut and screw type of gear boxes are not acceptable.
 - g. Nominal size of the valve must be cast on the valve body.
- A. The valve shall generally conform to relevant C.I. BS:5155 Wafer (Short), Valve shall be **worm gear operated** for smooth operation.

Data

–	Rating (Kg/sq.mm)	:	PN 1.6
–	Drilling	:	IS 1538 Table 4 & 6

3. SHOP TESTING:

–	Seat leakage	:	16 Kg/cm ² (5 min) – for PN 1.6
–	Body	:	24 Kg/cm ² (5 min) – for PN 1.6

- Each pump shall be provided with Butterfly valve to be provided on delivery side of size as per approved design.

➤ VALVE ACTUATOR

Providing, erecting electric Valve actuators totally enclosed, weather-proof and dust proof construction with IP-68, protection class suitable for installation in any position without lubrication, leakage or other operational difficulty with special grease filled gear box and hand wheel for emergency manual operation which will automatically dis-engage on restoration of power to motor and with 10 watt single phase space heater and continuous local mechanical position indicator and individually replaceable counter gear assembly and with two torque and four limit switches with S.S. flap and operated with gear driven cams and of rating 250 Volt, 5 Amp. AC/DC, torque switch dial and with TEFC squirrel cage induction motor working on 440Volt +/- 10%, 3 phase, 50Hz AC of intermittent duty rating S-2, insulation class “F” and temp rise restricted to class “B” with IP-68 protection class suitable for DOL starting and with three thermostat and 30% over load margin. The torque rating of reduction gear box shall be at least 1.5 times max. torque required for opening and closing of valve.

6. NON-RETURN VALVES:

- a. The valves shall be I S I mark and conforming to IS 5312 Part 1 (Single Door Type) for sizes 80 to 600 mm dia and IS 5312 Part II (Multi Door Type) for sizes above 600 mm dia.

- b. The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.
- c. Valves shall have in built quick closing non-slam characteristics achieved by suitable disposition of weight on door and the hydraulic passage. No spring loaded/ spring return action or external dampening arrangement is acceptable.
- d. Valves of multi door type shall be additionally provided with a supporting foot.
- e. All faces and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.

Data:

1.	Size	:	
2.	Rating (Kg/sq.cm)	:	PN 1.6
3.	Drilling	:	IS 1538 Table 4 & 6
4.	Accessories	:	
	By-Pass Arrangement	:	Required

SHOP TESTING:

B) Hydro-test

Seal Leakage	:	16 Kg/cm ² (5 min) – For PN 1.6
Body	:	24 Kg/cm ² (5 min) – For PN 1.6

- Each pump shall be provided with non-Return valve to be provided on delivery side of size as per approved design.
- On manifold pipe line one numbers of non-Return valve is to be provided of size as per approved design.

6. SLUICE VALVES:

1. Design requirement:

- A. Sluice valves shall be I S I mark and conforming to IS 14846, additionally, they should also meet specific requirement as stated.
- B. Spindle, thrust collar and operating arrangement including hand wheel should be designed in such a way that one adult male is able to operate the valve against full differential pressure by exerting no more than 16 kgf effort (Pull and push) on the hand wheel.

2. FEATURES OF CONSTRUCTION:

- a. Valves shall have inside screw, non rising spindle.
- b. Valves shall be with appropriate bushing arrangement for replacement of packing without leakage (300 NB and above)
- c. Valves 300 mm dia& above shall be provided with an antifriction device/ ball trust bearing arrangement to minimize friction between spindle collar and casting. These should be housed away from wet chamber and should have facility for periodic grasing.
- d. Valves of size 350 mm dia and above shall be provided with enclosed, grease packed spur/ worm gear box.
- e. Valves 450 mm dia and above shall be provided with a drain and air plug.
- f. Valves shall be fitted with gunmetal channel and shoe arrangement in case these are electrically operated, the clearance being controlled between 2 to 3 mm throughout the

door travel. The channels should be fixed from inside. Puncturing the body for fixing of channels is not allowed.

- g. All valve doors when fully closed, would ensure door faces are riding on body seat ring by atleast 50% of the width of seat ring and there is sufficient room for wear travel.
- h. All face and seat rings will be force/press fitted and additionally riveted (300 NB & above) to the recess in the CI casting.
- i. Nominal size of the valve shall be cast on the body of the valve:

Data

– Rating (Kg/sq.mm)	:	PN 1.6
– Drilling	:	IS 1538 Table 4 & 6

3. **SHOP TESTING:**

HYDRO TEST

– Seat leakage	:	16 Kg/cm ² (5 min) – for PN 1.6
– Back seat leakage	:	8 Kg/cm ² (2 min) – for PN 1.6
– Body	:	24 Kg/cm ² (5 min) – for PN 1.6

- Each pump shall be provided with Sluice valve to be provided on suction side of size as per approved design.
- Each pump shall be provided with Sluice valve to be provided on delivery side of size as per approved design.
- On manifold pipe line one numbers of sluice valve is to be provided of size as per approved design.

7. **PRESSURE INDICATION DEVICES: -**

Each pump shall be provided with pressure gauges along with siphon tube and cork of best quality. The pressure gauges should be of Aluminum casting body with glycerin field. The dial size shall be of 100mm.

8. **FLOWMETER: -**

- On manifold pipe line one numbers of flow meter will have to be installed having of size as per approved design, flow meter shall be electro magnetic type having additional display in pump house also through cable.
-

TECHNICAL SPECIFICATION FOR ELECTROMAGNETIC FLOW METER SHALL BE AS UNDER: -

The diam. of electromagnetic flow meter should be equal to the Header size of pipe line to be erected between pipe line with two sides flanged. The meter should be provided with 25 mtr. Cable and signal convertor should be mounted separately on the nearest wall in the pump house.

Electromagnetic Flow Sensor

Type	: Pulsed DC
Flow tube	: SS 304
Coil housing Material	: CS
Liner	: PPTE
Electrodes	: HC

Grounding type	: Rings
Grounding ring material	: SS 316
Process connection	: Flanged PN1.6.
Flanges	: CS
Area classification	: Non-Hazardous
Protection class	: IP 68
DS cable length	:25 Mtrs

Electromagnetic Signal Converter

Mounting	: Separate Version (Remote)
Type	: Microprocessor Based
Output	: 4-20mA, HART +1 Pulse +1 Status
Accuracy	: $\pm 0.5\%$ of measured value >0.5 m/s
Max load	: approx..500 Ohms,
Power consumption	: 10 VA
Display	: Large back lit 2-line LCD Display
Parameters	: Actual flow rate, totalized flow (8 digit), flow direction, flow Velocity.
Diagnostics	: Empty pipe detection
Local indication	: Programmable from front fascia
Power supply	: 230 VACS
Housing	: Die cast Aluminum with PU finish
Cable entry	: M20 x 1.5 polyamide cable glands.
Area classification	: Non-Hazardous
Protection class	: IP 68
Interchangeability	: Fully Interchangeable with all sizes of flow sensors

9. Suction & delivery pipes:

Providing, laying & jointing of D/F, M.S. Suction & Delivery pipes of lengths as per site requirement and size as per approved design.

10. Enlarger:

- Each pump shall be provided with DI D/F Eccentric Enlarger of size as per approved design.
x suction size of pump.
- Each pump shall be provided with DI. D/F Concentric Enlarger of size as per approved design
x outlet size of pump.

11. Dismantling joint:

Each pump suction and delivery pipe line and one number on manifold pipe line shall be fitted with DI D/F dismantling joint of size as per approved design. The dismantling joint shall be designed in such manner so that gap is created in pipe line for easy removing of pump, valves, pipes etc for maintenance.

12. Bends:

Each pump Suction pipe and delivery pipe may have to be provided with D/f bend as per site condition of size and as per approved design.

13. Common manifold pipes:

All the pumps delivery pipeline shall be connected to common manifold pipe which is to be provided as per size as per approved design.

14. Cables:

Providing, and laying of be I S I mark LT Cable for 415 Volts, of Aluminum conductor of 3½ core, having PVC Insulated, color code, wrapped with appropriate filler and care binder and single layer galvanized steel wire armoring for multi-core and overall PVC Jacket. Cable shall be laying, fitted with Lugs, Gland, etc., as required from Transformer to Panel. 2 x 3½ core x of size as specified as per approved design.

Providing, and laying of be I S I mark LT Cable for 415 Volts, of Aluminum conductor of 3½ core, having PVC Insulated, color code, wrapped with appropriate filler and care binder and single layer galvanized steel wire armoring for multi-core and overall PVC Jacket. Cable shall be laying, fitted with Lugs, Gland, etc., as required from Panel to Motor.

1 x 3½ core x of size as per approved design.

For Star side = 3.5 core and for Delta side = 3 core to be considered.

15. CONTROL PANEL BOARDS:

The LT A.C. Switch Board shall be of 440 Volts, 3 Phase and neutral, 50 Hz. Distribution board, indoor type, sheet clad by 1.5mm thick CRC sheet over M.S. Channel structure frame, floor mounted free-standing type, cubical pattern, dust & vermin proof, and shall comprise of following.

2 Nos. of Incoming feeders each comprising of: -

- 1 No. 630 An Amps ACB (SCADA compatible)
- 1 No. of 96sq.mm flush type ampere meter with selector switch.
- 1 No. of 96sq.mm flush type volt meter with selector switch.
- 1 Set. of Indication Lamps for all three phases, ON/OFF, Auto Trip.
- 1 Set. of CTs for protection and metering.
- 1 No. of over current and earth fault protection.
- 1 No. Multifunction meter.
- The bus bar shall be suitable for full load of Ampere of ACB of incomer.

1 No. Bus coupler between 2 incoming feeders comprising of 1 No. 630 Amp ACB terlocking arrangement both electrical as well as mechanical.

Outgoing feeder with front operated rotary handles facilities shall be provided as under:

- 2 Nos. of ACBs for out going with overload and short circuit protection
- 1 No. of 32 Amps 4P MCCB for auxiliary loads.
- 1 No. of 63 Amps 4P MCCB for auxiliary loads.
- 2 Set. of Ampere Meter for motor with selector switch.

- 2 Sets. of Capacitor of required KVAR with MCCB/MCBs. (Each capacitor shall have separate MCB/MCCB and contactor along with APFC relays)
- 4P MCBs for valve actuators.

Note: Above mentioned instruments ratings and details are minimum and indicative only and will be finalised after approval of SLD/Detailed design as per actual.

The bus bar shall be suitable for 3 phases, 4 wire and shall be of 250 amps. The bus bars shall be with colored insulated sleeves. The supports shall be suitably spaced to give mechanical rigidity for with standing stress due to system fault. The panel compartments shall have adequate space for termination of incoming and outgoing feeder cables equipped with gland, lugs etc. The contractor shall also provide rubber hand gloves, rubber matting in front of panel boards.

16. **SOFT STARTERS**

The soft starter panel shall be suitable on operating voltage $415V \pm 10\%$ 3ph, 4 wire and 240 V AC $\pm 10\%$ control supply voltage at $50Hz \pm 5\%$ to be provided on line side of motor for pump application as per IS 5553 (part 3) of 2mm thick CRCA sheet, with IP 41 protection, natural air cooled, duly epoxy power coated, with bottom side removable cable gland plates of non magnetic material.

The Estaster should limit the starting current of motor between 3 to 3.5 of fault load current, with Start/Stop/Reset – Push buttons, Bus bar shall be of Electolytic Copper Conductor, of suitable capacity with 'H' class insulation with temperature rise limit upto class 'B' & 50° Amp. temperature.

The starter should have power contactors as a by pass device having following protection relay (O/L, SP, EF, LR, UC) 1) U/O voltage relay. Indications by LED type indicating lamps.

The softstarters shall have microprocessor based and compatible with SCADA operation

17. **CIVIL WORK FOR ERECTION AND COMMISSIONING OF ENTIRE JOB.**

	Foundation as per site condition of pump set, valves support, etc with help of 1:2:4 Cement Concrete.	1 Job.
	Installation of all above supplied items as per rules along with earthing of all electrical equipments as per IE rules	1 Job.

B. Detailed specification for various items for sub- station.

1. **TRANSFORMER:**

General requirement:

Sub-station shall be provided as per scope of work mentioned for Raw Water, WTP & Clear Water capacity transformer

11/0.415 kV double copper wound outdoor type transformer. The transformer of sub-station shall be installed on the specially constructed open to sky. Stage of about 1.0-1.5 M. height above ground level connected hence the entire cable connection arrangements of these transformer shall be closed type.

Voltage ration	:	11/0.415 KV
Vector group	:	Dyn-II and all the transformers shall be filled with mineral oil and ONAN cooling type suitable for outdoor installation and for parallel operation.

- ❖ Each transformer shall be capable of operation continuously at its rated output without exceeding the limits of temperature rise as given below over the ambient temperature of 50°C.
 - a. In Oil by thermometers. : 45°C
 - b. In winding by resistance : 55°C
- ❖ The loading of the transformer shall conform to IS:6600/1972.
- ❖ The transformers shall be so designed as to capable of withstanding without injury to the thermal mechanical effect of short circuits at the terminals of any winding for a period as specified in IS:2026.
- ❖ The transformer shall be capable of continuous operation at the rated output under the following conditions.
 - a. Voltage variation : $\pm 7.5\%$ of rated voltage.
 - b. Frequency variation : $\pm 3\%$ of rated frequency.
 - c. Combined voltage and frequency : 10% variation.
- ❖ The transformer shall be free from any abnormal noise and vibration and have noise level below the limits prescribed in the relevant standards.
- ❖ The transformer shall be capable of running in parallel.

Constructional features:

➤ **Tank:**

- (i) The tank shall be of welded construction and fabricated from sheet steel or adequate thickness. All seams shall be properly welded to withstand requisite impact during short circuit without distortion. The tank wall shall be reinforced by stiffener of structural steel for general rigidity. The tank shall have sufficient strength to withstand without deformation (i) mechanical stock during transportation and (ii) all filling by vacuum.
- (ii) The tank cover shall be bolted on to the tank with weather proof, hut oil resistant, resilient gasket in between for compete oil tightness. If gasket is compressible, metallic stops shall be provided to prevent over compression. Bushing, cover of access holders and other devices shall be designed to prevent any leakage of water into and oil from the tank. The cover shall also be provided with 2 Nos. grounding pads for earthing.
- (iii) Oil sampling taps shall be provided with valve at top and bottom to collect sample of oil from the tank for testing.
- (iv) To facilitate the oil filtration by streamline filter suitable inlet and outlet taps with valve at the bottom and at the top of the tank diagonally opposite corners shall be provided. The valve at the bottom may be used as drain valve.
- (v) Thermometer pocket for top oil temperature measurement by mercury thermometer shall be provided.
- (vi) The transformer tank shall be fitted with a double diaphragm type of explosion relief vent at the top having equalizer pipe connection from conservator.

➤ **Core and coils:**

The transformer will be of core type, the core design shall be built up with inter lived high grade non-grain. Low loss, high permeability grain-oriented cold rolled silicon steel laminations properly treated for core material. The coils shall be manufactured from electrolytic copper of suitable grade, and should be properly insulated varnished and

stacked.

All insulation material shall be of proven design. Coils shall be also insulated that impulse and power frequency voltage stresses are minimum. Insulating level of graded insulation shall conform to the relevant standard of IS:2026 Part-III, 1977.

Coil assembly shall be suitable supported between adjacent sections by insulation spacers and barriers. Bracing and other insulation used in assembly of the winding shall be arranged to ensure a free circulation of the oil and reduce the hot spot of the winding.

All leads from the winding to the terminal board and bushing shall be rigidly supported to prevent injury from vibration or short circuit stresses. Guide tube shall be soused where practicable.

The core and coil assembly shall be securely fixed in position, so that no shifting or deformation accure during movement of transformer or under short circuit stresses.

➤ **Tapings:**

Off load tap changer is to be provided on the high voltage winding. The steps shall be of 1.25% variation required is $\pm 7.5\%$ Winding including tapping arrangement shall be designed to maintain the electromagnetic balance between HV and LV winding at all voltage rations.

➤ **Conservator tank:**

Conservator tank shall be provided with dial type level indicator visible form ground level and fitted with low oil level alarm contact. Plain oil level gauge shall also be provided. Transformer oil shall comply with IS:335-1972.

➤ **Temperature indicator:**

1 No. Dial type temperature indicator shall be provided in the transformer.

➤ **Terminal arrangement.**

Since the cables shall be provided for connection with LV systems of transformer, hence the cable terminal boxes shall be provided for the connections to have a closed connection.

➤ **Transformer bushing:**

All bushing shall conform to the requirements of the latest revision of relevant IS:2099-1973 & 3347. Bushings shall be so located to provide at least minimum permissible electrical clearance and between phase and ground as per the relevant standard.

Transformer accessories: -

Transformer shall be equipped with fitting and accessories as listed below complying with IS:3639/1966.

- Oil conservator with filter cap and drain plug for each transformer.
- Silicagel breather with connecting pipe and oil seal.
- Explosion relief vent with double diaphragm and equalizer pipe connection to conservator air space.
- Air release plugs.
- Direct reading plain oil level gauge – 1 No. for each transformer.
- Drain valve with threaded adopter.
- Oil sampling valves (top and bottom)
- Filter valves with threaded adopter (top & bottom)
- Cover lifting eyes.
- Jacking pads, handling and lifting lugs.
- Skids
- Radiator – These shall be tank (wall) mounted type.
- Rating plate and terminal marking plate.

- Termination arrangement for cable connection at sides LV.
- Neutral bushing.
- Off circuit tap charger.
- Clamping device with nuts and bolts for clamping the transformer on foundation rails.
- Temperature meter.

2. CABLES:

Providing, and laying of be I S I mark LT Cable of 1100 Volts, of Aluminium conductor of 3 -1/2 core, having PVC Insulated, colour code, wrapped with appropriate filler and core binder and single layer galvanized steel wire armoring for multi-core and overall PVC Jacket. Cable is required from Transformer to Incomer panel.
3½ core x of size as as per approved design.

3 LT PANEL BOARD:

The LT AC Switch board shall be 440 volts 3 phase and neutral, 50 Hz., distribution board, outdoor type, wall/floor mounted comprising of following:

1. 1 Nos. Incoming feeder **each** incoming feeder comprising of:
 - (a) 1 Nos. Three pole MCCB of amperes rating as as per approved design with in-built magnetic thermal release, under voltage release and shunt trip release.
 - (b) 1 Nos. suitable CTs for protection & metering.

The bus bar shall be suitable for 3 phase 4 wire and shall be of amps of MCCB as per rated per phase and 100 amps for neutral. Nominal current density in bus bars shall not exceed 1.5 amps per mm². The bus bars shall be with colored insulated sleeves. The supports shall be suitably spaced to give mechanical rigidity for withstanding stress due to system fault level of 40 KA for 1 second. The bus bar chambers shall be of adequate size to house the stated air insulated bus bars. Panel compartments shall have adequate space for termination of incoming and outgoing feeder cables equipped with compression glands etc.

All MCCB units shall be front operated handle type and Microprocessor based.

4. LIGHTING ARRESTOR:

Each Sub-Station shall be provided with 11 kV of L/A.

The lightning arresters (Surge Diverters) shall be single pole, station type; suitable for use in solidly earthed system i.e., 11 kV side short circuit level is considered upto 1500 MAV. The lightning arrester will comply with IEC 99.5 and IS 3070. All ferrous parts shall be hot dip galvanized. It should act as a by pass for the lightning surge and also to limit and squash the flow of follow current from the system after the surge has passed. Its rating should be 11kV, 50 Hz, heavy duty, long duration discharge class with 8/20 wave shape, 10,000 Amp and also be of pressure relief class.

5. 11 KV DROP OUT FUSE –.

Each Transformer shall be provided with DO Fuse set as per enclosed tentative drawing attached.

6. 11 KV GANG OPERATED A B SWITCH:

Each Transformer & Incoming of electricity board line shall be provided with 11 KV up right mounted Horizontal or Vertical rotating single break A b switch which should be compact in design, operated with manual handle, confirming to IS:9921 (Part I to V) 1981.

7. **ACRS CONDUCTOR –**

This shall be used for transmitting line from electricity board connection to VCB & Transformer for 11KV line of 48sq.mm or suitable size.

8. **11 KV PIN INSULATOR**

These shall be used in Sub-Station as per requirement.

9. **11 KV DISC INSULATOR:**

These shall be used in Sub-Station as per requirement.

10. **HARDWARE FOR ACSR CONDUCTOR**

Miscellaneous hardware material required to draw ACSR conductor from electricity board line to L/A to DO to AB Switch to Transformer.

11. **Earthing: -Material: -G.I. PLATE:**

Supply & fixing of G.I. Plate of size 600 x 600 x 6mm for additional earthing of Transformer, panel etc.

G.I. STRIP:

Supply & fixing of G.I. Strip of size 25 x 5mm from earthing pit to various points of earthing connection of all electrical equipments.

G.I. PIPES:

Supply & fixing of G.I. 50mm from earthing pit to various points of earthing connection of all electrical equipments.

HARDWARE FOR EARTHING:

Miscellaneous hardware material such as Galvanized Nut-Bolts, Washers, Coal/ Charcoal, Salt etc. required to complete the earthing arrangement.

MAIN HOLE COVER:

Main Hole Cover of size 300 x 300mm for earthing pits chamber protection.

12. **D.P. STRUCTURE for each sub station i/e for Raw water and Clear water:**

- 2 Pole Structure for incoming line fabricated out of RS joint of the size 200 x 100 mm of 9 to 11 M. length.
- 100 x 50 x 5mm MS channels of required length for installation of various equipment like LA/ Pin Insulator/ Disk Insulator/ DO Sets/ AB Switch, CT's, PT's, etc.
- MS Flats, MS Angles of 50 x 50 x 6mm, etc. for miscellaneous cross support, horizontal and vertical support etc.
- 6 pole structure for transformer will also be provided by the contractor
- Control room 20 Sqm will also be provided by the contractor.
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13. **FENCING:**

The boundaries of sub-station shall be fenced with help of M.S. Angles, flats, gate, as per requirement.

VERTICALS:

The vertical posts of 2.5 M height above G.L. shall be legged by 50 x 50 x 5mm size angle

fixed at a distance of 2 M and every corner shall be provided with diagonal struts of 50 x 50 x 5mm angle.

WIRE MESH:

The boundary shall be covered by G.I. Wire Mesh of 3mm thick netting size 100 x 100mm of height 2.5 M

FASTENING FLAT:

The wire mesh will be fastened with the supports by M.S. Flats of 25 x 3mm size for vertical & horizontal support as required.

HARDWARE:

The standard makes nut-bolts, G.I. Wire, Washers, etc., shall be provided for fixing of wire mesh.

One Iron Gate of 3.5 M. wide & height of 1.5 M. shall be provided.

14 METALLING:

50mm thick metal shall be covered uniformly over the entire surface of sub-station, the metal shall be hard, tough, resistance to abrasion and weathering action, nonporous drainable, and rough surfaces for proper interlocking.

15 CIVIL WORK FOR ERECTION AND COMMISSIONING OF ENTIRE JOB.

Transformer shall be kept above HFL of the plant and the foundation should be of RCC M20 grade concrete having pedestal above finished ground level to support load of transformer.

Construction of wall for partition between two transformers.

Construction of earth pit chamber as per I.E. Rules.

Trenches for cable from transformer to panel room with filling by sand.

16 ACCESSORIES:

Rubber Hand Gloves.

Ball Pin Hammer with Wooden Handle.

Screw Driver 8" & 12"

Shock Treatment Chart.

Danger Notice Board.

Fire Stand with Fire Bucket in sub-station.

Insulated Player.

Fire extinguisher 4.5 Kg.

D.O. Operating rod 11kV fibre H.D.

Discharge rod with accessories fibre.

Helmet H.D.

17 Work of erection (as per IE rules) of entire sub station equipments and allied works.

18 Work of drawing preparation, commissioning along with obtain of charging permission from electrical inspector as per IE rules.

PART- A**SCHEDULE FOR ITEMS FOR RAW WATER VT PUMP SET (PROPOSED).**

S.No	Particulars.
	Design, supply, fixing, commissioning, trial run of following as per detailed specifications given in the respective Annexure.
1.	V.T pump for 16 LPS at 15Mtr. total head as per detail specification along with column pipe of size as per approved design. column assembly of required length I/c bowl assembly, Foundation bolts for above pump set along with suitable HP VHS Electric Motor 3 phase, 415 volts, as per detail specification. Pump efficiency minimum 80% at duty point.
2.	Vertical Hollow Shaft motor, TEFC, 1450 RPM suitable to operate on 415V + 10%, 3P, 50Hz, AC supply having 'H' class insulation temp. rise limited to 'B' class with continuous duty, conforming to IS-12615
3.	Butterfly valve electrically operated of PN 1.6 size for delivery side of pump as per detail specification.
4.	Sluice valve of PN 1.6 size for delivery pipe as per detail specification.
5.	Non-Return valve of PN 1.6 size for delivery side of pump as per detail specification.
6.	Sluice valve of PN 1.6 size for manifold pipe line as per detail specification.
7.	Non-Return valve of PN 1.6 size for common manifold as per detail specification.
8.	D/f Flow meter of electromagnetic type for installation on manifold pipe as per detail specification.
9.	Pressure gauge of dial size for delivery side of pump as per detail specification
10.	DI Dismantling Joint for delivery side of pump as per detail specification.
11.	DI Dismantling Joint for common manifold pipe.
12.	M.S. D/F Pipe for delivery along with flanges hardware like Nut, Bolts, Washers & Rubber Sheet, complete for joining pipes, valves, etc.
13.	DI. D/F enlarger for delivery side
14.	M.S. S/F Bend of 90/45 deg for jointing to common manifold and pump outlet.
15.	M.S. D/F Pipe for common manifold of lengths as required along with flanges & hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.
16.	Aluminum Armored cable from CB to pump house CB including accessories like lugs, gland. For connection of Transformer CB Panel to Motor Panel.
17.	Aluminum Armored cable from Panel to motor including accessories like lugs, gland. For connection of Panel to Motor.
18.	EOT Crane of approved design complete as per specification.
19.	Motor control panel: Motor control panel shall be as per detail specification along with soft starters As per specification.
20.	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 3 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete
21.	Tools accessories as per specification.
22.	Installation and commissioning of all above items including painting, trial run of 3

	months and testing
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Above mentioned items are minimum requirements and indicative only. Contractor to provide all the items necessarily required for successful commissioning of the whole scheme as directed by Engineer in Charge. Being a LumpSumContract, nothing extra shall be paid on this account as these are deemed to be inclusive in the Contractor's Lump sum offer.

PART- B**SCHEDULE FOR ITEMS FOR CLEAR WATER PUMPSET (PROPOSED)**

S.No	Particulars.
	Design, supply, fixing, commissioning, trial run of following as per detailed specifications given given in the respective Annexure.
1	HorizontalsplitcaseCentrifugal pump for 22.35 LPS at 40 M total head with positive Suction as per detail specification along with Coupling, Coupling guard, Base Plate & Foundation bolts for above pump along with suitable HP Electric Motor as per detail specification. Pump efficiency minimum 80% at duty point.
2	Suitable HP Electirc motor 3 phase, 415V, foot mounted type TEFC, 1450 RPM as per detail specification.
3	Sluice valve of PN 1.6 for suction side of pump as per detail specification.
4	Sluice valve of PN 1.6 for delivery side as per detail specification.
5	Non-Return valve of PN 1.6 for delivery side of pump as per detail specification.
6	Sluice valve of PN 1.6 for manifold pipe line as per detail specification.
7	Non-Return valve of PN 1.6 for common manifold pipe line as per detail specification.
8	Foot valve flanged type to be installed at the suction side of pumps.
9	DI eccentric enlarger at suction side of pump
10	DI conccentric enlarger at delievry side of pump
11	Pressure gauge of dial
12	D/F Flow meter of electromagnetic type for installation on manifold pipe as per detail specification.
13	M.S. D/F Pipe for suction as per site requirement of along with flanges hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.
14	DI Dismantling Joint for suction side of pump as per detail specification.
15	M.S. D/F Pipe for delivery along with hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.
16	M.S. D/F Bend of 45°/90° for jointing to commonmanifold and pump outlet.
17	M.S. D/F Pipe for common manifold along with flanges & hardware like Nut, Bolts, Washers & Rubber Sheet complete for joining pipes, valves, etc.
18	3½ core AluminumArmored cable including accessories like lugs, glands. For connection of Transformer CB panel to Motor Panel.
19	3 ^{1/2} core AluminumArmored cable from starter to motor including accessories like lugs, gland. for panel to Motor.
20	EOT Crane of approved design complete as per specification.
21	MOTOR CONTROL PANEL: Motor control panel shall be as per detail specification, along with soft starters as per specification.
22	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. strip 25 x 3mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete, as per IE Rule.
23	Accessories as per specification.
24	Installation and commissioning of all above items including painting, trial run of 3 months and testing

Above mentioned items are minimum requirements and indicative only. Contractor to provide all the items necessarily required for successful commissioning of the whole scheme as directed by Engineer in Charge. Being a LumpSum Contract, nothing extra shall be paid on this account as these are deemed to be inclusive in the Contractor's Lump sum offer.

PART – C-1

SCHEDULE OF ITEMS FOR ELECTRIC SUBSTATION(FOR RAW WATER SUMP WELL)

S.No.	Particulars.
	Design, supply, fixing, commissioning, trial run of following as per detailed specifications given in the respective Annexure.
1	Substaions of 11/0.415 KV with 2 nos 100 KVA (1W+1S), Transformer having as per detail specification.
2	HT breakers with CT arrangements
3	Lightning Arrestors.
4	DO Fuse Unit.
5	A.B. Switch Complete with operating Rod/ Handle.
6	ACRS Conductor from AB switch to VCB and VCB to transformers
7	Pin Insulators.
8	DISC Insulators.
9	Hardware kit, compete for laying of ACSR Conductor & inter connection from A/B Set, L/A Set, D/O Set, Pin & Disc Insulator upto transformer.
10	3½ core Aluminum Armored cable from Transformer to Breaker panel including accessories like lugs, glands.
11	Main panel having CB for fixing near transformer.
12	Earthing work using G.I. Plate of 600 x 600 x 6mm, G.I. Strip 25 x 5 mm, Complete hardware of earthing like coal, salt, galvanized nut-bolts, funnels, G.I. Pipes etc., and main hole cover for earthing pit. Complete
13	I Section 200 x 100 - Length as required. Channel 100 x 50, etc. – as required.
14	Fencing work using 50 x 50 x 5mm size vertical post of 3 Mtr. length and 50 x 50 x 5mm size struts for even corner of 3 Mtr., Wire mesh of 3mm thick with netting size of 100 x 100mm of height 2 Mtr., M.S. Flats of size 25 x 3mm size for vertical & horizontal support., Hardware material, like Nut, Bolt, G.I. Wire, etc. for fencing., Gate of 3.5 Mtr. Wide & height of 1.5 Mtr. of Iron Steel.
15	Metalling
16	Street lighting poles of height – 8.5 Mtr. LED Lamp of 100 Watts & fitting for LED Lamp with hardware complete.
17	Cables of 2.5 sq.mm x 2 core copper armored cable for street lighting load.
18	Drawing preparation for sub – station and approval from safety electrical inspector.
19	Charging permission for sub – station and approval from safety electrical inspector.
20	All civil work relating to erection of poles, fencing work, construction of platform for transformer, earth pit chambers.
21	Installation and commissioning of all above items including painting, trial and testing
22	ACCESSORIES
	Rubber Hand Gloves.
	Ball Pin Hammer with Wooden Handle.
	Screw Driver 8” & 12”

	Shock Treatment Chart.
	Danger Notice Board.
	Fire Stand with Fire Bucket in sub-station.
	Insulated Player.
	Fire extinguisher 4.5 Kg.
	D.O. Operating rod 11 kV fiber H.D.
	Discharge rod with accessories fiber.
	Helmet H.D.

ANNEXURE – E-3

	Scope of work and technical Specification for Spigot and socket centrifugally cast (spun) ductile iron pipe class k-9 & k-7 with inside cement mortar lining presure pipe in raw water pumping main, clear water pumping main& distribution system network, HSC, etc																																															
1.0	SCOPE OF WORK: The scope of work shall be as below:																																															
1.1	Providing, laying, jointing, interconnection, testing & commissioning for Raw water pumping main, Clear water pumping main&Distributionsystemof D.I. pipe class K-9& K-7including all allied works 1. Raw water Rising/Pumping/Gravity Mains: - <table border="1"><tr><td>Sr.No</td><td>Dia& Type</td><td>Length (M)</td></tr><tr><td>I</td><td>250mm, DI-K-9</td><td>11674</td></tr><tr><td></td><td>Total</td><td>11674</td></tr></table> 2. Clear water Rising/Pumping Mains: - <table border="1"><tr><td>Sr. No</td><td>Dia& Type</td><td>Length (M)</td></tr><tr><td>I</td><td>150mm, DI-K-9</td><td>3975</td></tr><tr><td>Ii</td><td>200mm, DI-K-9</td><td>218</td></tr><tr><td>iii</td><td>250 mm, DI-K-9</td><td>1706</td></tr><tr><td></td><td>Total</td><td>5899</td></tr></table> 3. Distribution System: - <table border="1"><tr><td>Sr. No</td><td>Dia& Type</td><td>Length (M)</td></tr><tr><td>I</td><td>100 mm, DI-K-7</td><td>3140</td></tr><tr><td>Ii</td><td>150 mm, DI-K-7</td><td>400</td></tr><tr><td></td><td>Total</td><td>3540</td></tr></table> 4. Functional Household Service Connection (HSCs) and all other allied works. <table border="1"><tr><td>Diameter (mm)</td><td>Nos.</td></tr><tr><td>15</td><td>100</td></tr><tr><td>20</td><td>10</td></tr><tr><td>25</td><td>5</td></tr><tr><td>Total</td><td>115</td></tr></table> 5. Scope also inclusive of State/National Highways and all allied works Above all includes valves, fixtures, road restoration, concrete encasing and all allied civil works The work of providing, laying, testing DI pipeline in project area including excavation cutting concrete road, tar road and restoring to the original shape after lowering the pipes including protecting public services and making good if damaged, including valves, pressure relief valves, DI and MS specials, interconnection with the existing DI		Sr.No	Dia& Type	Length (M)	I	250mm, DI-K-9	11674		Total	11674	Sr. No	Dia& Type	Length (M)	I	150mm, DI-K-9	3975	Ii	200mm, DI-K-9	218	iii	250 mm, DI-K-9	1706		Total	5899	Sr. No	Dia& Type	Length (M)	I	100 mm, DI-K-7	3140	Ii	150 mm, DI-K-7	400		Total	3540	Diameter (mm)	Nos.	15	100	20	10	25	5	Total	115
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	<p>pipelines if any, fixing of all the appurtenances such as chambers, all the road crossings, railway crossings if any, hydraulic testing of pipe line, performance of the network commissioning to rated capacities and trial run including all cost etc complete.</p> <p>The work shall include but not limited to the following</p> <p>LAYOUT DRAWINGS OF PUMPING MAINS: -</p> <p>The drawings showing tentative alignment and layout of the pumping mains, ground configuration and other necessary details are enclosed along with these specifications. The contractor shall have to submit the detailed layout drawing, sufficient to show the details as mentioned below-</p> <ul style="list-style-type: none"> • R.L. of ground, invert level of pipes and H.G.L. at every 30 m interval. • Location of horizontal and vertical bends. • Degree of bends, degree or radius of curves, tangent distance for curves, location and covering length of all valves and other appurtenances. • Details and description of all specials. • Location and size of supporting pillars, bridges and culverts to cross the waterways. • Location and sizes of thrust blocks and anchor blocks. • Location and sizes of valve chambers. • Details, dimensions and plan including complete description of expansion joints and flanges. • The layout plan submitted by the contractor can be altered or modified by the Engineer-in-charge to suit the requirement depending upon the field conditions before or even after the acceptance of the tender or during the course of execution of work and the contractor shall not claim for compensation in any way on this account.
1.1	ISI mark socket and spigot centrifugally cast (spun) Ductile Iron Pressure pipes class K-9 and K-7 with inside cement mortar lining conforming to IS:8329-2000 with suitable rubber gasket (Push on) joints as per IS:5382-1985 duly inspected by RITES/IR Class with all ductile iron fittings and ISI marked sluice valve conforming to IS 9523-2000 including testing and commissioning.
1.2	Excavation in trenches in all types of strata for laying & jointing of above pipe line with required depth and width as per specification.
1.3	Providing and fixing D.I. D.F. sluice valve including testing & jointing with cost of nut, bolts, rubber insertion duly inspected by RITES/IRClass
1.3.1	Providing and fixing following DI double flange ISI mark sluice valve fitted with cast iron cap including jointing and testing with cost of jointing materials
1.3.2	Providing, laying & jointing D.I./ MJ fittings conforming to IS 9523:2000
1.4	Construction of Brick & RCC valve chambers in all the places where sluice valve, Air valve and non-return valve are provided, Anchor Blocks, Pedestal etc. as required as per specification. The internal dimension of Brick & R.C.C. chamber shall have clear space of 500 mm all around in valve. This clearness can be modified only after with instruction issued by the Engineer in charge looking to the site conditions.
1.5	Back filling of trench as per IS:12288-1987.
1.6	Providing and making all interconnections as required to charge the laid pipe lines under scope of work.
1.7	In case, the shifting of any existing, water pipe line/sewage line is considered necessary by the department such service lines will have to be shifted by the contractor for which

1.8	<p>the payment shall be made for the actual work done as per approved rate of this contract.</p> <p>The firms/contractors are directed to submit the details plan and elevation of all the pipelines showing the dimensions of all components and other details. All the valves and electromechanical fittings shall be SCADA & PLC compatible with actuators for implementation of SCADA. The contractor has to procure and install informatory board's displaying Name of work at the location given by CMO.</p>
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2.0 D.I. PIPES

2.1	Manufacture: -All the pipes shall be ISI Mark and confirming to IS: 8329:2000. The pipes should be duly inspected by RITES/IRCLASS before supply.
2.2	Hydrostatic test: - Hydrostatic test of Pipes shall be carried out as per relevant IS codes and guidelines.
2.3	Tolerances: -The tolerance shall be permissible as per IS:8329-2000.
2.4	Coating: -All the D.I. pipes should be internally in lined with cement mortor and externally out coated with metallic zinc coating having finishing layer as indicated in Annexure A, as per IS 8329-2000.
2.5	<p>Marking: -Each pipe shall have cast, stamped or indelibly painted on it the following appropriate marks:</p> <ul style="list-style-type: none"> a) Indication of the source of manufacture. b) The nominal diameter. c) Class reference d) The last two digits of the year of manufacture. <p>Marking may be done:</p> <ul style="list-style-type: none"> a) On the socket faces of pipe centrifugally cast in metal mould, and b) On the outside of the socket or on the barrel of pipe centrifugally cast in sand mould. <p>Any other marks required by the purchaser may be painted on.</p>
3.0	DUCTILE IRONFITTINGS:
3.1	The Ductile Iron fittings shall be ISI mark conforming to IS 9523-2000.
3.2	COATING:
3.2.1	Fittings and accessories shall be normally delivered internally and externally coated.
3.2.2	The external coatings shall be applied with zinc rich paint with finishing layer as included in Annexure "A" of IS 9523:2000.
3.2.3	The internal Linings shall be applied with portland cement mortor (with or without additions) as included in Annexure "B" of IS 9523:2000.
3.3	MARKING:
3.3.1	<p>Each fitting shall have as cast, stamped or indelibly painted on it, the following appropriate marks:</p> <ul style="list-style-type: none"> a) Indication of the source of manufacture, B) The nominal diameter, C) The last two digits of the year of manufacture, d) PN rating flanges when applicable, and e) Any other mark required by the purchaser.
3.3.2	Marking may be done on the barrel of castings or on the outside of the sockets.
3.4	BIS Certification Marking

	The fittings may also be marked with the Standard Mark.
4.0	LAYING AND JOINTING:
4.1	SITE PREPARATION:
4.1.1	Preliminary work required to be done before laying of pipe lines includes pegging out, clearing and disposal of all shrubs, grasses, large and small bushes, trees, hedges, fences, gates, portions of old masonry, boulders, and debris from the route.
4.1.2	Where trees have been felled, the resulting timber shall be stacked properly and disposed of as directed by the authority. Tree roots within a distance of about 0.5 metre from either side of the pipeline should be completely removed before laying pipe lines.
4.1.3	All other serviceable materials, such as wood, bricks and stones, recovered during the operation and clearing the site, shall be separately stacked and disposed of as directed by the authority.
4.2	FORMATION:
4.2.1	GENERAL: Before pipe line is laid, proper formation be prepared for pipe line
4.3	Excavation and Preparation of Trenches for Laying Underground Pipe Lines.
4.3.1	The width of the trench at bottom between the faces of sheeting shall be such as to provide not less than 300 mm clearance on either side of the pipe except where rock excavation is involved. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, strutting and planking, and handling of specials.
4.3.2	Special consideration should be given to the depth of the trench. In agricultural land, the depth should be sufficient to provide a cover of not less than 900 mm so that the pipe line will not interfere with the cultivation of the land. In rocky ground, rough grazing or swamps, the cover may be reduced provided the water in the pipe line is not likely to freeze due to frost.
4.3.3	It may be necessary to increase the depth of pipe line to avoid land drains or in the vicinity of roads, railways or other crossings.
4.3.4	Care should be taken to avoid the spoil bank causing an accumulation of rain water.
4.3.5	Where pipes are to be bedded directly on the bottom of the trench, it should be trimmed and levelled to permit even bedding of the pipe line and should be free from all extraneous matter which may damage the pipe or the pipe coating. Additional excavation should be made at the joints of the pipe so that the water main is supported along its entire length.
4.3.6	Where excavation is through rocks or boulders or at locations of B.C. soils the pipe line should be bedded on concrete bedding or on at least 150 mm of fine-grained material, or other proper means are used to protect the pipe and its coating. Material harmful to the pipe line should not be used.
4.3.7	Temporary under pinning, supports and other protective measures for building structures or apparatus in or adjacent to the trench should be of proper design and sound construction.
4.4	ROCK EXCAVATION - The term "rock" wherever used in this standard, shall have the same meaning as given in terminology in IS:1200 (Part 1)- 1974.
4.4.1	Blasting - Blasting for excavation shall be permitted only after securing the approval of the authority and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the authority. The procedure of blasting shall conform to the requirements of the authority.
4.5	Stacking Excavated Material - All excavated material shall be stacked in such a manner that it will not endanger the work or workmen and it will avoid obstructing footpaths, roads and driveways. Hydrants under pressure, surface boxes, fire or other utility controls shall be left unobstructed and accessible during the construction work. Gutters shall be kept clear or other

	satisfactory provisions made for street drainage, and natural water-courses shall not be obstructed.
4.6	Barricades, Guards and Safety Provisions - To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, torches, red lanterns and guards, as required, shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadways. All materials, piles equipment and pipes which may serve as obstruction to traffic shall be enclosed by fences or barricades and shall be protected by illuminating proper lights when the visibility is poor. The rules and regulations of the local authorities regarding safety provisions shall be observed. The cost of above works is deemed to be included in the Lump sum offer of bidder, nothing extra shall be paid in this regard. In case contractor fails to comply with the directions department will be at liberty to execute the above works and deduct, the amount incurred plus a penalty of 10% of amount incurred, from contractor's RA/Final bills.
4.7	Maintenance of Traffic and Closing of Streets -The work shall be carried including closing of road/street in such a manner which will cause the least interruption to traffic. Where it is necessary for traffic to cross the open trenches, suitable bridges shall be provided.
4.7.1	Suitable signs indicating that a street is closed shall be placed and necessary detour signs for the proper maintenance of traffic shall be provided.
4.8	Protection of Property and Structures - Trees, shrubbery, fences, poles, and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the authority. When it is necessary to cut roots and tree branches, cutting shall be done under the supervision and direction of the authority.
	Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work, shall be provided under the direction of the authority. The structures, which may have been disturbed, shall be restored after completion of the work.
4.9	Protection of the Existing Service - As far as possible, the pipe line shall be laid below existing services, like water and gas pipes, cables, cable ducts and drains but not below sewers which are usually laid at greater depth. Where it is unavoidable, pipe line should be suitably protected. A minimum clearance of 150 mm shall be provided between the pipe line and such other services. Where thrust or auger boring is used for laying pipe line across roads, railways or other existing utilities, large clearance as required by the existing utilities, as required shall be provided. Adequate arrangements shall be made to protect and support the existing services during the laying operations. The pipe line shall be so laid as not to obstruct access to other services for inspection, repair and replacement. When such utilities are met with during excavation, the authority concerned shall be intimated and arrangements should be made to support and protect the utilities in consultation with them and in case of such damaged services will be repaired at the cost of contractor himself.
4.10	Back-Filling - For the purpose of back-filling, the depth of the trench shall be considered as divided in to the following three zones from the bottom of the trench to its top: a) Zone A : From the bottom of the trench to the level of the centre line of the pipe. b) Zone B : From the level of the centre line of the pipe to a level 300 mm above the top of the pipe, and c) Zone C : From a level 300 mm above the top of the pipe to the top of the trench.
4.10.1	Back-filling in Zone A shall be done by hand with sand, fine gravel or other approved material placed in layers of 80 mm and compacted by tamping. The back-filling material shall be deposited in the trench for its full width of each side of the pipe, fitting and appurtenances simultaneously.
4.10.2	Back-filling in Zone B shall be done by hand or approved mechanical methods in layers of 150 mm special care being taken to avoid injuring or moving the pipe. The type of back-fill material to be used and the method of placing and consolidating shall be prescribed by the authority to suit

	individual locations.
4.10.3	Back-filling in Zone C shall be done by hand or approved mechanical methods. The types of back-fill material and method of filling shall be as prescribed by the authority.
4.10.4	Back-fill under permanent Pavement - Where the excavation is made through permanent pavements, curbs, paved footpaths, or where such structures are undercut by the excavation, the entire back-fill to the sub grade of the structures shall be made with sand in accordance with paved footpaths and pavements consisting of stone, gravel, slag or cinders shall not be considered as being of a permanent construction. Method of placing and consolidating the back-fill material shall be prescribed by the authority.
5.0	LAYING OF PIPES:
5.1	<p>Laying Underground- Pipes should be lowered in to the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 250 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes, either a well-designed set of shear legs or mobile crane should be used. When lifting gear is used, the positioning of the sling to ensure a proper balance, should be checked when the pipe is just clear of the ground. If sheathed pipes are being laid, suitable wide slings or scissors dogs should be used.</p> <p>All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This is done by passing a pull-through in the pipe, or by hand, depending on the size of the pipe. When laying is not in progress, a temporary end closure should be securely fitted to the open end of the pipe line. This may make the pipe buoyant in the event of the trench becoming flooded, in which case the pipes should be held down either by partial re-filling of the trench or by temporary strutting. All persons should vacate any section of trench in to which the pipe is being lowered.</p>
5.2	<p>Pipe Line Anchorage -</p> <p>This shall be provided as per relevant BIS 5330:1984 with up-to-date amendments.</p>
6.0	TRANSPORTATION, HANDLING AND INSPECTION:
6.1	General – Ductile iron pipes are less susceptible to cracking or breaking on impact but the precautions set out should be taken to prevent damage to the protective coating and brushing or damage of the jointing surfaces.
6.2	Transportation - Pipes should be loaded in such a way that they are secured and that no movement should take place on the vehicle during transit.
6.3	Off-Loading - Cranes should be preferred for off-loading. However, for pipe up to 400 mm nominal bore, skid timbers and ropes may be used.
7.0	HYDRAULIC TESTING:
7.1	<p>After a new pipe line is laid and jointed, testing shall be done for:</p> <ol style="list-style-type: none"> Mechanical soundness and leak tightness of pipes and fittings Leak tightness of joints Soundness of any construction work, in particulars that of the anchorages All other tests as per the direction of Engineer in Charge
7.2	<p>The completed pipe line shall be tested for a pressure given in IS 8329:2000, Hydro static test pressure in field shall be carried out as per clause 6.4.4.2 Testing of pressure pipes of Manual of Water Supply and Treatment of CPHEEO.</p> <p>3% amount withheld for hydro static Testing of Pipeline work shall be released after successful hydro static testing of that particular section of pipeline.</p>
8.0	Flushing and disinfection of mains before commissioning:

	The pumping main & distribution mains shall be disinfected before commissioning as per provisions given in CPHEEO manual and IS 5822:1970.
9.0	Removal, Restoration and Maintenance of paved footpaths etc (after laying of pipe):
9.1	Allowable Removal of Pavement - Pavement and road surfaces may be removed as a part of the trench excavation, and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of pavement area required to be removed for the installation of gate valves, specials, manholes or other structures. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 150 mm on each side of trench. The width and the lengths of the area of pavement removed from the installation of gate valves, specials, manholes or other structures should not exceed the maximum linear dimensions of such structures by more than 150 mm on each side. Wherever, in the opinion of the authority, existing conditions make it necessary or advisable to remove additional pavement, it shall be removed as directed by the authority.
9.2	Restoration of Damaged Surface and Property - Where any pavement, shrubbery, fences poles or other property and surface structures have been damaged, removed or disturbed during the course of work, such property and surface structures shall be replaced or repaired after completion of work. The permanent pavement shall not be restored to a condition equal to that before the work began but the top surface of the removed pavement shall be levelled and finished in such a manner as the traffic may pass smoothly. After proper compaction and settlement only, it shall be made to original as per the type of road top is existing
9.3	Cleaning-up: All surplus materials, and all tools and temporary structures shall be removed from the site as directed by the authority. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump and the construction site left clean to the satisfaction of the authority.
10.0	APPURTENANCES: The following appurtenances shall be suitable designed and fixed on the suitable points on the conveyance main.
10.1	SLUICE VALVES: The sluice valve shall be installed as per direction of Engineer - in- charge. The sluice valve shall be class PN 1.6 up to 600 mm dia& class PN 1.0 above 600 mm dia conforming to IS 14846: 2000..
10.2	CAST IRON DOUBLEAIRVALVES: Double orifice type cast iron double Air Valves shall be fixed coupled with isolating sluice valve and at the suitable points based on detailed design. The Air valves shall conform to IS 14845-2000..
10.3	BRANCH CONNECTIONS: “T” outlet with manually operated sluice valves shall be provided in the distribution pressure Main for Branch connections.
10.4	The appurtenances shall be located in such a way that these are clearly and easily accessible for operation and maintenance.
11.0	CONSTRUCTION OF CHAMBERS FOR APPURTENANCES:
11.1	CHAMBER FOR APPURTENANCES: The suitable RCC chambers shall be constructed around the appurtenances and valves fixed on the line, the minimum working space shall be 500mm on all sides. The chamber shall have Pre cast RCC cover conforming to IS:456-2000 suitable for heavy traffic loads.
11.2	CIVIL WORKS:

	All the allied civil works necessary for laying and jointing of pipeline shall be a part of this contract; therefore, the contractor shall design and carry out the necessary civil works such as thrust blocks, anchor blocks, chambers for appurtenances and necessary earth work. All the civil works shall be designed and carried out as per the relevant Indian Standard Code of practice. All the materials used on civil work should be of a quality approved by CMO. Rejected material shall be removed from the site immediately at the cost of contractor.
12.0	Testing, Commissioning of pipe line, trial run and defect liability period: - After completing the job of laying and jointing of pipe line the contractor will do testing, commissioning. The repairing of bursting and leakage of pipeline during this period shall be done by the contractor at his cost including cost of all materials.
13.0	Inspection of Pipes, valves & fittings Inspection of the pipes, valves & fittings will be done by the IRC/ITES. The departmental officials may also inspect at factory site.

14. THRUST BLOCKS

- 14.1 Thrust blocks are required to transfer the resulting hydraulic thrust from the fitting or pipe on to a larger load bearing soil section & shall be designed as per ISS.
- 14.2 Thrust blocks shall be installed wherever there is a change in the direction of the pipe line, size of the pipe line or the pressure-line diagram, or when the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also.
- 14.3 Thrust blocks shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component shell when laid on slopes and the type of soil. The thrust blocks shall be designed and provided as per Appendix 6.6 of the CPHEEO Manual.
- 14.4 When a fitting is used to make a vertical bend, it shall be anchored to a concrete thrust block designed to have enough weight to resist the upward and outward thrust. Similarly at joints, deflected in vertical plane, it shall be ensured that the weight of the pipe, the water in the pipe and the weight of the soil over the pipe provide resistance to upward movement. If it is not enough, ballast or concrete shall be placed around the pipe in sufficient weight to counteract the thrust.
- 14.5 When the line is under pressure there is an outward thrust at each coupling. Good soil, properly tamped is usually sufficient to hold pipe from side movement. However, if soft soil conditions are encountered, it may be necessary to provide side thrust blocks or other means of anchoring. In such cases only the pipe on each side of the deflected coupling shall be anchored without restricting the coupling.
- 14.6 Pipes on slopes need be anchored only when there is a possibility of the backfill around the pipe sloping down the hill and carrying the pipe with it. Generally, for slopes up to 30° good well drained soil, carefully tamped in layers of 100 mm under and over the pipe, right up to the top of the trench will not require anchoring.
- 14.7 For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

15. DISINFECTION OF PIPE LINE BEFORE COMMISSIONING:

- 15.1 Pipeline carrying potable water shall be suitably disinfected before commissioning as per guidelines given in CPHEEO Manual & relevant IS codes.
16. DLP for 12 months to be carried out by the agency concurrently with O&M

17.0 SUPPLY AND LAYING, JOINTING OF DUCTILE IRON PIPES AND SPECIALS:-

- 17.1 **Standards:-**Except as otherwise specified, 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. 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. DI pipes of ISO standard shall also be accepted.

- 17.2 **Casting:** The pipes will be centrifugally cast (spun) Ductile Iron pipes for Water, confirming to the IS 8329. The pipes used will be with push on joints (Rubber Gasket Joints). The class of pipe to be used shall be of the class K-9.
- 17.3 **Surface coating:-**The pipes shall be coated with Metallic Zinc coating as per appendix A, with a finishing layer of bituminous paint, and have factory provided cement mortar lining in the inside as per the provisions of Appendix B of the IS 8329.
- 17.4 **Standard length:-**The pipes will be supplied in standard lengths of 5.50 and 6.00 meters with chamfered ends suitable for push-on jointing. Each pipe of the push on joint variety will also be supplied with a rubber EPDM gasket, confirming to the IS: 5382. Any change in the stipulated lengths will be approved by the Engineer – in charge.
- 17.5 **Manufacture of Gaskets:-**The gaskets should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the contractor to see that the manufacturer of the pipes gets them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub contractor's premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.
- 17.6 **Flanged joints:-**The flanged joints will confirm to the Clause 6.2 of IS 8329. The pipe supply will also include one rubber gaskets for each flange.
- 17.7 **Hydraulic test at works:-**Each and every pipe shall be tested hydraulically by the manufacturer as specified under clause 11 for the pressures specified in table 1 of IS: 8329. The test shall be carried out before application of surface coating and lining except Zinc coating which may be applied before the hydrostatic test.
- 17.8 **Test for Gaskets:-**The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5832 and will be in accordance to Clause 3.8 and contractor shall submit the test certificate issued by the manufacturer with the pipe supply, without which payment for pipe supply shall not be released.
- 17.9 **Third party inspection:-**The inspection and testing of the pipes shall be carried out by the employer and/or inspecting agency appointed by the employer, in the manufacture's workshop at the contractor's cost. The pipes will be subjected to following tests for acceptance:
- Visual and dimensional check as per Clause 13 and 15 of IS 8329 for length, internal and external diameter, wall thickness, deviation from straight length and roundness.
 - Mechanical Tests as per Clause 10 of IS 8329 for Tensile Strength and Brinell hardness Test.
 - Hydrostatic Test as per Clause 11 of IS: 8329.
- The sampling for the above tests shall be as per the provisions under clause 9 of the IS:8329. All the tests shall be conducted in presence of the inspecting agency. The pipes shall be dispatched only after issue of the test certificate by the inspecting agency for satisfactory test results as required. The inspection charges for such tests shall be paid by the contractor to the inspecting agency.
- 17.10 **Retest:-**If a test piece representing a batch fails in the tensile or Brinell hardness test in the first instance, two additional tests shall be made on test pieces selected from two

other pipes from the same batch. If both the test results satisfy the specified requirements, the batch shall be accepted. Should either of these additional test pieces fail in the test, the batch shall be deemed as not complying the required standards and shall be rejected.

17.11 Marking:-

- All pipes will be marked as per Clause 18 of IS 8329 and show as below:
- Manufacturer name/ stamp
- Nominal diameter
- Class reference
- A white ring line showing length of insertion at spigot end

17.12 Packing and Transport: The pipes should be preferably transported by road from the factory and stored as per the manufacturer specifications to protect damage.

18.0 SPECIFICATIONS FOR DUCTILE IRON FITTINGS (SPECIALS)

18.1 General:-The Ductile Iron (DI) fittings shall be D.I. fittings shall be ISI marked as per IS : 9523-2000, suitable for Tyton joints to be used with Ductile Iron pipes with flanged and Tyton jointing system.

18.2 Types of specials:-The following types of DI fittings shall be manufactured and tested in accordance with IS: 9523 or BS: 4772

- Flanged socket
- flanged spigot
- double socket bends (90°, 45°, 22½°, 11¼°)
- double socket branch flanged tee
- all socket tee
- double socket taper
- All the fittings shall be of PN 1.6 pressure rating

18.3 Supply:-All the DI fittings shall be supplied with one rubber ring for each socket. The rubber ring (EPDM) shall conform to IS: 12820 and IS: 5382. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

18.4 Manufacture of Fittings / Specials

The metal used for manufacture of DI Fittings / Specials shall conform to the appropriate grade as specified in IS : 1865-2005. Two side lugs shall be provided on each Socketed fitting, across all types and sizes along with Lifting loops on fitting across all types and sizes from DN 400 & above. D.I. Fittings shall also contain a Stub, minimum length - 15mm x dia.- 10 mm., which can be cut at random to carry out Metallographic test to ascertain minimum 80% Graphite Nodularity as per Clause – 9.1 of IS:1865-2005, in the form - V or VI as per IS : 7754-2003. Fittings manufactured through Induction furnace route only shall be used. The fittings should also be supplied by the manufacturer of the pipes. They should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the contractor to see that the manufacturer of the pipes get them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub contractors premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.

18.5 Lubricant for ductile iron pipes and specials

18.5.1 General:-This section covers the requirements for lubricant for the assembly of Ductile Iron pipes and specials suitable for Tyton push-in rubber ring joint.

18.5.2 Specifications

The lubricant has to have the following characteristics:

- Must have a paste like consistency and be ready for use
- Has to adhere to wet and dry surfaces of DI pipes and rubber rings
- To be applied in hot and cold weather ambient temperature 0-50°C, temperature of exposed pipes up to 70°C
- Must be non toxic
- Must be water soluble
- Must not affect the properties of the drinking water carried in the pipes
- Must not have an objectionable odour
- Has to inhibit bacterial growth
- Must not be harmful to the skin
- Must have a shelf life not less than 2 years

18.5.3 **Acceptance tests:-**They shall be conducted in line with the provisions of the IS 9523

18.6 **Packing for DI specials and Rubber Gaskets**

All the DI fittings shall be properly packed with jute cloth. Rubber rings shall be packed in polyethylene bags. Rubber rings in PE bags and nuts, bolts etc. shall be supplied in separate jute bags.

18.7 **LAYING AND JOINTING OF DI PIPES AND SPECIALS**

Use of tackle

Pipes should be lowered into the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 200 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes suitable mechanical equipment have to be used.

Cleaning

All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This is done by passing a pull-through in the pipe, or by hand, depending on the size of the pipe. All persons should vacate any section of trench into which the pipe is being lowered.

Laying on steep slopes

On gradients of 1:15 or steeper, precautions should be taken to ensure that the spigot of the pipe being laid does not move into or out of the socket of the laid pipe during the jointing operations. As soon as the joint assembly has been completed, the pipe should be held firmly in position while the trench is back filled over the barrel of the pipe.

The designed anchorage shall be provided to resist the thrusts developed by internal pressure at bends, tees, etc.

The assembly of the pipes shall be made as recommended by the pipe manufacturer and using the suitable tools.

Jointing

The socket and spigot end of the pipes shall be brushed and cleaned. The chamfered surface and the end of the spigot shall have to be coated with a suitable lubricant recommended by the manufacturer of the pipes. Oil, petroleum bound oils, grease or other material which may damage the rubber gasket shall not be used as lubricant. The rubber gasket shall be inserted into the cleaned groove of the socket. It has to be checked for correct positioning. The two pipes shall be aligned properly in the pipe trench and the spigot end shall be pushed axially into the socket either manually or with a suitable tool specially designed for the assembly of pipes and as recommended by the manufacturer. The spigot has to be inserted up to the insertion mark on the pipe spigot. After insertion, the correct position of the socket has to be tested with a feeler blade

Deflection of the pipes

Deflection of the pipes -if any- shall be made only after they have fully been assembled.

The deflection shall not exceed 75 % of the values indicated by the pipe manufacturer.

Anchoring of the pipeline

Thrust blocks shall be provided at each bend, tee, taper, end piece to prevent undue movements of the pipeline under pressure. They shall be constructed as per design of the Engineer according to the highest-pressure during operation or testing of the pipes, the safe bearing pressure of the surrounding soil and the friction coefficient of the soil.

Measurement and payment

The net length of pipes as laid or fixed shall be measured in running meters correct to a cm. Specials shall be included and measured in the total length. The portion of the pipe at the joints (inside the joints) shall not be included in the length of pipe work.

Excavation and preparation of trenches for laying underground pipeline: -The trench shall be so dug that the pipe may be laid to the required alignment and at required depth. When the pipeline is under a roadway, a minimum cover of 1.2 m shall be provided; in other cases, the minimum cover of 0.75 m above the crown of the pipe shall be provided. The trench shall be shored, wherever necessary and kept dry so that the workman may work therein safely and efficiently.

Recovery of other serviceable material: -

All serviceable materials such as wood work, bricks, masonry etc. recovered during the operation of cleaning or excavations, which, in the opinion of the Engineer-in-Charge are suitable for reuse in restoring the surface, shall be separately stacked and disposed-of as directed by Engineer-in-Charge.

Dewatering: -

Dewatering shall be carried out by the contractor, wherever necessary. The discharge of the trench dewatering pumps shall be conveyed either to drainage channels or to natural drains and shall not be allowed to spread over in the vicinity of work place.

Trenching: -

The excavation of trenches shall be carried out by hand or machines. The width of trench shall be kept to a minimum consistent with the working space required. At the bottom, between the faces, it shall be minimum 200 mm clearance on either side of the pipe. However this is for the safety of the trench, the method of laying and jointing the pipe and the need to avoid damage to pipe coating.

Preparation of bottom of trench:-

The bottom of the trench shall be properly trimmed to permit even bedding of the pipeline. The curvature of the bottom of the trench should match the curvature of the pipe as far as possible, subtending an angle of 120° at the centre of the pipe. Where rock or boulders are encountered, the trench shall be trimmed to a depth of at least 100 mm below the level at which the bottom of the pipe is to be laid and filled to a like depth with non compressible material like sand or crusher dust or moorum of adequate depth to give the curved seating.

Special foundation in poor soil:-

Where the bottom of the trench at subgrade is found to consist of material, which is unstable to such a degree that in the opinion of Engineer-in-Charge it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, a suitable foundation for the pipe, consisting of piling, timbers or other materials, in accordance with the direction of the Engineer-in-Charge, shall be constructed.

Excavation in hard rock by blasting:-

Blasting for excavation shall be done only when the contractor obtains the license for the same and only when proper precautions are taken for the protection of persons and property. The hours of blasting shall be fixed by the Engineer-in-Charge. The procedure of blasting shall conform to the requirement of licensing authority. The excess excavation by

blasting shall be filled up by 1:4:8 cement concrete. The contractor shall have to make his own arrangement for procurement and storing of explosives required for blasting. Rubble available from excavation of hard rock, shall be the property of the contractor, for which recovery of Rs. 65/- per cum of the quantity of hard rock excavated shall be made from his running account bills.

Braced and sheeted trenches:-

Open-cut trenches shall be sheeted and braced as required by Engineer-in-Charge and as may be necessary to protect life and property or the work. When closed sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting.

Stacking of excavated material:-

All excavated materials shall be stacked in such a manner that it does not endanger the work and avoids obstructing footpaths and roads, hydrants under pressure, surface boxes, fire, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage and natural watercourses shall not be obstructed.

Maintenance of traffic and closing of streets: -

The work shall be carried out in such manner that it causes the least interruption to traffic, and the road/street may be closed in such a manner that it causes the least interruption to the 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.

Structure Protection: -

Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstruction encountered in the progress of the work shall be furnished under the direction of the Engineer-in-Charge. The structures, which may have been disturbed, shall be restored upon completion of the work.

Protection of property and surface structures:-

Trees, shrubbery fences, poles and all other property and surface structure shall be protected unless their removal is shown on the drawings or authorized by the Engineer-in-Charge. When it is necessary to cut roots and tree branches such cutting shall be done under the supervision and direction of the Engineer-in-Charge.

Avoidance of the Existing Service:-

As far as possible, the pipeline shall be laid below existing services, such as water and gas pipes, cables, cable ducts and drains but not below sewers, which are usually laid at great depth. If it is unavoidable, pipeline should be suitably protected. A minimum clearance of 150 mm shall be provided between the pipeline and such other services. Where thrust or auger boring is used for laying pipeline across road, railways or other utilities, larger clearance as required by the concerned authority shall be provided. Adequate arrangements shall be made to protect and support the other services during laying operations. The pipeline shall be so laid as not to obstruct access to the other services for inspection, repair and replacement. When such utilities are met with during excavation the authority concerned shall be intimated and arrangements made to support the utilities in consultation with them.

Restoration of sewerage system:

If the sewer lines are coming in the way of pipeline alignment, it shall be properly restored either by constructing manholes on both sides and connecting it with similar sewer line, so as not to disrupt the services of the sewerage system or by laying the pipeline below or above the sewerage system as per the directions of Engineer-in-Charge.

Preparation of Formation for Sections of pipe line to be laid above Ground:-

Formation should be prepared by cutting high grounds and filling in low areas. Care has to be taken while fixing the alignment and gradient of the pipeline, to balance the cutting and filling quantities, as far as possible, with minimum of lead. Care should also be taken to ensure that pipe rests fully either on cutting or on bank.

Disposal of surplus material:

Excavated material in excess than required for backfilling the trenches, shall be disposed off as per the directions of Engineer-in-Charge. Surplus excavated stuff available at one section shall be used for back filling at other reaches, wherever required.

Extra material required for back filling:

If in any case, it is required to bring the soil for back filling from outside, it should be of good quality and should not have chemicals e.g., sulphates, chlorides, conductivity etc., which may cause corrosion to pipes, specials and other structures, beyond the permissible limits.

Road, rail and river crossings: -

The mode of laying the pipeline, crossing road, railway or river shall be determined so as to satisfy the requirement of the authority concerned.

18.8 SPECIFICATION FOR PUSHING

The pipes pushed through the Railway / Road Embankment should have minimum cushion of 2.00 m (Or as shown in the Railway's approved Drawing) above the pipes. The cautionary boards should be kept at sufficient distance from the point of crossing. The pushing should be done with the use of Hydraulic Jacks / Winch Machine as per the standard procedure of the Railway's. Every precaution should be taken that while pushing no settlement takes place in the track/ Road. The embankment should be protected with sand bags to avoid any seepage during working. The temporary thrust bed / thrust wall constructed for pushing should be dismantled after completion of pushing work. The M.S. Pipe barrels shall be field welded with electric arc welding machine. The entire work should be carried as per the latest specification of the Railway Department for pushing of pipe work. Jacking of the M.S. Pipes to form the opening under the Railway track under running traffic condition maximum allowable deviations from the Theoretical alignment will be limited to 200 mm Horizontally and 100 mm Vertically. Any deviation beyond this tolerance will be rectified by the tenderer at his own cost. Any temporary structures such as thrust walls etc. shall be dismantled immediately after completion of the pushing work. Minor seepage water which can be dewatered manually by bucket etc shall be done by the contractor and no extra payment will be paid for this how ever if the subsoil water is heavy and needs dewatering by pumps then it will be paid as per regular practice of PHED/PWD.

Highway crossing:-Wherever it is necessary to cross the Highways, the proposed pipelines should be crossed by the trenchless method. The pipes to be crossed are for raw water, treated water and sewage pumping mains. The pipe shall be laid inside the MS pipe casing with proper slope and alignment. The necessary arrangement viz, jacking pits & receiving pits, Equipments, including men and material required for jacking the MS sleeve pipe by trench less method and laying the pipe inside MS sleeve pipe shall be arranged by contractor.

18.9 JACKING OF STEEL SLEEVE PIPE

The hydraulic pipe jacking can start after completing the Jacking pit. The hydraulic pipe jacking by tunneling method. A guide frame is fixed on the firm support of the Jacking pit. The main jacking station with hydraulic cylinders shall fixed on the guide frame and to the abutment structure thrust block made of concrete or steel plate at the end of the pit. Mild Steel make jacking pipes (IS 3589-2001 with material grade is Fe 450) of required dia and length as per requirements are lowered on the guide frame and jacked section wise through

the ground from the Jacking pit to the Receiving pit by means of hydraulic jacks. Each length of protective steel pipe is welded to the jacked pipe. Thus, the soil is removed by hand mining under the protection of a cutting shoe and moved through the jacked section to the surface. Depending on the existing soil the jacking pipes have to be lubricated with bentonite liquid. Boulders or other obstacles can be removed with the help of winches without any handicaps. Before arriving to the receiving pit construct the receiving pit. After completion of jacking procedure cut off the cutting shoe and remove out from receiving pit. Completion of all inspection and handing over of each Section/Package of Pipe Jacking Works with protective steel pipes to the Engineers for inspection and after approval from Engineers Contractor to install his standard sewer pipes.

GROUND SUPPORT AND DEWATERING

The excavated area will be protected by the machine's shield and subsequently the pipes in order to minimize possible settlement of ground above the pipeline. In addition to that the bore is supported by bentonite suspension, which also reduces the friction between the pipes and the soil. Any dewatering if required shall be arranged by the contractor. There is no separate payment for dewatering.

CONSTRUCTION OF JACKING PIT

Jacking pit shall be constructed, of size of min. 4.5 m x 3.5 m. This size will vary depend upon the length of MS pipe. The depth of pit shall be such that it will suit the Jacking pipe depth. Proper timbering to be provided with the support of walls & struts during excavation. Required thickness of RR stone masonry wall in cement mortar 1:4 shall be provided for all four sides of the pits. 200 mm thick M 15 PCC floor shall be provided in the pit. A 400 mm thick reinforced concrete thrust or steel plate of suitable thickness wall to be provided to resist the Jacking force. The contractor may propose the alternate construction material such as concrete wall, brick masonry etc. during construction stage. Besides, the pit dimension may be changed to suit the site condition & requirement. Therefore, it is advisable that contractor should consider all these probable changes & method of workings and quote the rate accordingly.

RECEIVING PIT

The receiving pit shall be constructed with the same material and method adopted for Jacking pit. The size of receiving pit shall be 2.5 m length x 2.5 m width. The depth of it shall be as required to suit the jacking pipe depth. The receiving pit to be constructed as per drawing and as directed by Engineer.

SEQUENCE OF WORK

- Inspection of pits (including abutment structure, as per attachment) and approval (requirements as per structural analysis).
- Installation of hoist at starting pit.
- Measurement of height and slope for jacking.
- Installation of main jacking station and guide frame.
- Fixing of frame to the firm support.
- Make opening in the wall for beginning of jacking.
- Installation and adjustment of cutting shoe.
- Installation of bentonite liquid station.
- Transportation of Mild Steel pipe from stock yard to jacking station.
- Installation and adjustment of first steel pipe (3.00 metres long) or and as directed by Engineer.
- Fixing of steel pipe and cutting shoe by welding.
- Start of jacking by hydraulic pressure from the main jacking station.
- Lubricate the annular space by the bentonite liquid.
- Excavation of soil by hand mining under the protection of the cutting shoe.
- Transportation of soil through the jacked section with the *help* of tipper to the jacking pit and remove by hoist.

- After jacking of 3.00m installation and adjustment of the next steel pipe.
- Joint both the pipes by welding.
- Continuation of jacking, hand mining and installation of steel pipes for done alignment and slope of designed sewer and as instructed by Engineer.
- Before arriving to the Receiving pit construct the Receiving pit.
- After completion of jacking procedure cut off the cutting shoe and remove out from receiving pit.
- Dismantling of jacking station and guide frame and remove out from Jacking pit.

Final Inspection of each Section /Package of Pipe Jacking Works to the Engineer, Contractor to install his standard sewer pipes.

- 18.10 **Quality control:-**Control of dimension of Jacking and Receiving pit (as per structural analysis). Visual checks of each Steel Pipe against damages, disturbances and irregularities as well as measurement of the dimension of wall thickness and inner width. Supervisor will keep record for the pipes delivered to site directly from the factory. Control of jacking direction and slope as per construction drawings before and during and after jacking. Control of welding seam (tightness and thickness)

SAFETY MEASURES

In order to ensure safety during jacking procedure for all labour and the public, the following measures should be implemented:

- a. Signal hats and/or signs have to be erected in order to warn and divert the traffic around the concerned area, where pits are opened.
- b. Pedestrians will not be allowed to enter the area closer than 3 metres to an open pit or the control unit, unless there is sufficient barricading.
- c. A gas monitor has to be used for every entrance and work into the pits or line. Before access, the monitor shall be moved down to the bottom of the pit minimum 5 minutes by rope. When poisonous condition is detected, the area will not be entered.
- d. Accessing people shall use protective clothes, gloves, rubber boots, helmet, head lamp and additional all safety measures including an oxygen bottle with rescue mask has to be available on site all the time.
- e. A ventilation blower shall be used in the jacking section.
- f. Pre-arrangements with the next hospital have to be ensured in case somebody is injured.
- g. A first aid kit must be available on site at every time.
- h. No stay below hanging goods such as pipes.
- i. Use fire extinguisher for fire protection.

Measurements

The measurement for State Highway crossing by push through method shall be in running meters.

- 18.11 **MS Pipes and specials underground, outer coating:**

Coating:-All underground buried mild steel piping shall be protected by the application of hot coaltar enamel and fibre glass wrapping. The coating shall consist of one coaltar primer coat, one coaltar enamel coat, wrapping of fibre glass and one more coat of enamel and then a final wrap of enamel impregnated fibre glass.

Pipe surface shall be cleaned thoroughly by shot or sand blasting process. The cleaning shall ensure that the pipe surface shall be free from millscale, rust, oil, welding scale and other foreign materials.

The priming paint shall be of material recommended by the manufacturer. Freshly primed pipe shall be handled carefully to prevent damage. Any damaged areas shall be re-primed before applying enamel.

The material to be used as enamel shall be Shalimar coaltar enamel and fibre glass manufactured by Fibre Glass Pilkington of India Ltd., or approved equal.

Enamel shall be moisture and dirt free at all times prior to and at the time of heating and application. The primed surface shall be dry and clean at all times and the enamel shall be applied not later than 3 days after application of primer. Along with first flood coat of enamel, single spiral wrap of fibre glass inner wrap shall be applied overlapping at least 25 mm. It shall be seen that fibre glass impregnates in the first flood coat. Second coat of enamel and second wrap of bitumen impregnated fibre glass or kraft paper shall be applied in the same way. The total thickness of the coating shall not be less than 4 mm.

Each end pipes left bare for welding purpose shall be hand coated and wrapped after field welding is completed and the pipe has been hydro-tested.

19.0 SPECIFICATION FOR BULK FLOW METER

The Flow meter shall have following Salient features:-

- Suitable for conductive liquid.
- Absolutely maintenance free.
- Full bore type.
- Remote electronics.
- Simple & cost-effective construction.
- Outstanding accuracy.
- Empty pipe indication.
- Universal power supply.
- Communication port.

19.1 Description:-

The bulk flow meters of electromagnetic full-bore type are micro-controller based full bore type electromagnetic flow meter with remote electronics specially used for various industrial applications. These flow meters shall accurately measure the flow rate of conductive liquids & slurries in closed pipes. The meters shall be of simple & rigid design, the flow meter shall be an obstruction less & maintenance free instrument in place of conventional mechanical flow measuring device. The use of 'Pulsed DC' technology offers highest ability & better measuring accuracy in the form of electrical signal 4 - 20 mA DC linearly proportional to volumetric flow in case where electric supply is available and battery operated (With one additional battery) wherever instructed by EIC. The instrument is based on Faraday's law of electro-magnetic induction. A magnetic field is generated by the instrument in the flow tube. The fluid flowing through this magnetic field generates a voltage that is proportional to the flow velocity. Corresponding electrical output is provided with respect to measuring voltage.

19.2 Technical specifications

Media: Liquids (Conductive)

Basic Application: Water

Conductivity : $3.5 \mu\text{S/cm min}$

Viscosity : 200 cp max

Recommended flow rate : Min./max full scale value ($v \sim 0.3$ or 10 m/s) velocity

Nominal Size : 15 NB to 1000 NB

Excitation : Pulsed DC coil

Type of Output : 1) 4 - 20 mA DC, Isolated 2) Pulse

Remote Electronics Cable : 25 mtr max

Remote Display : 16 x 2 LCD - 4 digits for Flow Rate & 8 digit for

Totalised Flow

Calibration Range : As per requirement or (Factory Standard Calibration)

Accuracy : $\pm 0.5\%$ F. S

Linearity : $\pm 0.5\%$

Repeatability : $\pm 1\%$

Process Temperature : Rubber: 85 °C Max & PTFE: 100 °C Max

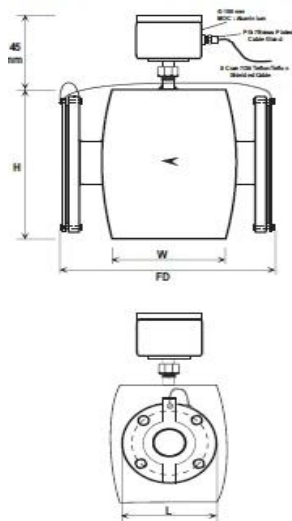
Process Pressure	: 10 kg/cm ² max
Material of construction	: Lining - Rubber / PTFE (Teflon) Flange - CS / MS / SS Electrode - SS 316L / Hastalloy C / Platinum Coil Housing - MS / SS 304
Power Supply	: 1) 24 V DC, External 2) 90 - 250 V AC, 50 Hz
Power Consumption	: < 10 VA
Isolation	: 1.4 KV between Input, Output & Power Supply
Response Time	: < 100 mSec
Temperature Coefficient	: +/- 0.1% per 0C
Remote Electronics	: IP- 68, 2" pipe mount type
Sensor construction	: As per IP- 68
Process Connections	: ASA 150 flanged, as per table B 16.5
Mounting	: In-Line (Horizontal OR Vertical)
Operating Conditions	: Temperature 0 to 55 0C / Humidity 5 to 95% non condensing

19.3 OPTIONAL

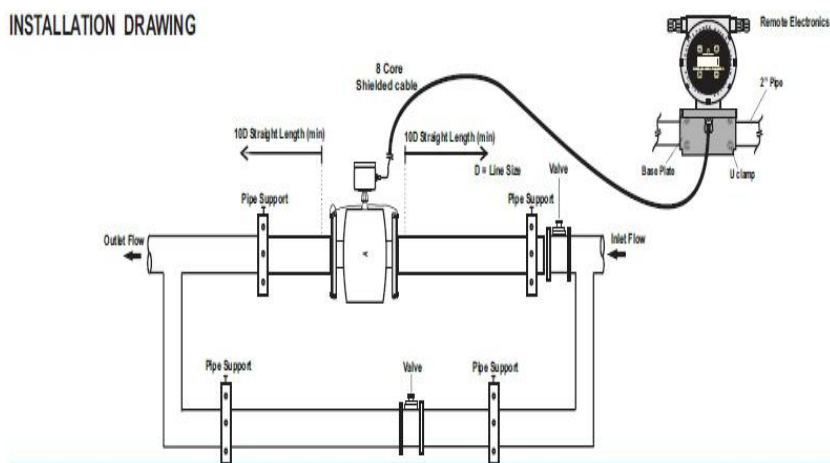
Communication Port	: RS 485 with MODBUS RTU Protocol
GSM Telemetry	: GSM Module Inbuilt in Electromagnetic Flowmeter with SMS facility & Programmable (Showing Flow rate & Flow totalizer)
ELMAG	: 200R with Remote Electronics

Note: - For process conditions other than above arising actually at site after execution of components please consult factory.

DIMENSIONAL DETAILS



INSTALLATION DRAWING



20.0 Specification - Pilot-operated, hydraulic water-level and Flow control valve**20.1 Flow with Attitude/Level control valve;**

The Weir/Globe pattern Control valve will maintain a maximum water level in the elevated reservoir, stopping the inflow of water when the level reaches the maximum-allowed level. The valve will stay closed until the water level drops to a preset minimal value, and the open fully. While the valve is in opened position it will regulate the water flow rate to the tank. The rate of flow should be regulated within the whole range of potential flows. The control circuit will include a device/speed-control that will extend the closure time, in a way that the inlet pressure will not generate water hammer. The valve should be with latch solenoid for remote on/off function.

20.2 Specification of Flow Control/Pressure Reducing Valves.

- a. The control valves shall be designed for flow control application for providing precise control over the flow rates/pressure range,
- b. The body of the control valve shall be designed, and hydro tested for the applicable pressure rating, considering the surge pressure as per provisions in BS-EN- 12266-1-2013 or any other equivalent standard.
- c. The control valves shall be designed to cause minimum head loss. The calculation method confirming to ANSI/ISA-75.01.01-2007 (IS/IEC 60934-2-1 Mod) -2012 for flow equations for sizing of Flow control/pressure Reducing valves shall be adopted. This approach allows valves from various manufacturers to be compared using the same approach, thus ensuring that the best valve is selected for the application. Fisher's Control valve Handbook, latest international standards/publications may also be referred in the above context.
- d. The seal at the seat ring should give leak tight malleably. The valve shall pass through seat leakage test as per ANSI FCI-70-2-2006 Class VI or any other equivalent standard.
- e. The material of all components of valve/internal working parts shall be corrosion resistant to chlorinated water.
- f. Wherever capability with SCADA or RTU local PLC is required, digital communication port RS 232/485 fiber optics having connectivity as per industry standard protocol should be provided (RTU shall be provided by contractor and contractor shall also comply with the capability requirements).
- g. Provision of battery-operated option should be there in case of power failure

20.3 Plunger Type Flow Control/Pressure Reducing Valve:

In addition to above-

- a. Plunger valves shall be provided with electrical actuators having the control facility for intermediate valve positioning by connecting external signal.
- b. The electric actuators shall be designed to provide the required torque for operations in the flow and pressure conditions of the water transfer system. Gear assembly shall be provided as necessary.
- c. The flow path with annual flow cross section in any open position shall be rotationally. The movement of piston Plunger by means of Crank/shaft/spindle drives shall be Axial/Linear along with irreversible worm gear box including position indicator.
- d. The general design requirements of the valve, Gear assembly and electric actuators described in the tender will be applicable to the flow control valves also.
- e. A hand wheel shall be provided for plunger valves so that operations of the valve can be carried out when the power supply of valve has failed. The torque requirements at the hand wheel shall be such that one person can operate the valve. Hand wheel shall be positioned to give good access for operational personnel.

- f. Hand wheel shall be provided with integral locking device to prevent operation by unauthorised persons.
- g. A selector switch shall be provided on the actuator for remote/local/hand operation of the valve

20.3.1 Material of Construction for Plunger type Flow Control Valve

Body (Global Type)	Ductile Iron GGG40 – DIN 1693 or EN-JS 1030
Plunger /piston	Stainless steel AISI-304/Gr 1.4301
Piston Guides	Bronze Welded Overlay/SS
Shaft Crank/Spindle	Stainless steel AISI-420/Gr 1.4021
Seat Ring	Stainless steel AISI-316/Bronze
Seal (O-Ring/Quad ring)	Synthetic Rubber-Buna-N/EPDM (FDA/WRAS approved)

Bearing Bush	Bronze
Bolts	SS A4
Eye bolt for lifting	Galvanised steel- 1.0401
Slotted cylinder/Strainer	Stainless steel
Coating (Both inside & Outside)	Fusion Bonded Epoxy, min 250 micron (NSF/FDA/WRAS approved)

20.4 Diaphragm Type Flow Control /Pressure Reducing Valves:-

In addition to above

- a. Diaphragm type flow control/pressure deducing valves shall be of single/double chambered self actuated Automatic valves i.e operated from line fluid pressure itself. For continuous regulation or an intermediate positioning, the control valves shall be provided with two solenoid valves with facility of connecting the external signal.
- b. Commands/electric signals for positioning of the control valve (for SCADA compatibility) will be from RTU.
- c. The diaphragm must stand a Mullens Burst Test of a minimum of 25 bar per layer of nylon fabric and shall be cycle tested 100000 times to insure longevity.
- d. The internal valve component shall be assessable removable and repairable and repairable without removing the valve body from pipeline.
- e. These valves should be of self-regulating type when power supply is not available

20.4.1 Material of construction for Diaphragm type flow control Valves:

Suitable material of construction to the above specified valves should be as noted in the table below: -

Body and cover (weir/ Globe Type)	Ductile Iron ASTM A 536 Or DIN 1693-GGG 40
Diaphragm and Resilient seal disc	Flexible, non-wicking nylon fabric reinforced synthetic elastomer-Buna-N EPDM/NYLON reinforced rubber (FDA/WRAS approved)
Seat Ring	Stainless steel 304/316 or above, raised, replaceable inline & onsite
Stem	Cast steel/Stainless Steel 304/316(replaceable inline & onsite)
Spring and Bearing Bush	Stainless Steel AISI-302/304/316
Disc guide, disc retainer & Diaphragm washer	Cast Steel/Stainless Steel AISI-304/316, Bronze & Coated Steel
Seal	Synthetic rubber-Buna-N/EPDM (FDA/WRAS approved)

Pilot	Body: Stainless Steel, AISI-304/CF or Brass/Bronze Elastomer: NBR
Tubing	Stainless Steel AISI-304/Copper/Flexible Nylon Tubing
Nut-Bolts and Studs	Stainless Steel AISI-304-ASTM-A 193 B7
Solenoid Valve (IP 65)	Brass, SST 304/316
Throttling Plug	To have the linear flow (non turbulent flow),if required, V-shaped or U-shaped throttling plug may be provided.
Coating (Both inside & outside)	Fusion Bonded Polyester/Epoxy, min 250 micron (NSF /FDA/WRAS approved)





21.0 Maintenance


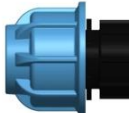

- The bidder should propose a recommended five year set of spare parts per a batch of 5 valves of the same diameter and quote their price.
- The bidder should specify the warranty period.
- The valve should require low maintenance. No set periodic packing or parts replacement should be required.
- The valve's pilot control loop should include a low maintenance, inline "self-cleaning" control-filter.
- The typical weight of any control chambers and trim assembled as a complete unit, regardless of valve diameter, shall not exceed the permitted lifting weight for a single person as defined in the regulations. Disassembly will not require usage of sophisticated, heavy lifting devices such as cranes of any type. Should such devices be required – these are to be provided and installed at the assembly site by the supplier.

22.0 Scope & Specification for Functional House Service Connection:- The work involves but not limited to followings:-

- I. The Site shall be handed over to the successful contractor by CMO Nagar Panchayat/ULB. The contractor has to coordinate with the the distribution network contractor, as per the instructions of CMO Nagar Panchayat and allocate the magnitude of meters to be connected in every zone. A reconnaissance and door to door survey has to be carried by the contractor in complete project area and shall quantify zone wise requirement of the consumer meters/house service connections. The requirement of such meter's/HSCs zone/ward wise shall be submitted to CMO Nagar Panchayat for approval in writing and after the approval of CMO Nagar Panchayat only the supply order shall be placed.
- II. The contractor shall submit a bar chart showing schedule of all the activities and probable time frame required to complete the same within a week's time from the work order.
- III. The contractor shall carry out third party inspection from the approved TP agencies such as RITES/IR Classetc, also he should inform the CMO Nagar Panchayat about the schedule of manufacturing and testing and arrange a visit of CMO Nagar Panchayat officials to the factory to inspect the process.
- IV. Every meter must carry the serial no with embossed mark and batch number in which the inspection has been done. Also, the name of CMO Nagar Panchayat shall have to be embossed on each meter.
- V. The contractor shall depute one site team for making awareness in the public about the advantages of the meters and how they can bring the monthly charges down by using water sensibaly. The team shall guide the public regarding the use of meters, meter reading and charges to be paid by the public on actual consumption of water. The contractor shall prepare a check list in coordination and approval of CMO Nagar Panchayat depicting the above facts and shall take the signature of the citizen where the meter has been installed along with the necessary documents pertaining to CMO Nagar Panchayat and produce the same for release of installation amount.

- VI. The contractor shall also take photograph of the complete system installed along with GPS point and the consumer information. The contractor needs to submit all information in GIS format to the CMO Nagar Panchayat as a submission/completion report.
- VII. It will be the sole discretion of the department to alter or de-scope the work of supply & installation of HSC during the execution. The payment shall be made only for the items executed / used at site, with prior permission of department, any extra item procured (without written permission of department) or not used at site shall not be reimbursable to the contractor. The contractor shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full as specified in the tender but which he did not derive in consequence of the curtailment of the works by reason of alterations, omissions or variations or in consequence of the full amount of the work not having been carried out.
- VIII. The lumpsum item to include but not limited to followings:-
1. The excavation of the trenches includes excavation of the pit for making house service connections from the already laid line to the respective house including all the labour, cost of material used for excavation in soft strata below CC roads the size of the pit shall be minimum but not limited to 1.00m x 1.0m x 0.70m below the CC road lowest bed surface. The pit shall be well excavated below the existing pipe line to facilitate flawless fixing of the strap on the pipe line. The pipe shall be cleaned well from all the foreign material prior to start the fixing activity.
 2. The excavation for excavating CC road surface including chiseling and cost of all manual, mechanical means for cutting the sides to facilitate the excavation in soft rock or hard strata, the size of the pit shall be but not limited to 1.0m x 1.0m x 0.50m. The provision shall be applicable for hard strata if met with on upper side or either on the lower side of the pit.
 3. Dewatering:-The dewatering from pipeline either from the pools of ground water or from the charged pipe line shall be pumped out from the pit and the pipe line shall be made dry to make the connections of the house service connection. The dewatering shall be of but not limited to 1 BHP/Hour
 4. Cutting the parent pipe if required:-The contractor has to make cutting of pipe wherever necessary with filing and champharing and making the mouth clean for fixing the fittings
 5. Making strap joint:-The strap joint shall be of best quality confirming to ISO as detailed below
 6. Providing & Supply of Clamp Saddle (DI Strap Saddle) for House Service connections from metal pipe Water Distribution mains shall be of fastened strap type with threaded outlet for service connection. Clamp Saddle shall be suitable for nominal size of distribution mains pipe line. The strap shall be elastomeric coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the unidentical metals. The saddle shall be single strap type up to pipe sizes of NB 600 and service outlet 15mm, 20mm & 25mm. Fasteners shall be of threaded nut-bolt- washer type. The sealing between the saddle and mains shall be obtained by using a profiled elastomeric seal matching to the curvature of the pipe. The seal shall be of elastomeric type, suitable for all potable water application. The material of construction of the body, straps, fasteners etc, shall be of non corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both.

N.	Discription	Dimension	Material	Load /Pressure testing	Image
1	Strap Saddle suitable for DI Pipe	A) outlet (inch) shall be from 1/2" B) Strap available for pipe dia 50mm to 600mm.	1)Body shall be of Ductile Iron 2) Strap & other hardware shall be of SS 304 3) Seal shall be of Nitrile /EPDM/Silicon	Shall be Tested for 15 kg/cm2	
2	PP Ferrule with Sealing on Top cap	Shall be from 1/2" (15mm)	1) Pigmented UV resistant virgin polymer, other material shall be Derlin /Silicon rubber 2) Insert shall be SS 304	Shall be Tested for 15 kg/cm2	
3	Both Side Compression Elbow	1)Suitable for pipe dia from 1/2"(20mm)	1) Shall be made of UV resistant virgin polymer 2) Insert shall be of SS 304 3) "O" ring shall be of EPDM/Nitrile	Shall be Tested for 15 kg/cm2	
4	PP Ball Valve 20 mm/ 1/2"	1)Suitable for pipe dia from 1/2"(20mm)	1) Pigmented UV resistant virgin polymer ,other material shall be Derlin /Silicon rubber 2) Insert shall be of SS 304	Shall be Tested for 15 kg/cm2	
5	PP Strainer with built-in Air valve	1)Suitable for pipe dia from 1/2"(20mm)	1) Pigmented UV resistant virgin polymer ,other material shall be Derlin /Silicon rubber 2) Insert shall be of SS 304	Shall be Tested for 15 kg/cm2	
6	Female threaded (SS304) compression Elbow	1)Suitable for pipe dia from 1/2"(20mm)	1) Shall be made of UV resistant virgin polymer 2) Insert shall be of SS 304 3) "O" ring shall be of EPDM/Nitrile	Shall be Tested for 15 kg/cm2	

8	Male Threaded (SS304) compression Elbow	1) Suitable for pipe dia from 1/2"(20mm) to 1-1/2"(50mm)	1) Made of UV resistant virgin polymer 2) Insert is of SS 304 3) Oring is of EPDM/Nitrile	Tested for 15 kg/cm ²	
9	Female Threaded (SS304) Straight Compression adaptor	1) Suitable for pipe dia from 1/2"(20mm) to	1) Shall be made of UV resistant virgin polymer 2) Insert is of SS 304 3) "O" ring is of EPDM/Nitrile	Shall be Tested for 15 kg/cm ²	
10	Male Threaded (SS304) Straight compression Adaptor	1) Shall be suitable for pipe dia from 1/2"(20mm)	1) shall be made of UV resistant virgin polymer 2) Insert shall be of SS 304 3) "O" ring is of EPDM/Nitrile	Shall be Tested for 15 kg/cm ²	

7. Fitting the compression joints:- The compression joints, bend, adopters and other fittings shall be fixed as per the latest norms in this field
 8. Fitting the nipples and Pipes:- Providing and fixing Polythelene- Aluminium- Polythelene (PE-AL-PE) composite pressure pipes conforming to IS 15450-2004 UV. Stabilised with carbon black having thermal stability for hot and cold-water supply, capable to withstand temperature up to 800 C including jointing & testing of joints as per the direction of the engineer in charge.
- External work

IX. Specifications for Multilayer Composite pipes and Associated Fittings:-

1. Multilayer Composite Pipes (as per IS 15450:2004):

- i. Description: - Co-extruded polyethylene composite pressure pipe as per IS 15450:2004 having welded aluminium tube reinforcement between inner and outer polyethylene layers being bonded to Aluminium tube by a melt adhesive with welded aluminium tube of itself being capable of sustaining internal pressures. The Composite Pipes will have pressure rating of 13.8 Kg/Cm² at 230 C. and 11.0 Kg/Cm² at 600C. The pipes should also withstand 6 Kg/Cm² pressure at 800C operating temperature.

ii. Pipe Dimensional Details: The dimensional details will be as under:

Description	Pipe Size						
	1014	1216	1620	2025	2532	3240	4050
Minimum Outside Diameter (mm)	14	16	20	25	32	40	50
Minimum Wall Thickness (mm)	1.70	1.75	2.00	2.45	2.80	3.40	4.00
Standard Coil Length (meters)	200	200	200	100	50	50	50
Minimum Aluminium Thickness (mm)	0.20	0.20	0.25	0.25	0.30	0.30	0.30
Minimum Outside PE Layer Thickness (mm)	0.40	0.40	0.40	0.40	0.40	0.40	0.40

2. Associated fittings: The composite compression fittings shall be manufactured from engineering polymer blend with SS 304 inserts. The fittings when tested alone or in assembly

with composite pipe shall comply with the requirement as required for the duty conditions applicable for pipe.

3. TECHNICAL PREQUALIFICATIONS FOR PE-AL-PE PIPE MANUFACTURER: -

- i. The Contractor must submit the copy of the BIS licence granting the ISI mark Certification for materials having BIS specifications and being used in the contracted job.
- ii. The Quality Control Laboratory of the manufacturer should be well equipped to carry out all the acceptance tests specified in IS 15450:2004 standard. Having laboratory recognized by IAPMO India will be added advantage.
- iii. The manufacturer of Pipes & Fittings must have ISO 9001-2008 certification for its Quality system.
- iv. The contractor shall undertake to only supply materials manufactured by such pre-approved manufacturers.
- v. The contractor shall also obtain a letter of confirmation from the manufacturer that the manufacturer will be fully support the warranty given by the contractor and will also support and depute the engineer for testing the system so installed.
- vi. The Contractor shall submit a note from the manufacturer for site testing procedure.
- vii. The installed capacity of the manufacturer of PE-AL-PE Composite Pipes should be minimum 50 Lac meters per annum. The Contractor shall submit the certificate from the manufacturer on the available installed capacity at the manufacturing facility.
- viii. The contractors must provide an undertaking from the manufacturer to have access to the factory to witness the manufacturing and testing facilities.
- ix. The contractors must provide an undertaking from the manufacturer to the effect that the manufacturer will supply pipes, fittings and specials required for successful and timely execution of the project without any interruption irrespective of any possible dispute between the manufacturer and contractor.
- x. The pipe, fittings, specials as a system must pass all the tests specified in Annexure A of 15450:2004.

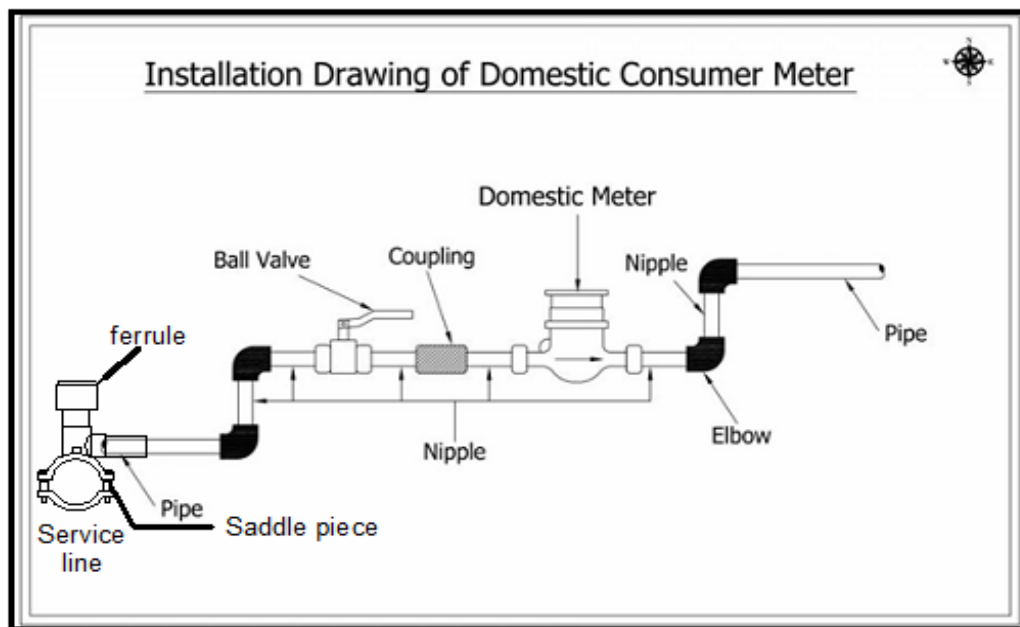
4. Test pressures for On Site testing: -

- i. Test duration should not exceed 24 hours.
 - ii. Maintain the test pressures at 1.5 times the operating pressure of the system.
 - iii. In no case test pressure should be more than 15 bar.
5. Installation Procedure: - The manufacturer's "users' manual for pipe & fittings" should be submitted for installation instructions in detail.
6. Precautions: -
- a) Pipe should be stacked carefully so as to prevent them falling or causing damage with any external sharp-edged material.
 - b) It must be ensured that end caps are retained when pipes are stacked in storage yard.
 - c) Where pipe will be connected to heavy items such as pumps or valves, the pump or valve should be supported directly using the support brackets
 - d) The pipe should be protected from any heavy load/impact and drilling or nailing etc.
 - e) Where these pipes are provided under the ground, adequate top sand cover should be provided.
 - f) Proper sand bedding must be provided for laying the pipe in trenches
 - g) The rate to include providing and fixing of PE-AL-PE pipes upto 6 m length for each connection. If the length of pipes required to be increased or decreased then payment will be regulated/deducted as per CGPHED SOR. The payment for fixing of these pipes shall be deemed to be considered in the lumpsum offer. The provision of PE-AL-PE pipes shall be as per the dia of connection i.e. shall be suitable for 15mm, 20mm and 25mm dia connections as per the numbers mentioned in the schedule.

- h) Fixing the ball valve: - Providing, Supply and installation of PP/Composit Ball Valves

- i) in PN1.6 rating with one end compression using blue colour compression nut in polypropylene material & other end with female threads Conforming to ISO:4422-4, certified from WRAS UK/KIWA etc. suitable for food products & drinking water, female threads in accordance with ISO:7/BS:21/ IS: 554 and shall be inclusive of all cost such as testing, all taxes related to central, state & municipal, inspection charges, transportation up to site, transit insurance, loading, unloading, stacking etc. Complete.
- j) Testing and making watertight the complete system: - After successful installation the complete system shall be checked for water tightness and any drops or leakage shall be rectified to the fullest satisfaction of the engineer in charge. The contractor shall take a signature of the person in whose house the connection has been installed, that the
 - Connection has no leakages in it
 - The site restoration work has been done satisfactorily
 - The ball valve is functioning properly.
 - The meter wheel is functioning properly
 - The contractor has performed the volume delivery test and the units in the meter are exactly matching with the volume of water
 - The actual pipe is consumed in Rmt against this house service connection.

The rates quoted by the contractor shall be inclusive of all the above activities and specifications, nothing extra shall be paid by the department.



The drawing shown above is for the general idea of the system to be installed at each house service connection, however the contractor shall deem to be consider other additional fittings in his quoted rate also, which are necessary.

ANNEXURE – E-4

Scope and Specifications of Rehabilitation of Existing 2.00 MLD Water Treatment Plant & Expansion of Treatment capacity to 3.00 MLD:**Detailed Scope of Work – Rehabilitation & Augmentation of WTP****A. Civil Repair Works**

S. No.	Component	Detailed Scope of Work
1	Aeration Fountain	Repair and restoration of aeration fountain including structural repairs, cleaning of pipeline, fixing leakages, repainting of structural components, and ensuring proper aeration efficiency.
2	Flash Mixture & Clariflocculator	Structural repair of flash mixer and clariflocculator units including repair of walls, baffles, walkways, and inlet/outlet channels; plastering, crack filling, and ensuring hydraulic performance.
3	Filter House	Repair of filter house structure, column/beam repairs, floor resurfacing, drainage correction, and restoration of operational efficiency.
4	Chemical House	Repair of chemical storage and dosing building including flooring, ventilation, chemical-resistant coating, and leak-proofing arrangements.
5	Sump & Pump House	Structural repair of sump and pump house including desilting, crack repairs, plastering, waterproofing, and repair of access systems.
6	Waterproofing (Filter Beds & Sumps)	Application of suitable waterproofing treatment (cementitious/polymer-based) to filter beds and sump structures to prevent seepage and leakage.
7	Internal Painting	Surface preparation, primer application, and painting of internal surfaces using water/chemical-resistant paints including doors & windows
8	External Painting	Exterior surface treatment and painting with weather-resistant coatings for durability and protection including doors & windows
9	Compound Wall	Repair of damaged portions, plastering, structural strengthening (if required), and repainting of compound wall including gate.

B. Mechanical & Electrical Work Repairs

S. No.	Component	Detailed Scope of Work
1	Piping & Valves	Inspection, repair, and replacement of damaged pipelines and valves including leakage rectification, alignment correction, and hydro-testing.
2	Wash Water System & Air Blowers	Repair/overhauling of wash water system and air blowers including motor servicing, bearing replacement, alignment, and performance testing.
3	Under Drainage System	Complete replacement/rehabilitation of underdrain system including manifolds, and associated piping.
4	Clariflocculator Bridge	Repair of bridge structure including alignment, corrosion protection, and replacement/repair of drive units and motors.
5	Flash Mixer Motors	Supply, installation, testing, and commissioning of new motors for flash mixers including electrical connections.
6	Wash Water Pumps	Replacement of pumps including installation, alignment, testing, and commissioning with all accessories.
7	Filter Media	Removal of old media, cleaning of filter bed, supply and laying of new graded filter media (sand, gravel, etc.) as per standards.
8	Chlorination System	Replacement/installation of chlorination system including dosing pumps, pipelines, safety devices, and calibration.
9	Laboratory Equipment	Supply and installation of essential water quality testing equipment as per direction of Engineer Incharge/CMO
10	Internal Electrification	Rectification and upgrading of internal electrical systems including wiring, panels, earthing, lighting, and safety compliance.

C. Augmentation – Civil Works (New Construction)

S. No.	Component	Detailed Scope of Work
1	Additional Filter Beds of 1 MLD capacity	Design and construction of new filter beds including excavation, RCC work, inlet/outlet arrangements, and integration with existing system.
2	Extension of Filter House	Extension of existing filter house including civil, structural, roofing, and finishing works to accommodate additional units.
3	Filter Media	Supply and laying of graded filter media for new filter beds as per CPHEEO/PHE standards.
4	Under Drain System & Piping	Installation of underdrain system including manifolds, and additional piping arrangement with valves and fittings for proper operation.

Scope of Work & Specifications for Rehabilitation & Expansion of Existing Water Treatment plant of 2.00 MLD to 3.00 MLD capacity conventional Water Treatment Plant (WTP) with all Civil, Electrical & Mechanical (E&M), Instrumentation & SCADA works, trial run, DLP followed by 12 months from completion of Operation and Maintenance (O&M) including replacement and warranty.

- 1.0 The lump sum contract comprises all necessary site planning, detailed design, rehabilitation, Expansion, supply, delivery to site, installation, construction, testing, and commissioning of all required works for the **(2.00 MLD Existing And 1.0 MLD Expansion) capacity Water Treatment Plant.**

The scope includes rehabilitation and upgrading of all Civil and Building works, along with associated Electrical and Mechanical works/equipment, instrumentation, control systems, compatible PLC/SCADA, pipelines, pumping installations, blowers, compressors, machinery, apparatus, station pipework, lifting and handling systems, ventilation equipment, electrical systems, interfacing lighting systems, earthing, fire safety and lightning protection systems, materials, fittings, accessories, and all ancillary works of every kind required to achieve the highest operational standards.

The work shall ensure compliance with the prescribed specifications and the guarantees provided by the Contractor, including hydraulic testing, structural testing, and equipment testing, complete in all respects, as directed by the Engineer-in-Charge.

The system shall be made fully functional from the raw water inlet up to the clear water reservoir and clear water pump house outlet.

The scope also includes:

- Application of epoxy coating on internal surfaces of water-retaining structures
- Anti-termite treatment for below-ground structures
- Ceramic tile flooring
- External painting with acrylic emulsion paint with silicon additives
- Provision of stainless-steel railings

- 2.0 All the Expansion components of WTP shall be designed as per CPHEEO, Govt. of India guidelines and relevant latest Indian Standards and codes.

- 3.0 Detailed drawings & Design calculations (Hydraulic, Electrical, Mechanical, Instrumentations & Structural) of all the components of WTP for Expansion of Existing Water Treatment plant should be got approved from Govt. Engineering College, Raipur/ NIT Raipur, Chhattisgarh at the cost of contractor and then submitted to respective ULB for approval.

- a. The successful bidder shall first submit General Arrangement (GA) drawing accommodating all the proposed units of WTP for Expansion& submit the same for approval through PMC.
- b. Contractor shall also prepare & submit hydraulic designs & GA drawings of each unit for expansion and after its approval shall prepare & submit Good for Construction (GFC) structural designs&architectural, structure, mechanical, electrical, instrumentationdrawings and get them

approved by Govt. Engineering College, Raipur /NIT, Raipur, Chhattisgarh and finally submit them for approval of Engineer –in- charge through PMC. All costs for approvals shall be borne by the contractor. After written order to commence the work, contractor; will have to submit the all the details design and drawings within 75 days.

- 4.0 The Contractor shall produce QAPs of the equipment for approval of the Engineer-in-charge prior to procurement.
- 5.0 The Contractor shall produce QAPs and samples of the materials for approval of the Engineer- in-charge prior to procurement.
- 6.0 Any third-party inspection required at manufacturer's place, the cost of the same shall be included in the tender amount no separate amount will be paid to contractor.
- 7.0 Required preventive maintenance kit and mandatory spares shall be supplied by contractor and rate for the same shall be included in the quoted rates.
- 8.0 Required skilled and un-skilled staff for operation and maintenance with all required tools and tackles will be in scope of the Contractor shall be included in the quoted rates.
- 9.0 Obtaining all statutory, legal and regulatory permissions/NOC from respective authorities.

Specifications: -

Water Treatment Plant capable of delivering **(2.00 MLD existing And 1.0 MLD Expansion)** filtered water comprising of Civil works, providing and fixing of electrical, mechanical equipment including testing & satisfactory trial run etc, with a provision of over loading of plant with 25% except inlet and outlet control arrangements which should be designed to permit a 100% overload for emergent occasions.

The principal requirement is a spacious and convenient WTP layout. The structure should represent a pleasing appearance with aesthetic features forming a balance between function and form. The interiors of the structure shall be eye appealing and in keeping with the objectives of the plant viz., production of pure and wholesome water.

The source of Raw water as mentioned above in scope of work. The plant should have arrangements for flow measurement, chemical dosing, chemical mixing, mechanical flocculation and clarification, filtration by rapid sand gravity filters, disinfections by pre and post chlorination, chemical storage and laboratory & laboratory equipment's. WTP should be capable of treating the raw water to get the filtered and chlorinated water excluding wash water requirement per day. It should also be possible to overload the treatment plant by 25%.

While designing and constructing, it should be ensured that all materials, design, construction and fabrication details for different units including doors and windows conform to the IS-specifications and codes of practice wherever available and in their absence, to the established standards.

- i. Filtered Water Standards: -The filtered / purified water should be in conformity with the standards specified in IS 10,500(2012). The contractor shall be required to give guarantee for the performance standards, which should be satisfied by filtered water effluent. When the plant is working at the maximum rate of filtration, samples for this purpose shall be collected at filtered water outlet prior to chlorination and get tested at such laboratory as may be specified by Engineer in Charge and results of such tests shall be final and binding on both the parties.

The Engineer in Charge shall decide the manner and frequency of sampling of raw water and filtered water.

- ii. Performance Standards: The filters performance standards as specified in “Manual of water supply and Treatment 1999” para 2.2.9 shall have to be achieved.
- iii. Acid Reaction: The Filter water shall not have an acid reaction in any circumstances and shall contain not less than 10-PPM alkalinity, measured in terms of calcium carbonate. The PH value of the filter effluent shall be between 7.0 and 7.5. The chemical characteristics of the filtered water shall be in confirmation to standards.
- iv. Testing and Inspection: All pipes and other castings subjected to pressures, shall be hydraulically tested to 2 times the designed pressures as directed by the Engineer-in-charge. The entire work during manufacturing and erection, shall be subjected to inspections by the departmental staff (Engineer-in-charge or his nominees) for which adequate facilities, shall be extended by the tenderers at his cost.
- v. Completion Drawings: The tenderer shall furnish on completion of the work and handing over the same to the Department, three sets of white print plans mounted on cloth, showing the working detail of the several components, units of the plant and equipment's, including civil works (i.e., building etc.) installed and erected, together with a descriptive specification for the daily working, operation and maintenance and a list of spares along with the plant. The original cloth tracings of the above completion plans shall also be handed over to the department for record. A section of filter media together with its density, sizes, depth and specifications, shall be enclosed in triplicate duly attested.
- vi. Treatment: The treatment is comprised of the following process:
 - Aeration
 - Alum dosing and flocculation
 - Coagulation and settling
 - Filtration by Rapid Gravity Sand filters
 - Disinfection using gaseous chlorine
- vii. The Rehabilitation & Expansion of conventional WTP is designed as per specifications, with the following treatment units
 - a. Inlet Pipe and Cascade Aerator/Aerator Fountain.
 - b. Inlet chamber and Inlet Channel with Parshall flume & necessary devices.
 - c. Chemical house and chemical feeding equipments including automatic valve operation system with audio visual annunciation at the central control panel.
 - d. Flash mixer.
 - e. Clariflocculator
 - f. Rapid gravity sandfilter and filter House
 - a) Provision of filter media
 - b) Wash water tank and pumps
 - c) Air blowers
 - g. Disinfection / Chlorine unit
 - h. Clear water sump and pump house
 - i. Sludge drying beds
 - j. Administrative block to accommodate Office room, Laboratory and laboratory equipment's etc.
 - k. Staff quarters
 - l. Guard room
 - m. Store house.
 - n. Sanitary block, with carpet area of minimum 15 Sqm.

- 1.1 **Expansion of Rapid Sand Filters and Filter House:** - The clarified water will flow to the Rapid Gravity Declining Rate filter type through clarified water channel. The filters shall be designed as per CPHEEO guidelines. At least 2 nos. of filter bed must be provided according to the availability of the space. Each filter bed will be of twin type and the area to be calculated accordingly.

The maximum filtration area of an individual filter shall not exceed 100 m². The average filtration rate (total flow rate through all filters divided by the filtration area of all filters) at maximum capacity shall be not more than 4.8 m³/m²/hr with one filter offline for washing & maintenance. The filters shall allow for a maximum headloss of 1.8 m across the filter media. The filter run should normally be not less than 20 hours with a loss of head not exceeding 1.8m.

The filter shall be of declining rate filter. Each filter bed self- contained and capable of working under full or part load independently of the other. Arrangement has to be made for incoming water to be uniformly distributed between the various filters and individual on each filter bed. Each filter inlet will include isolation penstock. In filtering mode, the water will be fed into the filter, above the filter media, in such a manner that the filter media is not disturbed.

The filters shall be designed to operate under maximum filter rate of 4.8 m³/m²/hr., but the inlet and the outlet control arrangements shall be designed to permit a 100% overload for emergent occasions as per provision made in para 7.6.3.3 of manual on Water Supply & Treatment.

Dimensions of the filter unit should be as per para 7.6.3.5. of the manual of the “Water supply & Treatment” published by CPHEEO.

Quality and quantity of gravel & sand shall be as per 7.6.3.6 to 7.6.3.10 of CPHEEO manual.

Automatic effluent controller capable of operation between 50% to 160% of the normal flow.

Piezometers should be provided to determine the loss of head occurring at any time during the filter run. One set of photometers should be provided for each filter unit.

Compressed air should be used in the air wash system to secure effective scrubbing action. The quantity of wash water used should not exceed 2% of the total amount of water filtered. The air should be forced through a piping system (independent of the under drains) at the rate of 375 LPM/Sqm of the filter area at 0.18 kg/cm², pressure for a duration of 5 minutes following which wash water shall be introduced at a rate of 300 LPM/Sqm of the filter area.

The duration of the washing process should not exceed ten minutes. Both the filtered water and the water for washing should pass at uniform rates throughout the area of each filter.

The water standing on the bed at the close of the wash should be clear with a turbidity not exceeding 10 NTU.

The air wash and under drain system should be exactly in accordance with the para 6.6.3.12 (b), 6.6.3.13 and 6.6.3.9 of the manuals on water supply and treatment published by CPHEEO. The capacity of air blowers provided should be such that there is 100% standby arrangement.

The capacity of the wash water tank shall be adequate for the complete wash for 2 filter units at a time for a period of at least 10 (Ten) minutes. The size of the inlet pipe connected to wash water tank must be such as to ensure filling in 2 hrs and the size of outlet pipe from the wash water tank to the filter must be such as to ensure flow of water within the period of one complete wash of two filter units.

Electrically driven wash water pumping units should be provided at least in duplicate. Each pump should be capable of filling the wash water tank in two hours with 100% standby.

The wash water is proposed to be disposed off the same in nearby nalla through gravity. The wash water gutter invert level should therefore be fixed considering H.F.L. of nalla / natural drain so that drainage by gravity during flood can be possible.

- i. Filter media: -The filter bed should be as per CPHEEO manual on Water treatment and water Supply.
- ii. Back wash water System: -The wash sequence will include air scouring followed by water washing. The air scour rates selected to provide collapse pulse washing. This will be followed by a water only rinse at a wash-water rate selected to ensure re-stratification of the filter bed. There should be no mud balls after washing. Also, there should be no air binding during filtration or during washing. Provision for necessary sump & pump house shall be made by the bidder.

The following wash rates shall be adopted for filter wash.

- Conjunctive Air/Water wash rate: min. 45 m³/m²/hr
- Water wash rate: not less than 12 m³/m²/hr (Bidder to ensure re stratification media after each back wash)

A pressure relief system will be provided to prevent damage to a filter floor should its design pressure rating be exceeded for any reason. Drain valves will be provided to allow each individual filter to be drained. Also, hand railing should be provided to all filters to safeguard against accident as per factory Act. All the filter valves shall be pneumatically operated with manual override arrangement. The minimum size of pipeline and valves shall be of as per bidder's design and required to be approved by the consultant.

The backwash shall be arranged at such a pressure that the sand should expand to about 130 to 150 % of its undisturbed volume. The backwash shall be of air water type. The air shall be introduced for duration of 5 minutes and then the wash water shall be introduced through the same under drains for 10 minutes. For introducing air and water the piping may be same or separate. it shall be worked out by the firm with due consideration to the economy.

iii. Appurtenances: -

- I. Rate of Flow Controllers: -Since it is proposed to provide declining rate filtration, hence one rate of flow controller shall be provided. In this case filter influent shall be entered below the low water level of filters so relatively large influent header pipe or channel will serve all the filters. It shall be provided with influent valve for each individual filter.
- II. Filter Gauges: -It shall be provided to measure accurately the rate or flow through each filter box and to determine the loss of head occurring at any time during the filter run. It must be simple in operation and easy in handling by the maintenance staff.
- III. Filter Underdrain System: -As per CPHEEO Manual
The design parameters in under drainage system shall be as given in Para 7.6.3.9 of CPHEEO manual. The under-drain system with central manifold or laterals either perforated in the bottom or having umbrella type strainers on top shall be provided. The central manifold and laterals shall be of UPVC class 10.
- IV. Pipe Gallery: -Effluent wash and wastewater pipes all together with the sluice valves are placed in the pipe gallery should be well designed with minimum 2.00 m width provided with a ladder or steel rungs to make it for the maintenance staff easily accessible to the bottom. It should be well ventilated. It should have a sufficient slope to drain out the wash water or other leakage water. The two pipe galleries shall be provided one gallery for effluent pipe Air and wash water pipes and other Gallery specially for

draining out the wastewater of filters. It shall be designed by contractor and preferably of R.C.C. pipe. It shall be connected with wastewater sump. The system will avoid the unnecessary congestion of the pipes and avoid the hindrances in cleaning of pipe galleries. One shall be towards the module chambers side and other towards the influent header pipe side it should be constructed with minimum R.C.C. grade M-30.

- V. Rate of Filtration: -The rate of filtration shall be taken as 4.8 m³/m²/hour. The inlet and outlet arrangements shall be designed to permit 100% overload for emergency conditions.
- VI. Capacity of Filter Units: -The capacity of filter should be such that the number of units can take care of the total quantity of water to be filtered and with optimum efficiency to keep the filters working without undue overloading at any time.
- VII. Size of Filter Units: -Where the filters are located on both sides of pipe gallery, the ratio of length to width of a filter box shall be about 1.25 to 1.33. A minimum 2m depth of water shall be provided above filter media. The filters shall be constructed in R.C.C. of minimum grade M-30.
- VIII. Filter Controls: -All the Inlet, Outlet, backwash, air and drain water valves for the individual bed of Filter shall be electrically operated butterfly valves with actuators. The filter bed operation shall be carried out through local (Control desk with HMI) as well as remote control panel with PLC system. A loss of head transmitter and level transmitter shall be provided for each filter bed level monitoring.

The filters shall be arranged in one row with a Filter gallery of 4 m to accommodate pipe and a filtered water channel. The minimum walkway near the filter should be 1.5 mt. wide and pipe gallery should be minimum 4.0 m wide to accommodate all the pipes and valves and have a proper slope to drain out the wash water through wash water pipe. All sluice valves on each filter shall be pneumatically actuated, with manual override facility.

The filter consoles shall be fitted with pilot lamps to indicate shut and open positions of the respective valves or sluice gates actuated by limit switches mounted on the cylinders. The consoles shall be provided with push bottom starters for each of the wash pump and air blower motors with indicating pilot lamps. The consoles shall also be provided with arrangements to give an audio-visual signal to the central control room and to the wash pump/air blower room in case of emergency.

Two electrically driven air compressors mounted on a pressure storage tank for supplying air for actuating the pneumatic cylinders, shall be provided. The displacement of the compressor and the capacity of the storage vessel shall be so designed that it will be always available with one unit in operation, sufficient quantity of air under required pressure to actuate the cylinders when the filters are washed one after the other at intervals of 30 minutes. The compressors shall be fitted with a pressure switch to maintain the required pressure in the storage vessel and a drier for dehumidifying to ensure dry air to the cylinders. An audio-visual alarm shall be installed in the central control room to indicate failure of the pressure system. One compressor shall work at a time and the other one shall be standby. The compressors be rated at 15 bar and provided with a pressure switch each with both cut-in and cut-out facilities.

- Filters shall be of the declining rate type with filtration rates varying by $\pm 20\%$ of the average over a filter runs length. At the start of the

filter run, when the bed is clear the filtration rate shall be 20% above the average value whilst at the end of the filter run the filtration rate shall be of 20% below the average value.

- Clarified water shall be fed to each filter from the inlet channel through a submerged penstock opening.
- At the outlet of each filter the filtered water shall flow through an adjustable valve or 'setting valve', which shall limit the maximum flow to 20% above average flow. The valve setting shall be adjusted during commissioning in order to achieve the required range of filtration rates between clean bed and dirty bed conditions to within $\pm 20\%$ of the average flow through the filters.
- A separate valve drain shall be provided to drain the underflow chamber. Emergency access to the underside of the filter floor shall be provided.
- Filter valves and penstocks shall be fitted with electric actuators with facility for manual operation.
- Each filter shall be equipped with instruments for measurement of the differential head across the filter bed. Measurement accuracy shall be $\pm 2\%$ of the measured value. Each measurement instrument shall be equipped with stainless steel needle isolating and drain valves.
- A control console for each filter shall be installed in the gallery.
- These consoles shall be equipped such that the operator can initiate the backwashing operation manually.
- The control consoles for each filter shall include the following facilities and indications as a minimum:
 - Start filter wash cycle -key operated push-button;
 - Manual/automatic key operated selector switch;
 - Filter water holding tank full-lamp;
 - Open/close push buttons for each actuated valve and penstock;
 - Open/close indication for each valve and penstock-lamp;
 - Filter ready for wash-lamp;
 - Filter washing - lamp;
 - Filter in service - lamp;
 - Filter out of service
 - Wash water pump tripped - lamp;
 - Air scour blower tripped - lamp
- Filters shall be washed in sequence automatically under the control of a preset timer, adjustable from 12 to 36 hours. Filter backwashing shall be inhibited to prevent two filters washing simultaneously and also to prevent wash initiation when the filtered water holding tank has insufficient water in storage.
- Programmable Logic Controllers (PLCs) may be used for filter washing controls, with each filter being controlled by a dedicated PLC with the initiation controlled by a central PLC. PLCs shall be arranged so that failure of one unit does not disable the automatic washing of more than one filter.
- Lamps in the monitoring room shall indicate the state of each filter, i.e. filter in service, filter washing and filter wash overdue.
- Filter washing time cycles shall be manually adjusted to suit the monitored turbidity

IX. Filter Valves and Motive Power System: -

- Butterfly valves shall be used for the filters in preference to penstocks or sluice valves unless the penstocks or sluice valves proposed are of a size which can be operated easily by one man.
- Filter valves which require to be operated as part of the washing cycle shall be operated by pneumatic power. The system shall be capable of operation in the event of electric power failure and details shall be provided by Contractor, as to how this will be done. The time taken to open or close any valve shall generally be between 10-30 seconds.
- Compressors for valve/penstocks operation duties shall be in duplicate with duty/standby units including receivers, provided to serve only the filters. The standby unit shall be so arranged to automatically operate if the duty unit fails and also initiate an alarm state on the filter block control room enunciator. The rating/capacity of each compressor shall be designed to serve a total of 3 filters, and to enable valves on at least three filters to be operated simultaneously.
- The compressor installation shall be designed to satisfy conditions for maximum air demand and shall ensure the duty compressor does not start more than six times in any hour and the running time of the duty compressor shall not exceed 35 minutes in any one hour. The standby compressor unit and receiver shall be identical in size.
- To avoid overheating, an integral cooling system shall be provided for each compressor unit.

X. Piezometer tapings: -In two filters (to be selected by the Engineer-in-Charge's), necessary piezometer tapings as per approved design shall be provided for each filter to determine the head loss gradient across the media. The Contractor shall provide and fix on the two filter front walls in an accessible position (with standing platform if necessary) all the necessary puddle pipes, strainers, manometers, tubes, calibrated scales, mounting boards and fixing brackets, interconnecting small bore tubing, cocks and fittings.

Paving: -A paving in front of clear water control chamber 4.0 m wide shall be provided by contractor. The paving shall be in grooved vitrified tiles good in appearance and colour, laid over M-25 cement concrete.

Stair case: -The stairs made of RCC M30 with granite rise, tread and landings shall be provided. The staircase shall be provided to connect ground level to the floor of control room and wash water pump or air blower floor to the operating platform of control room.

XI. Effluent and wash Water pipe: -The effluent pipe shall be designed for a velocity of 0.9 to 1.8 mt./second and wash water pipe for a velocity of 1.5 m/second. These shall be C.I. double-flanged class. Pipes conforming to I.S. 7181 - 1984 and C. I. specials shall be conforming to I.S. 1538-1976. The sluice valve provided shall be conforming to I.S. 14846-2000.

- iv. Module Chamber of Clear water Control Chamber: -It shall have sufficient space to accommodate sluice valves of effluent pipes, effluent discharge weir and clear water effluent pipe feeding to clear water sumps. It shall have sufficient circulation space minimum 2.00 m of ground floor where the module chambers shall be minimum ceiling height of floor shall be 4.00 m. The ground floor shall be easily accessible by providing aluminium ladders. Arrangement for effluent sluice valves, air blowers piping, Wash water tank etc shall be framed structure of minimum R.C.C. M-30 grade concrete. At a height of minimum 10.00 m, the wash water tank shall be provided for storing the water for washing the filters. The panels of framed structure shall be constructed of chimney brick masonry with cement mortar 1:5

and plastered with mortar 1:5 the ground floor as well as first floor shall have sufficient ventilation of about 30% of floor area. As far as possible natural ventilation shall be provided, the window shall be of Aluminium. Z-section provided with 4 mm thick transparent glass. The gate shall be provided on all the four sides. The main gate shall be made of aluminium automatically closing type fitted with glass and the other gates one towards filter sides and other towards chlorine room side and open area side shall be made of Z section of Aluminium fitted with glass. The windows of Aluminium frame shall be opened outside fitted with mosquito net with all arrangements of opening and closing the window stoppers etc. complete. The flooring in chamber shall be anti-skid tiles as approved by the Engineer-in-Charge with good finish up to 30-cm. height. The ground floor shall have drainage arrangement to easily drain out water in case of cleaning the water from module chamber.

- v. Performance Capability: - For Rapid gravity filters, the performance standards should be in accordance with para 6.6.8.2 of manual on water supply and treatment published by CPHEEO.

- 1.2 Disinfection / Chlorine Unit: -Chlorinators using chlorine gas from standard liquid tonners and capable of feeding chlorine into the raw water at inlet point for pre chlorination and for clear water in clear water reservoir without the aid of any power are required. Suitable numbers of vacuum type chlorinators with suitable booster pumps and all accessories shall be provided so that at least 100% standby capacity be available. Capacity of each chlorinator shall be sufficient to dose at the maximum rate of 3 mg and 2 mg per liter for pre & post chlorination respectively.

A suitable scale showing delivery should be incorporated in the chlorinators. A weighing balance of suitable capacity shall also be provided to measure the quantity of chlorine in the chlorine tonner. The chlorinators shall be housed in a separate room attached to the filter house the area of which should be sufficient to house at least two chlorine tonners. The tenderers are advised to quote for both types of chlorinators. The department reserves the right to select the more suitable one. There should have a separate entrance. The carpet area of chlorine room shall not be less than 30 sqm excluding the space required for chlorine tonner. This room shall be a part of filter house. All the requirements specified for civil works in case of filter house shall be applicable for this also except that the doors and windows frame shall be wooden. Other requirements of chlorine room and the chlorinators shall be as per para 7.5.5 of manual on water supply and treatment published by CPHEEO. Suitable exhaust arrangement for chlorination plant should be incorporated.

A suitable rail trolley may also be provided for bringing and taking out the tonner from the room. The storage space of at least 50 sqm shall be provided, where chlorine tonners will be stored and shall be properly located and designed for facility of removing and bringing in chlorine tonners.

The chlorinator panels & pre, Post chlorine booster pumps shall be SCADA compatible & integrated with SCADA Operation.

- Laboratory equipments should be as per requirement of Engineer in Charge and as per provisions mentioned in the CPHEEO manual duly amended.
- For All building works (Where ever required)- Vitrified tiles (60 cm x 60 cm), for Stairs- Granite, For Pump House-Ironite, For Chlorine and Alum – Kota Stone, for Aerator Vitrified tiles floorings should be used respectively as per the approved design and as per the direction of Engineer in Charge.
- The filter beds, shall be open to sky i.e. there shall be no roofs over the filter beds.

- Sign and Warning Boards: -All buildings and treatment units shall be provided with sign & warning boards as directed by Engineer in Charge, indicating the name and function of these at no extra cost to department. All the signboards displaying name of the technical units and directions shall be written in English and Hindi. The main signboard erected at the main gate of the plant shall have matter written in English & Hindi.

At the start of construction work the contractor shall erect signboards one at the entry of the construction site and another near the temporary site office displaying all the project related information like name of the work, client, value of the works, start and completion date as per contract, capacity of the plant, number of units and other details as directed by Engineer-in-Charge. The size of the board shall be decided in consultation with the Engineer-in-Charge.

The size of the board shall be 1200 mm x 1200 mm minimum or as directed by Engineer-in-Charge. The signboard shall be partially reflective Flex type on SS Grade 304 minimum 1.2 mm thick supported with frame of aluminium channels / double back-channels minimum 3 mm thick through aluminium rivets. The signboard shall be subsequently attached to the post(s) through steel bolts. The posts shall be 75 mm diameter galvanized steel with welded top cap in case the signboard is supported on one post only, however, if two posts are used to support the signboard the diameter of each shall be minimum 40 mm and thickness 1.6 mm. The steel posts shall be embedded in RCC footing of size as approved by the engineer or as per the design. The total height of the post shall be 1800 mm + size / depth of the signboard. For larger size boards, more than 1200 mm x 1200 mm, the contractor shall submit the designs and drawings, wind load calculations, etc for approval of Engineer-in Charge prior to its construction

- Electrical installation: -Both internal and external electrification should be provided at entire plant area as per the direction of Engineer-in-charge. Before starting the procurement and installation work, Contractor must submit all the designs, drawings and calculations to the Engineer-in-Charge for approval.
- All the electrical panels of WTP (Flash, mixer, Chemical house, Wash water & air blower panels, clarifloculator panels, chlorinator etc.) & RDOL panels shall be provided with SCADA operation compatible.
- Electric Motors shall be covered in properly designed and shaped 8-gauge G.I. sheets to protect them against weather effects.
- The Treatment units shall be provided with desludging arrangement including sluice valves with operating rod and wheels and piping to lead sludge to the wash out system. There should be automatic arrangement to operate and the manual in the case of failure of the automatic device.
- The provision of the driving units for Flash Mixer and Clarifloculator shall be inclusive of all electrical connection and control, switch gear overload alarms etc. necessary for the designed efficiency and safety in working and up-keep of the plant.
- All the treatment works shall have proper walkways around with minimum width of 1.20m and shall be shaped aesthetically. There shall be a pipe railing of architectural design and the bends, corners and vertical stays and the horizontal railing properly, finished so as to offer a fine & streamline look. The number and placing of the walkway to be such that it will enable the operating staff to approach to the electrical motors and other essential portion of treatment work easily.
- Fire extinguishers for each building at every floor shall be provided and fixed as per the relevant IS Specifications.

- Providing supplying erecting and Commissioning, computer, peripherals and furnitures and other miscellaneous items including communication telephone and Internet connection
- Providing and fixing in position copper lightening conductor including all allied works and Earthing etc
- Supply, Installation, Testing & Commissioning of Solar-Photovoltaic (SPV) Garden Lamp Post system, LED based 18 watts as per MNRE specification and as per the drawings and including 5 years warranty including replacement and warranty. Illumination level, quantities and locations shall be as per the direction of Engineer in Charge, as per approved design and drawings, which shall not be less than the standard specifications.
- Glazed tiles of best quality should be provided to all water retaining faces and filter manifold as per the directions of Engineer-in-Charge.

1.3 SPECIFIC REQUIREMENTS FOR PIPES, SPECIALS AND VALVES

The piping material & work shall conform to the following standards for material & erection & testing.

- IS-1536, IS-1537 & IS -1538 Centrifugal Cast (spun) iron pipes and fittings for water and sewage.
- IS -1239 GI Pipes & Fittings
- IS - 4984 HDPE Pipes
- IS -8008 HDPE fittings
- IS -7634 Code of practice for laying HDPE pipes
- IS -3114 Code of practice for laying cast iron pipes.
- IS -780 Cast iron sluice Valves
- IS - 638 Rubber for flanged joints
- IS -1867 MS hexagonal bolts and nuts
- IS - 6392 Steel pipe flanges
- IS 7634 Laying & Jointing of HDPE pipes

i. **Pipe Sizing and Design Basis:-**

All piping including inter connecting piping between the various units components of the system as required to meet the duty specifications with valves shall be designed as per the following piping design basis. The piping design including material of construction, class of piping with unit sizes installation drawing shall be prepared by the bidder and furnished for approval of the Consultant / Engineer in Charge prior to procurement / fabrication and installation. The piping and valves will be sized on the following basis for sizing.

Service / Flow	Basis	Comments / Limitations
Gravity Lines for Sewage, Water & Waste Water	velocity between 0.6 to 1.2 m / sec & designed as pipe line flowing full	At peak flows a velocity up to 1.5 m/sec allowable. Minimum velocity to be more than 0.45 m/ sec
Pressure for Sewage , Water & Waste Water	velocity between 1.2 to 1.8 m / sec	In small sections at pump delivery / suction points a velocity up to 2.5 m/sec allowable. Minimum velocity not to be less than 0.6 m/ sec
Air (Pressurized Lines)	at velocities between 8-10 m/ sec (desirable) with a maximum of 15 m/ sec in	Velocities in excess of 16 m/ sec not permitted in any section

Service / Flow	Basis	Comments / Limitations
	small sections	
Service Water	velocity between 1.4 to 2.0 m / sec	In small sections at pump delivery / suction points a velocity up to 2.5 m/sec allowable. Minimum velocity not to be less than 0.9 m/ sec
Sludge Lines	velocity between 0.6 to 1.5 m / sec.	irrespective of quantity of flow, size will not be less than- 100 mm dia.- for pressure flow 150 mm dia – for gravity flow
Chemical Feed Lines	velocity between 0.6 to 1.5 m / sec	irrespective of flow will not be less than 20 mm dia.

Notwithstanding above the bidder shall submit a list of pipelines with tag nos ,flow , size selected for main line and valves at basic engineering stage with the detailed P&ID and the same shall furnished for approval of the Consultant / Engineer in Charge prior to any further engineering or procurement / fabrication and installation . The information shall be furnished in the following format

S No	Line No	From	To	Type of Flow	Flow m ³ /h	Selected Main Pipe Dia in mm	Velocity in m/sec	Type of Valve	Remarks

1.4 SPECIFIC REQUIREMENTS FOR PUMPING STATIONS

- i. **General:** Pumping stations are generally equipped with centrifugal pumps, driven mostly by electric motors. The direction of flow through the impeller depends on the type of pump. Radial flow occurs in volute and turbine pumps, axial flow in propeller pumps, and diagonal flow in mixed – flow pumps. The selection of pumping units requires knowledge of system head and pump characteristics. The system head, which is the sum of the static and dynamic heads against the pumps, varies

- 1 With the flow in the system
- 2 With changes in storage and suction levels and
- 3 With shifts in demand when a distribution system lies between the pump and the reservoir.

The pump characteristics depend on the size, speed and design of the pump. For a given speed N (rpm), they are defined by relationships between rate of discharge Q (M³/h, or gpm or lps) and the head H (feet or meter) the efficiency E in per cent, and the power input P in horse power. A pump of given geometrical design is also characterized by its specific speed N_s . This is the hypothetical speed of an homologues (geometrically similar) pump with an impeller diameter D such that it will discharge 1gpm against a 1feet head or 1M³/h against a head of 1.0 M. Since discharge varies as area multiplied by velocity and since velocity must vary as $H^{1/2}$, $Q \propto D^2 H^{1/2}$. But velocity varies also as

$$\frac{\pi D N}{60}$$

60

Hence $H^{1/2} \propto DN$ or $N \propto H^{3/4} / Q^{1/2}$ and the specific speed is given by the relation

$$NS = \frac{N Q^{1/2}}{H^{3/4}}$$

Generally, the efficiencies of pumps increase with their size and capacity. Below specific speeds of 1000 units, efficiencies drop off rapidly. Between specific speeds of 100 and 4000 units, radial flow pumps perform well. Mixed flow pumps are efficient in the range of 4000 to 7500 units. After that axial flow pumps have higher efficiencies.

The vendors are requested to study the details of Pump house and variations of levels and decide the type, speed and number of pumps for maximum efficiency of the system, so the power requirement is optimum.

Major equipments are listed below, but the vendor has to include all the items which are required to complete the work in all respect. Specification of the items is given below but vendors are advised to use best equipments available in the country Generally Indian standards and code of practice shall be adhered to for selection of the equipments. Wherever Indian standards are not available international standards (American, British, German, and Japanese) may be followed, with proper justification.

Pumps, motors, Isolation valves (Sluice, Butterfly), Non-return valves, and Actuators (Electrical and Pneumatic), Sluice gates, pipes, dismantling joints, pipes – CI, DI, MS, GI, PVC, HDPE, EOT cranes, vacuum pumps, dewatering pumps.

Transformer, Bus –bars, HT panels, LT panels, starter panels, control panels, capacitor panels, cables, Earthing, Pressure gauges, vacuum gauges, Flow meter, level Indicator – Mechanical typed electronic type, ultrasound type, level switches, pressure switches, solenoid valves, Pneumatic cylinder, air fifiers, and regulators.

1.5 Lab Equipments

The bidder shall provide a t a minimum the following lab equipments:

- a) Pre-programmed Water Analysis System comprises of Water Spectrophotometer, Digital Titrator, Chemicals & Glassware
- b) PH Meter (Pre-calibrated)
- c) Conductivity Meter (Pre-calibrated)
- d) Pre-calibrated Luminescent D.O. Meter (Pre-calibrated & no consumables required)
- e) Pre-programmed Turbidity Meter
- f) Microbiological Testing Lab for Total Coli Form, Fecal Coli form & E- coli
- g) Analyzers for Hardness, Alkalinity, chloride, Sulphate, Nitrate, Ammonia, Total Nitrogen, iron
- h) Magnetic Stirrer
- i) Hot Plate
- j) Water Bath
- k) Muffle Furnace
- l) Ultrasonic Wash

- m) Water Purification System
- n) Distillation System
- o) Analytical Balance 0.1 mg
- p) Hot Air Oven
- q) Refrigerator (280 liter)
- r) COD Analysis System with Reactor, Chemicals & Reader for analysis in ranges of 0-40, 0-150, 0 - 1500, 0-15,000
- s) Colony Counter
- t) Distillation Apparatus
- u) Six Sample Flocculator
- v) Hot Plate
- w) Glassware & Chemicals
- x) Multi parameter system for PH, Conductivity, TDS, DO, Salinity, Temp. in single probe

1.6 General requirements/other works:-

1. There should be interconnecting channels, pipes, valves etc. for bye pass arrangement so that any individual unit can be put out of operation without affecting the working of others the bye pass arrangement shall also be designed to carry 25% additional flow during emergency.
2. Electric Motors shall be covered in properly designed and shaped 8-gauge G.I. sheets to protect them against weather effects.
3. The Treatment units shall be provided with desludging arrangement including sluice valves with operating rod and wheels and piping to lead sludge to the wash out system. There should be automatic arrangement to operate and also the manual in the case of failure of the automatic device.
4. The provision of the driving units for Flash Mixer, flocculator and clarifiers shall be inclusive of all electrical connection and control, switch gear over load alarms etc. necessary for the designed efficiency and safety in working and up-keep of the plant.
5. All the treatment works shall have proper walkways around the minimum width of 1.20 M and shall be shapped aesthetically. There shall be a pipe railing of architectural design and the bends, corners and vertical stays and the horizontal railing properly, finished so as to offer a fine & streamline look. The number and placing of the walkway to be such that it will enable the operating staff to approach to the electrical motors and other essential portion of treatment work easily.
6. All the C.I. Pipes used in the plant shall be of double flanged class "B" conforming to I.S. 1537 latest addition duly inspected by IRClass/RITES.
7. The C.I. special should be double flanged conforming to IS 1538-1976 duly inspected by /IR Class/RITES.
8. The C.I. Valves should be of double-flanged class II with I.S.I. Mark duly inspected by IR CLASS/RITES.
In no place operating rod of any valve or mechanism or any other obstructions shall come in 1.2 m walkway.
9. Fire extinguishers for each building at every floor shall be provided, and fixed as per the relevant i.S. Specification.
10. Overflow from clear water sump shall be connected to sludge disposal system and should have free fall.

11. Provision of SCADA and PLC with complete automisation of proposed WTP including the cost of Computers & peripherals, data loggers, including successful operation & maintenances.
12. Provision for Plantation & Butification of WTP premises.
13. Glazed tiles of best quality to all water retaining faces and filter manifold as per the directions of Engineer in Charge

1.7 SPECIFICATION FOR MECHANICAL WORKS

- Submerged structural parts (Steel) except hot rolled sections shall not be less than 6 mm thick.
- Prime movers and allied components such as electrical motors, starters, switches, reduction gears, drive mechanisms, bearings, plunger blocks, etc. shall be standard make.
- All rotating machinery, particularly gears shall be designed with adequate safety margins and service factors.
- All water submerged parts rotating mechanical parts and steel pipe under water shall be adequately protected after surface treatment. Oil, grease, dirt, soil and all surface contaminations from structural and fabricated steel parts shall be removed by cleaning with solvent vapour alkali emulsion or steam. Loose rust or paint weld spatter etc. shall be removed by hand chipping, scraping, sanding, wire brushing and grinding the bare finished shafting, finished flanges and other mechanical surface protected by grease or rust protection measures.
- Structural Mechanism support and super structures, walkway, hand rails with PVC tops Fabricated shaft etc. shall be protected with at least one coat of primer and two coats of paint IS 800-1962 (up to amended) code of practice for use of structural steel in general building construction should be followed. The department for procurement of any materials shall issue no permits.
- The tender must be inclusive of operation of the plant for the trial run period free of charge by contractors trained and qualified Engineers who should be completely familiar with the equipments supplied and erected and they shall train the departmental staff in operation of the plant within that period. Detailed operation manual as well as the drawings of equipments supplied, should also be supplied by the contractor free of cost. The cost of electrical energy, Chlorine Gas, and payment to departmental staff for operation of the plant, will be paid by the Department during this period.

Performance Guarantee must be demonstrated by the test run for this period of three months. The tenderers must furnish bonds covering items of work like mechanical and electrical equipments, piping etc. for one year or two consecutive rainy seasons whichever is more as a guarantee of satisfactory operation and rectification of any defects in the work, material or equipment furnished by them by way of repairing or replacement at their own cost. The tenderers must furnish the service of competent representatives for this period to instruct the plant operating personnel in the maintenance and care of flow indicators, rate controller, piezometers etc. and to conduct tests.

1.8 SPECIFICATION FOR ELECTRIC WORKS

- The work shall be carried out strictly in accordance with latest India Electricity rules, especially as per latest specifications of Chhattisgarh Electricity Board and relevant IS Specification.
- The size and type of wiring shall be suitable for A.C. supply at 440 (+5%) volts, 3 Phase, 50 cycles for Power and 220 Volts for lightning.
- All phase wire shall be inside concealed single metal conduit and pipe shall be

- properly earthed.
- Suitable protection by means of cut-out shall be provided in such live conductors for every circuit.
- Lighting arrestor along with suitable earthing arrangement as per relevant I.S. specification shall be provided.
- All switches and fittings shall be of superior type as directed by the Engineer-in-charge.
- For the work of wiring for lighting of building shall be carried through surface PVC conduit pipe as per the approved design. The tender shall be inclusive of electric connections for power from main board to drive unit and light.
- The scope of work shall include work of providing laying and fixing of power cable from electrical sub station to main distribution panel. The contractor shall provide wiring for power and light in open PVC conduit as per specifications
- The contractor shall provide and fix at proper places all around the plant/clarifloculator/clear water sump with LED lights of watts on suitable, & work in open during rains. However, the department shall have right to increase illumination level by 5% without any extra payment.
- Specifications for main distribution board :
The panel board shall be designed for the complete electrical load of treatment works, e.g., for prime movers of mechanical equipments of flash mixer, clarifloculator with its and carriage, alum and lime solution tank, chlorine boosters, wash water pumps, air blowers, Sampling table etc. and for entire load of internal and external electrification e.g., light, flood lights, LED, ceiling Fans, Cooling Fans, Coolers, ACs, refrigerator etc.
It shall consist of bus bars of suitable section, designed for capacity considering above electrical load, ammeters and volt meters of suitable range with rotary selector switches, phase indicator lamps with switches, CB or ICTPN switches of adequate capacity with HRC fuse. The panel board shall be cubical non draw out type with panel openings either from front or rear side for carrying out inspection, operation and maintenance. Suitable ICTPN rewirable fuse units of adequate capacity shall be provided for lighting load. This panel board shall be housed in a room near blowers and wash water tank filling pumps. The total area of room for blowers, pumps of WWT filling and panel board shall be a minimum 30 sqm. After completion of wiring the contractor shall fill in the necessary form required by CSPDCL Authority for getting connections and shall hand over the installation in complete working condition to the satisfaction of the Engineer-in-charge. The charges required to be paid to CSPDCL for obtaining electrical connections shall be arranged by the Department.

The tenderer has to work out details of illumination and arrangements and submit necessary drawing for acceptance of the Engineer-in-charge

The suitable capacity LED should be provided in the filter house. Industrial type nitrous enamel reflectors complete with original choke, starters etc. The required LED shall also be provided in the operation gallery to give a uniform lighting. The inspection boxes shall be fitted with corrosion proof fittings. A common switch board shall be provided for the starters for the pumps, air blowers, compressors and other pumps. These shall be provided in wash water tank feed pump house along with necessary cables to the various motors. The panel shall be completed with incoming triple pole switch, Voltmeter, Ammeter and isolating switches for the various pilot lamps etc.

The tenderer shall also include the cost of providing and laying the incoming power box

cables from the main sub station to be constructed by the department in the same premises to panel in the wash water pump room and also the wiring in VIR in heavy gauge conduit from indoor motors.

- 1.9 **Laboratory Equipments, Glassware & Chemicals** -The followings Lab Equipments, accessories, Glassware and chemicals shall be provided and maintained by contractor through the duration of project and its cost deemed to be included in his Lumsum offer. Nothing extra shall be paid by the department.

i. **DETAILS OF EQUIPMENTS FOR WATER TESTING LABORATORY**

S.No.	Name of Equipment's	Required quantity
1	Refrigerator (280 Liters)	1 No.
2	Incubator 37 ⁰ c±05 ⁰ c (Bacteriological) 220 Volt A.C.	1 No.
3	pH Meter (Digital(0-14 pH range)	1 No.
4	Nephelometer direct reading (Range 0-1000)	1 No.
5	Spectrophotometer visible range 220 to 850 nm	1 No.
6	Jar test apparatus with variable speed control 10 to 1000 RPM.	2 No.
7	Conductivity meter (systronics)	1 No.
8	Water distillation plant (15L/day)	1 No.
9	Auto calve (Cabinet 15 Atm pressure)	1 No.
10	Hot Air Oven 30 lit. cap 100° to 180°c	1 No.
11	Water bath 6 to 8 concentric 0 to 50 ⁰ c	1 No.
12	Dissolve oxygen Analyser (Digital)	1 No.
13	Chlorine comparator	2 No.
14	Heating metal (Capacity 1 Litre)	1 No.
15	Magnetic stirrer (1 Liter capacity speed control)	1 No.
16	Laboratory Balance 0 to 200 gm	1 No.

ii. **DETAILS OF CHEMICALS FOR WATER TESTING LABORATORY**

S.No.	Name of Equipment's	Required quantity
1	Phenolphthaline Indicator	1 Lit.
2	Mehayal orange indicator	1 Lit.
3	Sulphuric acid N/50	2 Lit.
4	Potassium Chromate 5%	1 Lit.
5	Silver nitrate	200 gms.
6	Manganese Soleplate	1 Kg.
7	Sodium thisulphate	1 Kg.
8	1-10 Phenepitheline	200 gms.

9	Hydroxylamine Hydrochloride	200 gms.
10	Eriochrome black 'T'	100 gms.
11	Murexide	20 gms.
12	E D T A N/50	5 Lit.

iii. **DETAILS OF GLASSWARE FOR WATER TESTING LABORATORY**

S.No.	Name of Equipment's	Required
1	Graduated pipette of capacity 1 ml.	5No.
	- do - 2 ml.	5No.
	- do - 10ml.	5No.
	Ordinary pipette of capacity 10 ml.	5No.
	- do - 25 ml.	5No.
2	Graduated Measuring Cylinder Capacity 10 ml.	5No.
	- do - 50ml.	5No.
	- do - 250ml.	5No.
	- do - 1000 ml.	5No.
3	Reagent Bottles of Capacity 250 ml.	10 No.
	- do - 500ml.	10 No.
4	Nester's tube of capacity 50 ml.	5 No.
	- do - 100ml.	5 No.
5	Conical flask of capacity 100ml.	5 No.
	- do - 250ml.	5 No.
	- do - 500ml.	5 No.
	- do - 1000ml.	5 No.
6	Beakers of capacity 100ml.	5 No.
	- do - 250ml.	5 No.
	- do - 500ml.	5 No.
	- do - 1000ml.	5 No.
7	Test tube with rim of size 25 x 250	100 No.
	- do - 15 x 150	100 No.
8	B O D Bottle 300 ml.	15 No.
9	Funnel 4	15 No.
10	Filter paper (Whatman's) No.1	4 Pkt.
	- do - No. 40	4 Pkt.
	- do - No. 42	4 Pkt.
12	Desiccators	1 No.

iv. **DETAILS OF ACCESSORIES & MATERIAL FOR LABORATORY**

S.No.	Name of Equipment's	Required quantity
1	Water Sampler (Steel) of capacity 2 Lit. - do - 5 Lit.	2 No. 2 No.

2	Gas Cylinder	2 No.
3	Burners (Bunsen Marks) ½" Pipe with tuner tone	4 No.
4	Wire basket 5 x 5 x 5	2 No.
5	Burette Clamps (Nickle plated)	4 No.
6	Tongs stainless steel 13"	2 No.
7	Spatula steel 8"	10 No.
8	Test tube stand (Iron)	10 No.
9	Rubber cork various sizes	50 No.
10	ICE Box (thirmocal)	3 No.
11	Iron Box with clamp	6 No.
12	Blotting paper	10 Sheets
13	Wire gage 6 x 6"	6 No.
14	Stop Watch	1 No.
15	Nessler's tube stand	5 No.
16	Sample Box	2 No.
17	Brown Paper	5 Sheets
18	Pipette Stand	3 No.
19	Non-absorbent cotton	1 Kg.
20	Test tube brush (Nylon)	10 No.
21	Burette brush	10 No.

v. **REQUIREMENT OF CHEMICAL FOR BACTERIOLOGICAL TEST**

S.No	Name of Equipment's	Required quantity
1	Mac conkey Broth (D S)	1 Kg.
2	Mac conkey Broth (S S)	1 Kg.
3	Peptone	1 Kg.
4	Lactose	1 Kg.
5	Sod Chloride	1 Kg.
6	Bile Salt	0.5 Kg.
7	Natural Red	100 Gms.
8	Brilliant green bile lactose Broth (BGIB)	4 Kg.
9	Tryptophe broth	4 Kg.
10	Sprit	

ANNEXURE - “E-5”**1. Scope of work & specification of work: for OHSRs: -**

1.1. Designing (structurally & aesthetically), and constructing RCCOHSRs of following capacity with RCC staging.

1.1.1. Details of proposed and existing OHSRs

SNo.	Location	Capacity (KL)	Staging (in m)
1	Ward-15 (proposed)	160	20

Note: INTZ Type tank is not allowed

1.2. Details of scope of work for above OHTS, but not limited to followings: -

- (i) Trial Pit-Bidders are advised to carry out their own trial pit sections to get the idea of soil conditions at its own cost before quoting the offers.
- (ii) Geotechnical investigations for determination of SBC
- (iii) Approval of Design and Drawings as per tender document
- (iv) Construction of Levelling course of PCC (1:2:4) for foundation of OHSR complete.
- (v) Casting of RCC foundation & Pedestals.
- (vi) Casting of RCC complete staging upto bottom slab of container with brace beams.
- (vii) Casting of vertical walls of reservoir/container complete.
- (viii) Casting of Top Dome/Slab
- (ix) By-Pass arrangement
- (x) Providing and fixing of ISI Mark DI Pipes and specials for Inlet, Outlet, Scour & Overflow and ISI mark DI Double Flanged Heavy duty specials and Duck Foot Bends and DI Sluice Valves with Dismantling Joints etc. complete at site including approval by the Third-party Inspection.
- (xi) RCC Valve Chambers with RCC Covers. RCC Stair Case from Ground Level to Balcony and from Balcony to roof of the OHT with gate to be provided.
- (xii) Providing and Fixing of all accessories such as Lightning Arrestor and Earthing Pit, Digital Water Level Indicator, Aluminium Ladder from Roof to inside of Floor Level of Tank, Ventilating Cowls/Shaft, Manhole Covers with Frame complete at site including approval by the Third-Party Inspection.
- (xiii) Construction of Control Room below OHSR with all Fixtures, Valves, Pipes etc for Scada Monitoring and slab at 1st brace level from FGL.
- (xiv) Providing and supplying of three row of 25 mm dia, G.I. medium class pipe Railing with RCC “L” type column 1000 mm height @ 1.5m C/C OR 50x50x6mm M.S. angle iron post 1m high. The stair case will be closed by a M.S gate with jali as per the direction of Engineer-in-Charge at the ground level.
- (xv) Architectural Treatment, Plinth Protection of minimum 5 m wide at outer periphery from external column & Drainage and Boundary Wall.
- (xvi) CC Flooring at Finished ground level/plinth level below the OHSRs.
- (xvii) Backfilling of excavated foundation upto finished ground level below OHT.
- (xviii) Painting as per Specifications.
- (xix) Successful water tightness testing of work
- (xx) Testing and Commissioning
- (xxi) All DI Specials shall conform to IS 9523
- (xxii) Others works (if any) to complete the Job.

(xxiii) The work of construction of R.C.C. Over Head Service Reservoirs involves specialised workmanship, hence requirement of higher standard than general concrete work is essential. The height of staging will be reckoned from ground level at the site and main road level to the site, i.e., the ground level at the site or road level whichever is higher shall be treated as the base level for determination of staging height. Back Filling with moorum, if necessary as per the site conditions, shall be in the scope of the contractor and nothing extra shall be payable on this account since construction of OHSR being a lumpsum item. The contractor shall construct proper plinth protection surrounding the GL brace to give finished look after construction.

- 1.3. The service Reservoir should be flat bottom circular in shape supported on circular columns. The foundation, columns, bracings etc should be so designed so as to have a provision for construction of a single storeyed building between GL bracing & first bracing with RCC roof and the live load of roof slab shall be taken as 300 kg/sq-m and the dead load of roof slab shall be taken as 375kg/sq-m.

The position of the bottom of bracing shall be so fixed that head room of ground floor to be constructed should be approx. 3.5 m. In addition to Construction of RCC slab at 3.5 m above GL, Provision in design should be considered for construction of extra slab on 2nd brace of OHSRs from GL including weight of brick work etc for construction of office/accommodations at later stage.

The construction of such extra slab/building work is not included in this lump sum contract except RCC slab at 3.5 m height from GL level.

- 1.4. Preparation and submission of "As Built Drawings" for approval of the Engineer-in-charge.
- 1.5. All works shall be executed as per the directions of the Engineer-in-charge.
- 1.6. **By-Pass arrangement**-For uninterrupted supply in case of repair. Contractor shall make arrangement for providing By-pass arrangement at each OHSR and should submit layout drawing of same for approval of ULB through PMC.

While erecting DIDF pipes for Inlet, Outlet and Overflow and scour pipe arrangement, By-pass Arrangement shall be made directly connecting the Inlet pipe with Outlet Pipe before Inlet pipe entering the OHT and which shall have a controlling valve which will be closed always except when needed for repairs, O&M of OHSRs

- 1.7. SBC of all structures should be done at a minimum depth of 3 meters from natural Ground Level. Contractor to carry out SBC at all sites as per the conditions of NIT and shall submit the test certificate to the department before submitting design. A detailed soil investigation to be done at certain locations/site where soil condition is not good at locations where poorly graded soil is found like backfilled site, along the river/nala, coal dust, pond etc. at such locations the soil testing along with SBC shall be done as directed by engineer in-charge at the lump sum cost of the project for which no extra claim will be entertained. The SBC shall be calculated based on the shear as well as settlement criteria with detailed soil investigation report. Preferably standard penetration test to be done at such locations for SBC at the cost inclusive in NIT and as directed by engineer in-charge.

The Contractor has to carry out Plate Load Test through Government Engineering College Raipur /NIT Raipur/ C.G. to confirm the Safe Bearing Capacity of soil at stated location, and providing detailed SBC report as per technical specifications including following: -

- 1.7.1. **SBC report shall give clear recommendations of the depth of foundation & type of foundation [raft or independent footings]**. Contractor shall carry out Topographic survey within the boundary area of the service reservoir, including providing bench

marks, at the reservoir location, which is to be maintained during the entire period of construction.

- 1.8. Contractor shall prepare and submit a General Arrangement Drawing of OHSR covering items such as provision of **Ladder** within the container, ultrasonic level indicator, lightening arrestor, cage ladder, loc of out let pipe[DI Double flanged pipe], plinth protection, **electrically actuated sluice valve**, Railing details with its MOC, sectional elevation of cage ladder& residual chlorine sensors .The ultra sonic level indiactor and residual chlorine sensors shall be provided with compatible to PLC SCADA automation, monitoring and control system .
- 1.9. Carrying out detailed structural design for the overhead service reservoirs in confirmatory to the technical specifications, including preparation of working / construction drawings.
- 1.9.1. Providing and installing flanged DI pipes of Class K-9 for inlet, outlet, overflow and SCOURpipes, and specials (Bends, Tees, Duck-foot bend etc, of Class PN-25) confirming to technical specifications.
- 1.9.2. Providing & fixing DI sluice valves (compatible for fixing Electrical actuators) to be provided at Inlet, Outlet & washout pipes and as required for providing By-pass arrangement at each location.
- 1.9.3. Providing and fixing of lightening arrestor.
- 1.9.4. Contractor has to construct a Guard room (fitted with door & window) underneath OHSR with minimum Slab area = 12 Sqm with suitable electrical fittings like Light, fan, switch board for 2 nos. Electrical Poles as specified in the bid document, 1 no, focus light shall also be provided outside guard room but inside OHT boundary limits.
- 1.9.5. The water reservoirs shall be tested for water tightness as per clause 12 of IS:3370-2009, Part-1. Same shall be acarried out in presence of the Engineer-in-Charge and recorded in the Stage Passing Register. Relevant portions of the IS clause are reproduced below for compliance.

Clause 12.1.1 The tank shall be filled with water and after the expiry seven days after the filling, the level of the surface of the water shall be recorded. The level of the water shall be recorded again at subsequent intervals 24 hours over a period of seven days. The total drop in surface level over a period of seven days shall be taken as an indication of the water-tightness of the tank. The actual permissible nature of this drop in the surface level shall be decided by taking into account whether the tank is open or closed and the corresponding effect it has on evaporation losses and/or on account of rainfall. However, Underground tanks whose top is covered may be deemed to be water-tight if the total drop in the surface level over a period of seven days does not exceed 20 mm.

In case of tanks whose external faces are exposed such as elevated tanks, the requirements of the tests shall be deemed to be satisfied if the external faces show no signs of leakage and remain apparently dry over the period of observation of seven days after allowing a seven-day period for absorption after filling.

Clause 12.1.2 [IS -3370-Part 1:2009] *If the structure does not satisfy the conditions of test, and the daily drop in water level is decreasing. The period of test may be extended for further seven days and if specified limit is then reached, the structure may be considered as satisfactory.*

Clause 12.1.3 [IS 3370 Part 1: 2009] *The roofs of liquid-retaining structures should be water-tight and should be tested on completion by flooding the roof with water to a minimum depth of 25 mm for 24 h or longer, if so specified. Where it is impracticable, because of roof slopes or otherwise, to contain a 25 mm depth of water, the roof should have continuous water applied by a hose or sprinkler system to provide a sheet flow of water over the entire area of the roof for not less than 6 h.*

In either case the roof should be considered satisfactory if no leaks or damp patches show on the soffit.

Should the structure not satisfy either of these tests then after the completion of the remedial work, it should be retested in accordance with this clause. The roof insulation and covering if any, should be completed as soon as possible after satisfactory testing.

- 1.9.6. During the Contract period, the contractor has to procure and install informatory board displacing Name of work (and specific details) at the location given by Nagar Panchayat at his own cost.

Providing necessary electric fittings for illumination at the suggestive location of the service reservoirs. Only LED bulbs of 30 W shall be provided for illumination purpose.

- 1.9.7. Disinfecting and cleaning the reservoir / tank before successful commissioning. Conduct necessary Water Tightness test for the service reservoir for successful commissioning of the system.

- 1.9.8. Mix Design for Concrete Works- in Mix Design, the proportions of the constituents (i.e., cement, coarse aggregates, fine aggregates, and water) shall be determined by weight. Concrete batching and mixing plant as per IS: 4925-2004. Water cement should be carried out as per design mix.

- 1.9.9. Preparation of GA, Structural & piping Design & drawings of the OHSR.

- 1.9.10. Contractor shall submit Concrete mix designs to Engineer-in Charge for approval as prepared by Govt Engg College /NIT Raipur CG, before commencing any work. The contractor shall get the Concrete Design Mix based on trial mixes of Concrete cubes made up of approved sand, coarse aggregate. This Concrete Design mix shall conform to IS-10262 (2009)-Concrete Mix Proportioning-Guidelines & clause 9.2 of IS-456 (2000) clearly specifying with complete details that Target Mean Compressive strength shall be achieved which is equal to Characteristic Compressive strength at 28 days (in N/mm^2) plus 1.65 times the standard Deviation (assumed as given in Table 8 of IS: 456 (2000)).

Acceptance Criteria of concrete cubes taken during construction:

Clause 16.0 "Acceptance Criteria of IS: 456 (2000) shall be meticulously followed as regards Concrete cubes casted during execution of RCC work at site.

Compressive strength: Mean strength determined from any group of four consecutive test results shall comply with col 2 table 11 of IS-456. And any individual result shall comply with col 3 of Table 11 of IS-456.

Flexural Strength: Mean strength determined from any group of four consecutive test results shall exceed the specified characteristic strength by at least 0.3 N/mm^2 . Strength determined from any test results shall not be less than the specified characteristic strength by less than 0.3 N/mm^2 .

- 1.9.11. To prepare "As Built" drawings, showing all details and submit the same for necessary approval after the completion of each reservoir as constructed. All codes and standards referred to in these Specifications shall be the latest revision thereof and codes which are not mentioned herewith but relevant to work shall be applicable.

1.10. Specific Requirements

The Bidder shall be responsible for design, supply and procurement, testing and commissioning and providing all materials, equipment and services, specified or otherwise which are required to meet the intent of this specification, ensuring high degree of

reliability and ease of operation and maintenance in future. The equipment and system / sub-systems shall conform in all aspects to high standards of engineering and workmanship and shall be capable of performing in continuous operation, in a manner acceptable to the Employer. All codes and standards referred to in these Specifications shall be the latest revision thereof and codes which are not mentioned herewith but relevant to work shall be applicable. The scope of work also includes, Design & construction of New OHT as per IS 456, IS 3370(part 1 & 4) and recent Earth Quake IS codes- IS 1893 (part 1 to 4) and IS 13920 if required. Contractor shall submit GA/Structural/plumbing drawings for approval of engineer. Construction of OHT shall as per approved construction drawings. Minimum freeboard of 300mm to be provided. Contractor to submit mix designs to engineer for approval.

The specifications for this work are as follows:

1.10.1. Cleaning of OHSR Site and making appropriate approach to OHSR Site

1.10.2. **Earth work**

- a. In all type of soils, boulders, ordinary rock, and hard rock (blasting prohibited) includes refilling and disposal of surplus earth as directed by engineer with all lead and lift, including dewatering by pumping or bailing out the water in watering condition, in foul condition or for any condition.
- b. In case Black cotton soil is encountered at site, the foundation of columns should be underlain with atleast 600 mm thick layer of sand.
The bed of foundation should be made firm by ramming it well, on rammed bed a 60 cm thick layer of sand should be spread in layers of 15 cm each. Each layers of either stone or sand should be provided to desired height before placing foundation concrete-bed block upon it.
Additionally, alround the mat foundation of columns & wall footing, a trench of 200 mm wide should be dug & soil replaced with sand.
Backfilling after casting of foundation should be carried out with sand only.
- c. In case BC soil extends deeper into the ground at site, the excavations shall be carried out until firm strata is reached to avoid of BC soil. The foundation shall be changed to raft foundation & revised structural drawing of foundation shall be prepared & submitted by the contractor's Structural Expert to PMC for approval.
- d. The Contractor shall proceed with caution in any excavation and shall use all means to determine the exact location of underground utilities / structures like water line, sewer lines, conduits and other utilities etc, in the immediate vicinity thereof prior to excavation. The Contractor shall be solely responsible for the cost of protections or repair or replacement of any structure, water line, sewer line, conduit etc, above or below ground which may be broken or otherwise damaged by these operations.
- e. Trial trench/ pits once excavated shall not be left unattended. Once the underground utilities are identified, the trench and pit shall be filled up and compacted to its original level. Any subsequent depression at this location due to vehicular movement shall have to be made good by the Contractor by filling additional borrowed earth. In any case, no inconvenience is to be caused to the vehicular and pedestrian traffic due to such trial trench excavation. Payment shall be made as per relevant items of the BOQ.
- f. The excess excavated material shall be carried away from the site of works as specified, failing which, in view of public convenience, the Engineer-in-charge may carry out the work by any other agency at the Contractor's risk and cost.
- g. The inspection and testing of all the bought-out items (Pipes, Valves, Flow-meters etc), both at factory and site shall be carried out in presence of the Employer/ Engineer-in-charge or his representative unless otherwise directed by the Engineer-in-charge.

1.10.3. Soil investigation

The Contractor shall carry out Soil Investigation work. The investigation results shall be used to establish the soil and parameters are to be adopted for the design of structures as per relevant IS codes:

- The soil investigation is necessary for finalization of the type of foundation of the structure and hence all necessary parameters like SBC, N-Value, Settlement, dry density, unit weight of soil, submerged unit weight of soil, water table, cohesion value, angle of internal friction etc. are required to be determined for design purpose.
- Soil sampling as per IS 1892-1979 disturbed and undisturbed soil samples.
- Soil classifications as per IS 1498
- In case of strip foundation, the bearing capacity/allowable bearing pressure calculation shall govern by IS 6403-1981, for shear calculation and IS 1904-1986 & IS 8009 (part-1) 1976 for consideration of settlement.
- Record of boring shall be done as per appendix D (clause 6.5.1) IS 1892.
- All the Soil Test Reports are to be submitted in a separate booklet containing details of soil characteristics, testing details and results, foundation design and recommendations.

- 1.10.4. All plain cement concrete work to be of minimum M15 grade. All reinforced cement concrete work for water retaining portion like slab, beam vertical wall, slant wall and columns, staircase, balcony shall be in minimum M30 grade. **RCC staircase** to be provided. Spiral Staircase shall not be allowed
- 1.10.5. All type of centring and shuttering of foundation, columns, beams, domes stair case, landings curved slabs etc complete in all respect.
- 1.10.6. Providing, supplying and fabricating of Thermo-Mechanically Treated (TMT-500) reinforcement bars of all sizes ISI Marked [duly approved by the Ministry of Steel] conforming to IS-1786 for all the components of overhead tanks.
- 1.10.7. No plaster work is required for the form finished surfaces of the RCC structures.
- 1.10.8. Ventilator shall be provided with fly-proof wiremesh all around in all respect, as per direction of Engineer in charge.
- 1.10.9. Painting 2 coats with approved shade of emulsion paint having five years warranty (I.S.I. marked) over primer all over the exposed R.C.C. surface of the overhead tank. Inside the tank 2 coats of cement wash will be provided.
- 1.10.10. Painting 2 coats with approved quality and shade of paint on G.I. pipe (used for railing) fitting & M.S. angle irons M.S. gate, M.S M.H cover, M.S ladder etc. over a primer coat of red oxide, shall be coated with two coats of approved black Japan Paint with arrow mark flow of water on pipes.
- 1.10.11. The rates should include supply laying, jointing and fixing of D.I (D/F) pipes class (**K-9**) & valves with valve chamber for inlet, outlet overflow and washout including the supply and fixing of the puddle collars, valves & duck foot bends on proper foundation other jointing material such as rubber packing, nuts bolts, various, clamps, T&P for fixing of pipes and valves on the approval of these material by Engineer in Charge including making of sluice valves chambers.
- 1.10.12. Required number and size of valves It should be fixed in ground with horizontal pipe with suitable size of valve chamber
- 1.10.13. A complete set of lightening arrestors with earthing
- 1.10.14. A Heavy duty SFRC **MH frames&cover – 2 Nos** conforming to **IS-12592 [2002]** and swan neck type ventilator shall have to be provided on **top slab of ESR.**
- 1.10.15. Cleaning of site from garbage or any other unwanted material at site.
- 1.10.16. Any special protection, if required, for foundation. Plinth protection at the finished ground level, with 100 mm thick cement concrete flooring in M-15 mix shall be provided for an area which is 5 metres more than the dimensions of tank on all sides.

- 1.10.17. **Disinfection:** The disinfection of OHT is to be completed before commissioning. Disinfection shall be done by a liquid chlorine solution/ bleaching powder. Disinfection shall be considered to have been achieved if a chlorine residual of not less than 10ppm is remaining in the water of OHT after standing for 24 hours. Once disinfection is achieved the OHT shall be flushed with clear water.
Contractor has to make arrangement at his own cost for procuring Liquid chlorine solution/ bleaching powder for disinfection of the Tank. Quantity/ Quality of Liquid chlorine solution/ bleaching powder shall be as per norms stipulated in CPHEEO manual
- 1.10.18. 1.2 m wide RCC Staircase on columns, with RCC landing from ground level to balcony and 0.75 m RCC stairs from **balcony to top slab** as per standard specifications along with three rows of 25 mm dia GI Pipe medium class railing on both sides supported with RCC post or 50x50x6mm M.S. angle iron post 1m high. The stair case will be closed by a M.S gate with jali as per the direction of Engineer-in-Charge at the ground level.
- 1.10.19. Balcony will be 1.2m wide having three rows of 25 mm dia. GI Pipe medium class railing supported with RCC posts or 50x50x6 mm M.S angle iron posts 1m. High at 2m. Interval along the periphery of the balcony and around the top dome.
- 1.10.20. Providing Steel ladder 600 wide consisting of 2 nos each 100 mm x 12 mm thick MS flat sections as stringer and 2 nos of bars of 25 mm of dia as steps @ 300 mm c/c/ spacing. The bars of 25 mm dia shall be inserted in to the flat section by drilling holes in the flat and the bars shall be welded with the flat from inside and outside. The ladder shall be finished at welded joints so that all sharp edges are removed. The ladder shall be painted with chlorine resistant epoxy paints
- 1.10.21. Cleaning and dressing of the site of OHSR as per direction of Engineer in Charge after constructions and testing of the tank, pipe and pipe fitting etc.
- 1.10.22. The tank shall be water tight. The testing of the tank will be done at the cost of the contractor. Water for filling, however, will be supplied to him free of cost, if available. The rate should include the cost of specials etc. complete.
- 1.10.23. The overflow pipe of the OHSR will be connected to outlet pipe after chamber below ground level.
- 1.10.24. The Over Head Tank shall be designed by the contractor and all drawings and specifications of all components shall be got approved by the contractor from the Engineer. This shall be a Lump Sum Contract comprising of Design and construction of Over Head Service Reservoir. The bidder shall have to make the arrangement for procurement/arrange all the material, tools and plants required for successful completion of work allotted. The main items of the material required shall be cement, bricks, sand, aggregate, steel, pipes, D.I. pipes, pipe fittings, valves, steel poles, cables, wires, light fixtures & fittings and other mechanical, electrical and civil related items for completion of the package. The contractor shall have to arrange standard quality material conforming to IS specifications and as per the requirement of bid document. The contractor shall arrange skilled and unskilled labour as and when required for completion of the work in stipulated time.
- 1.10.25. Plinth protection works around OHSRs-
Protection work all around the OHSR shall be provided. It shall be circular in shape and 5m in width around the outer edge of wall. It shall have 1:60 slope from center and a drain be constructed all around the tank. The protection work shall be in M-15 grade concrete.
The Specific requirement related to Construction of the new service reservoirs is outlined below:

1.11. Reservoir Type and Structural requirement

The Service Reservoir should be flat bottom circular in shape supported over circular columns. The difference of level between lowest supply and full supply level of the tank and shall not be greater than 5.0m.

The position of bottom of bracing shall be so fixed that the head room of ground floor if

constructed should be approximately 3.5m. The construction of such building works is not included in this lump sum contract except specified.

The tank will have a 1.2 m wide balcony all around the tank at bottom slab level. The RCC stairs of 1.2 m width from ground level to the balcony at bottom slab level should be provided. The width of the RCC stairs from balcony to roof of the tank shall be 0.70 m. Steel ladder from roof of the tank to floor of the tank, all pipes and fitting (including puddle collars) up to duck foot bends and from duck foot bend up to minimum 5.0 meters out-side the supporting structures.

There shall be suitable arrangement for routing the overflow pipe into the delivery pipe. All pipes (Inlet / Outlet / Wash-out / Overflow) shall be suitably clamped with GI flat hoops/supports.

To avoid any accident at the time of cleaning or maintenance of the tank, the opening of the outlet and wash-out pipes should be covered with aluminium mesh of suitable size. Suitable provision for flushing and disinfection of water tank shall be considered with the wash-out pipes. The wash-out pipes shall eventually allow easy passage for the water to drain out.

All proposed pipes, shall be Double flanged Ductile Iron (Class K-9) pipes, confirming to IS: 8329.

1.12. Arrangement of Valves

All the inlet outlet/wash-out pipes shall be provided with Butterfly/slucice valves for running operation including maintenance activities. All valves provided shall be compatible with actuators.

Pipes of diameter greater than 300mm shall be provided with butterfly valves, whereas pipes of diameter 300mm and less shall be provided with sluice valves. All Valves (Butterfly / Sluice) shall be provided with dismantling joints for ease of replacement. Unless specified otherwise, the pressure rating of the valves shall be 16 Kg/cm² (1.6 MPa).

All valves shall be suitably enclosed in valve chambers with suitable pre-cast RCC cover. Sluice valve d/s of OHSR shall be electrically actuated with provision of actuator.

1.13. Chambers

All valves, dismantling joints shall be protected within R.C.C chambers.

The foundation concrete shall be 1:3:6 (1 cement: 3 fine sands: 6 graded stone aggregate 40 mm nominal size) of minimum 150mm thickness and inside plastering with cement mortar 1:3 (1 cement:3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design.

The chambers shall be of adequate dimensions to allow ease of operation and maintenance. The Contractor shall submit drawings for valve chambers for approval of the Engineer-in-charge.

1.14. Ultrasonic Water Level indicator: -Ultrasonic water level indicator shall comprise of electronic sensor system for accurate level marking with mercury level and all allied fittings such as electronic display board & battery backup etc complete. These will be compatible to PLC SCADA automation, monitoring and control system.

1.15. Painting and Lettering: -The overhead service reservoirs from ground level and above shall be finished with 2 coats of emulsion paint. The colour and shade of the paint shall be got approved by the Engineer. The inside of the tank shall be painted with good grade epoxy paint, acceptable to the Engineer-in-charge.

The name, location and capacity of each of the service reservoirs constructed shall be clearly written on the tank portion of the reservoirs.

The letters and figures shall be to the heights and width as ordered by the Engineer. These shall be stenciled or drawn in pencil and got approved before painting. They shall be of uniform size and finished neatly. The edges shall be straight or in pleasant smooth curves. The thickness of the lettering shall be as approved by the Engineer. Lettering shall be vertical or slanting as required. Two or more coats of paint shall be applied till uniform colour and glossy finish are obtained.

Black Japan paint (conforming to IS: 341) or ready mixed paint as ordered by the Engineer shall be used. The paint shall be of approved brand and manufacture. Ordinary ready mixed paint shall be of the shade required by the Engineer.

- 1.16. **Lightening Arrestor:** -All service reservoirs shall have provision for Lightening Arrestor. The arrangement shall comprise of providing and fixing in position on top of dome of OHSR lightning arrester with copper bar of 25 mm diameter and 2 m long connected to earthing below ground by GI strip (25mm x 6mm). The strip shall be connected to two earthing pits 6m to 8 m apart each earthing pit shall consist of an inspection chamber and watering chamber (500 X 500 X 800) mm with 250 mm thick brickwork (1:4), plastered with 15 mm thick Cement plaster (1:4), with a 40 mm dia GI pipe connected at base to a copper plate (600mm x 600mm x 6mm). The pits will be at least 3 m deep, bottom 2m filled alternately with salt and charcoal and the GI pipe fitted with funnels with wire gauge all as per approved drawing (As submitted by the Contractor and approved by the Engineer-in-charge), technical specification and direction of the Engineer-in-charge.

1.17. **Illumination and Electrical Works for Service Reservoirs**

Electrical illumination for the Service Reservoirs should include:

- Internal lighting system by providing 2 bulk head fixtures with **LED lamp** with all necessary wirings (copper wire in PVC conduit), sheet steel switchboard with hylam sheet cover with piano switches and sheet steel enclosed wall mounted MCB-DB with miniature circuit breakers. Single Phase supply at 240 V shall be made available by Employer at each reservoir site.
- External Lighting system with 2 Nos., MS steel tubular poles of 9m height mounted with **LED lamp**, 100 Watt each with complete fittings and fixtures.

The specific requirements for Electrical works are as follows:

- **Lighting poles:** Lighting poles shall be 9m long swaged steel tubular poles complete with red oxide primer and finished aluminium paint, complete with sheet steel loop-in loop-out box, street bracket, foundation for pole and lighting fixture.
- **Light Fixtures:** For area lighting street light fixture with single piece dia cast aluminium housing, POT optics reflector and heat resistant toughened glass cover with HPSV lamp shall be provided on steel tubular poles. For internal lightning in OHT bulk head fixture with toughened glass cover, wire guard and LED lamp shall be provided.
- **Cables:** Cables for external illumination shall be PVC insulated, PVC sheathed, armoured copper conductor cable. Cables trenches including excavation, backfilling with sand and brick protection as per standard practice shall be provided as required.

For internal illumination system PVC Insulated, stranded, copper conductor wire shall be laid in surface / concealed PVC conduit.

Cables shall conform to IS: 1554. Cables shall be capable of satisfactory performance when laid on conduits and buried undergrounds. Cables shall be capable of operating satisfactory under a power supply system voltage variation of +/- 15%, a frequency variation +/- 5% and a combined voltage and frequency variation of +/-15%.

Sl. No	Descriptions	Particulars
1	Rated Voltages, phases and frequency	230 V 1 ph 50 Hz
2	Color finish shade as per IS: 5	

Sl. No	Descriptions	Particulars
a)	Interior	Glossy White
b)	Exterior	Light Grey, Semi-glossy, shade 631 of IS: 5
3	Type of Mounting	Wall Mounted
4	Cable and conduit entry	Top & Bottom

1.18. Design Requirements

1.18.1. Employer's Requirements for Design works

The Bidder must fulfil the following requirements during contract execution stage:

Design for the service reservoir shall be got done from approved Government institute or as mentioned above in Instructions to bidders, acceptable to the Engineer-in-charge.

For each part of the Works, the prior consent of the Employer's Representative shall be obtained as regards the modalities of the design by the designer. However, nothing contained in the Contract shall create any contractual relationship or professional obligations between any designer or a design sub-contractor and the Employer. The Contractor shall carry out and be responsible for the design of the Works.

The Contractor holds himself, his designers and design sub-contractors as having the experience and capability necessary for the design.

The Contractor undertakes that the designers shall be available to attend discussions with the Employer's Representative at all reasonable times during the Contract Period.

The Design Requirements for the proposed service reservoirs shall be as stated below:

1.18.2. Load Combination and Stress: -

The different load combinations shall be taken as per IS: 875 (Part-V) and other relevant IS Codes.

1.18.2.1. **Dead Loads:** Dead loads shall include the weight of structure complete with finishes, fixtures and partitions and shall be taken as per IS: 875 (Part-I).

1.18.2.2. **Imposed Loads:** Imposed loads in different areas shall include live, erection, operation and maintenance loads. Equipment loads (which constitute all loads of equipment to be supported on the building frame) are not included in the imposed loads furnished below and shall be considered in addition to imposed loads. For consideration of imposed loads on structures, IS: 875 (Part – II) "Code of practice for design loads (other than earthquake) for buildings and structures" shall be followed. The following minimum imposed loads as indicated for some of the important areas shall however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered.

1.18.2.3. **Seismic load:** For design of all structures the seismic loads shall be considered and structure designed as per the provisions of IS-1893 (latest draft code) and detailing of reinforcement shall be done as per the provisions of IS-13920 (latest). The various design parameters, as defined in IS: 1893 (Part 1), to be adopted for the project site shall be as follows:

- Zone-II (As per IS)
- Zone factor = As per table given in IS:1893 (Part 1)
- Importance factor = 1.5
- Response reduction factor = 3.0

- e) Average response acceleration co-efficient as per site condition and building configuration

1.18.2.4. **Temperature Load:** For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The structure shall be designed to withstand stresses due to 50% of the total temperature variation. Suitable expansion joints shall be provided in the longitudinal direction whenever necessary with provision of twin columns. The maximum distance of expansion joint shall be as per provision of IS: 800 and IS: 456-2000 for steel and concrete structure respectively.

1.18.2.5. **Individual members Load:** Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion, etc.

Earth Pressure Co-efficient: Earth pressure for all structures shall be calculated using coefficient of earth pressure at rest, coefficient of active or passive earth pressure whichever is applicable depending upon the structural configuration.

1.18.3. Codal Provision

Tank Proper shall be designed as per:

- a) IS: 3370 Part I, II& IV
- b) IS:1 893 Criteria for EQ. resistant Structure, Zone II
- c) IS: 13920 Ductile detailing of RCC Structures
- d) Concrete Grade M-30 (Minimum)

Supporting Structure

- a) IS: 456 Plain and reinforced concrete code of Foundation practice
- b) IS: 11682 Criteria for design of RCC staging
- c) As per relevant BIS Code for type of foundation proposed
- d) Concrete grade M-30

Dispersion of Load in any direction through soil shall be as per IS: 8009. Dispersion of load through concrete shall be considered at an angle of 45 degree with horizontal from the edge of contact area.

The design and construction of RCC structures shall be carried out as per IS: 456 – 2000. Though limit state method shall be adopted for structural design of all components of the structure, working stress method shall be adopted for the design of water retaining structure.

For reinforcement detailing, IS: 5525 and SP: 34 shall be followed.

The responsibility for the designs, constructions structural stability shall however rest solely with the contractor and he shall have to make good any damage or loss to the Government due to defects if any in the above mentioned or any other work carried out by him. The contractor shall submit four sets of working drawings immediately after approval of the designs and drawings.

1.19. Construction Requirements

1.19.1. Construction Methodology

The Contractor along with designs shall submit the construction methodology to be adopted for the construction of the reservoirs. From all major concrete works for the reservoirs, concrete shall be brought from Batching Plant / Ready mix concrete. Concrete shall be brought to site in transit truck mixers.

Concrete pouring shall be carried out by either discharging the concrete through concrete pumps of

adequate capacity or lifted through diesel powered winch's / lift hoist of suitable capacity. Manual pouring of concrete shall not be permitted. However, for minor concreting works, manual pouring of concrete may be permitted with specific approval of the Engineer-in-charge.

1.19.2. Formwork and Staging

1.19.2.1. Steel formwork

Steel shuttering shall only be permitted. Steel formwork used for concreting should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing; seepage of slurry through joints etc. Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the Engineer shall be provided in the joints.

Form work shall be properly designed for self-weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). The formwork shall be robust and strong and the joints shall be leak-proof.

1.19.2.2. Staging

Balli shall not be used as staging. Staging must have cross bracings and diagonal bracings in both directions. Staging shall be provided with an appropriately designed base plate resting on firm (consolidated) strata.

All propping and centering should be either of steel tubes with extension pieces or built-up sections of rolled steel.

1.19.3. Testing for Water Tightness

All the reservoirs / tanks shall be tested for water tightness as per provisions of IS: 3370 and IS: 6494. In the rare event of the failure to pass the Water Tightness test successfully, the Contractor shall be responsible for ensuring water tightness by adopting requisite measures and no payment shall be made for such additional expenses.

The tank portion of the service reservoirs shall be tested for water tightness at full supply level as per procedure as described in IS: 3370 for Water tightness. In the case of tanks whose external faces are exposed such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no signs of leakage and remain apparently dry over the period of observation of seven days after allowing a seven-day period for absorption after filling.

In the case of tanks whose external faces are submerged and are not accessible for inspection, such as underground tanks, the tanks shall be filled with water and after the expiry of seven days after the filling; the level of the surface of the water shall be recorded. The level of the water shall be recorded again at subsequent intervals of 24 hours over a period of seven days. The total drop in surface level over a period of seven days shall be taken as an indication of the water tightness of the tank. The Engineer-in-charge shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the tanks are open or closed and the corresponding effect it has on evaporation losses. For many purposes, however, underground tanks whose top is covered may be deemed to be water-tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

If the structure does not satisfy the conditions of test, and the daily drop in water level is decreasing, the period of test may be extended for a further seven days and if specified limit is then reached, the structure may be considered as satisfactory.

The water container of OHSRs shall be provided with Epoxy based water proofing treatment by an approved Water Proofing Specialist firm/manufacturer.

In the rare event that the water retaining structure fails to pass the water tightness test satisfactorily, the Contractor will have to provide a comprehensive plan to identify the leakage areas and plug it by sealing cracks and joints, corners by injecting epoxy-based compound through guniting shall demonstrate the water tightness test successfully. The entire exercise shall be got done by the

Contractor at no extra cost.

The Contractor shall provide for the hydraulic test by making his own arrangements for water filling and disposal of water after the test and shall repeat this test, if necessary, until the requisite test results are obtained without any claim for extra cost or compensation. The tendered rates for hydraulic structures shall include all costs incurred by the Contractor for water tightness test.

10% of the amount reserved for each Civil (Water Retaining) Structure shall be retained for failure to comply with water tightness test.

1.19.4. Applicable Standards and Codes: -

Wherever reference is made in the Contract to specific standards and codes to be met by the materials and other supplies to be furnished, and work performed or tested, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to the date of bid submission shall apply, unless otherwise expressly stated in the Contract.

Where such standards and codes are national, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be accepted subject to the Engineers prior review and written approval.

Differences between the standards specified (In the contract / codes) and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineers approval. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the contract documents (or relevant codes as mentioned in the contract documents and or as decided by the Engineer).

1.19.5. Artistic painting of the complete OHSR Structure:

1.19.5.1. **Specifications:** Artistic painting work as per selected theme by engineer-in-charge in exterior wall at all height with providing and applying 2 mm thick ready mix exterior grade on walls to make the surface smooth and even with artistic painting with applying higher grade exterior emulsion paint of required shade with two or more coats applied @ 3.28ltr per 10 sqm over and including priming coat of exterior and decorative finish including cleaning washing of surface etc. complete for the work. The rate is inclusive of 3 years of maintenance of painting and it should be properly restored in case any damages occurred during the maintenance period it should be repaired with no extra cost to the department.

1.19.6. 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.

- i. **Quality Control and Tests: -** The Engineer-in-charge or his representatives shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, or by his Testing and Quality Control Units or by any other agency deemed fit by him) generally as per the requirements (outlined in the QA / QC manual). Additional tests may also be conducted where, in the opinion of the Engineer-in-charge, need for such test exists. In the absence of clear indications and frequency of tests for any item in the above-mentioned publication, procedures and tests as directed by the Engineer-in-charge shall be followed. The Contractor shall provide necessary cooperation and assistance in 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.

- ii. **Quality Assurance Plan:-**The Contractor shall provide Quality Assurance Plan adhered by the manufacturing units for production of items like Pipes, Specials, Valves, electrical equipments like motors, pumps, Actuators, VCB, ACB, MCCB, Transformer, PDMCC panels, PH, Turbidity meters, EMF meters, SCADA panels, residual chlorine sensor, ultrasonic level indicator to compatible to PLC SCADA system, etc as required prior to the procurement. If required Engineer-in-Charge may inspect through self (or designated representative or Third-Party Inspection agency all manufactured items at the vendor's workshop / factory at Contractors's cost. After delivery of materials, the same should be visually inspected at site. The Contractor shall supply samples of the material / units, for testing as per the frequency and number of tests specified in the Quality Control Manual and get it tested by independent agency.
 - iii. **Unacceptable Works:** -All defective/ deficient Works are liable to be demolished, rebuilt, and defective materials replaced by the Contractor at his own cost. In the event of such Works being accepted by carrying out repairs etc. as specified by the Engineer-in-charge, the cost of repairs will be borne by the Contractor. Defective / deficient works shall also imply non-confirmation to quality standards and mandatory tests that shall guarantee successful completion. No payment shall be made for rectification / repairs done on account of deficient in quality of materials or service.
- 1.19.7. **Rates of items of works:** -In the absence of any directions to the contrary, the rates are to be considered as full inclusive rate for finished works covering all labour, materials, wastage, transportation, temporary work, plant, equipment, testing, overhead charges and profit as well as the general liabilities, obligations, insurance and risks. The rates quoted by the contractor shall, unless otherwise specified, also include compliance the activities stated below:
- i. General works such as survey and setting out, clearance of site before setting out and clearance of works after completion; carrying out soil investigation works, condition assessment reports etc.
 - ii. Preparation and submission of detailed Work Program for the construction and completion of the works (using CPM/PERT techniques) giving, in addition to construction activities, detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/equipment and their installation and testing, and for all activities of the Employer that are likely to affect the progress of work, etc., including updating of all such activities on the basis of the decisions taken at the periodic site review meetings or as directed by the Engineer-in-charge.
 - iii. Tests to ensure that the material for construction are as per the relevant provisions contained in the Specifications including carrying out necessary test at Works on samples of various materials as proposed to be used on the Work and conducting tests thereon as required as per the provisions of the Contract and or as per codal provisions.
 - iv. Design of mixes as per the relevant Clauses of the Specifications giving proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant clauses of the Specification to be submitted to the Engineer-in-charge for his approval before use on the Works.
 - v. Testing of various finished items and materials including cement, concrete, bearings as required under these Specifications and furnishing test reports/certificates.

- vi. Cost of in-built provisions for Quality Control and Quality Assurance activities including of safeguarding/protection of the environment, as required from time to time.
 - vii. Cost of Designs, Documents, drawings including necessary as-built drawings and other submittals as required under the specifications. Cost for procurement for necessary software (like Auto-CAD) required for preparation / updating the water supply network drawings, including finalisation of as-built drawings shall be considered to be included within quoted rates.
 - viii. Cost incurred on Traffic management plan, including diversion works, accommodation of traffic, including erecting barricading, caution signs, project sign boards, and safety tapes to ensure protection at site.
 - ix. Cost of all taxes, duties and royalties, site commissioning and all incidental costs.
 - x. Cost of all operations like storing, erection, moving into final position, etc. necessary to complete and protect the work till handing over to the Employer; and
 - xi. Cost for storage of tools, plants and equipment's including office operations, as required from time to time.
 - xii. Any other data which may be required as per these Specifications or the conditions of Contract or any other annexes/schedules forming part of the contract;
 - xiii. Any other items of works which is not specifically provided in the technical specifications/Payment Schedule/Drawings etc, but which is necessary for complying with the provisions of the Contract.
- 1.19.8. **General requirements for Building Works:** -Unless otherwise specified, all the building works shall generally comply with the following Employer's Requirements:
- i. All buildings shall have reinforced concrete framework.
 - ii. 75 mm thick RCC Damp Proofing Course in M15 shall be provided to all building walls.
 - iii. Anti-termite treatment as per IS: 6313 part-III – 1971 with injection of chloropyriousemulsifiable concrete (1%) timber care ground treatment chemically emulsion 1:3 and creating a chemical barrier under and around the column pits, wall trenches, basement excavation, top surface of plinth filling, junction of wall and floor along the external perimeter of building, expansion joints, surrounding of pipes and conduits etc.
 - iv. All external walls shall be in 230 mm thick brick masonry built in cement mortar in (1:4). Transoms and mullions shall be of 115 mm x 230 mm size of cement concrete in M15 with four numbers 6 mm bars and 6 mm links at 150 mm c/c shall be provided to form panels not exceeding 3500 mm x 3500 mm in size.
 - v. All internal partition walls except for toilets shall be in 230 mm thick brick masonry built in cement mortar 1:4 with transoms and mullions as stated above. Toilet partition walls shall be in 115 mm thick brick masonry built in cement mortar 1:4 and shall have transoms and mullions as stated above to form panels not exceeding 1200 mm x 1200 mm size.
 - vi. All internal masonry surfaces shall be finished with 12 mm thick smooth faced cement plaster in cement mortar (1:4).
 - vii. All external masonry surfaces shall be plastered in two coats with sand faced cement plaster in cement mortar (1:4) and shall have total thickness of 20 mm. Waterproofing compound of approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.
 - viii. Bathroom/ W.C. floor slab shall be sunk and filled with brickbat coba (broken bricks set in lime) and provided with waterproofing as per the specifications of an approved specialist waterproofing company. The finished floor level in Bathroom / W.C. areas shall be normally 12 mm below the finished floor level on the outer side.
 - ix. The toilet facilities shall include at least:

- 1 No. Water closet with white wall hung seat minimum 580 mm long with PVC flushing cistern of 10 liters capacity.
- 1 No. Urinal of sizes 600 mm x 400 mm x 300 mm flat back type in white porcelain separated by a kota stone partition of size 680 mm x 300 mm shall be provided outside toilet.
- 1 No. Wash basin of size 510 mm x 400 mm in white Porcelain with inlet, outlet with bottle trap.
- 1 No. Mirror of size 400 mm x 600 mm PVC moulding wall mounted type fitted over washbasins.
- 1 No. Soap dispenser
- 1 No. Chromium plated brass towel rails minimum 750 mm long.
- All stopcocks, valves and pillar cocks shall be of chromium-plated brass, heavy duty.
- All fittings such as 'P' or 'S' traps, floor traps, pipes, down-take pipes etc.
- The sewage from toilet blocks shall be led to a septic tank with soak pit. The Contractor, at a suitable location, shall provide a septic tank having appropriate capacity, as per specifications.
- Size of Septic Tank for 05 users conforming to IS-2470-Part-1[1985] is as follows:

<u>Length</u>	<u>Breadth</u>	<u>Liquid Depth</u>
[for 2 years cleaning period]		
1.5 m	0.75 m	1.05 m

Soakage pit will have to be provided for secondary treatment of sewage.

x. **Septic tank:** -Free-Board - A minimum free board of 300 mm should be provided.

xi. **Commissioning of Septic Tank:** - The tank should be filled with water to its outlet level before the sewerage is let into the tank. It should, preferably, be seeded with small quantities of well digested sludge obtained from septic tanks or sludge digestion tanks.

In absence of digested sludge, a small quantity of decaying organic matter, such as digested cow dung may be introduced.

- (i) For roofing drainage, cast iron rainwater down-takes with khurra and door bend with C.I. grating at top shall be provided. For roof areas up to 40 sqm minimum two nos. 100 mm diameter down-take pipes shall be provided. For every additional area of 40 sqm or part thereof, at least one no. 100 mm dia. down take pipe shall be provided. The RW pipes shall be concealed.
- (ii) Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rainwater.
- (iii) Building plinth shall be minimum 450 mm above average finished ground level around building and shall not be less than plinth level of existing buildings.
- (iv) All buildings shall have a minimum 1.0 m wide, 100 mm thick plinth protection paving in M15 grade concrete finished with stone slabs/ tiles. All plinth protection shall be supported on well-compacted stratum.
- (v) All concrete channels and ducts used for conveying liquid shall have smooth finish from inside. The width of concrete channels shall not be less than 500 mm. All open channels shall be provided with Stainless Steel (SS 304) hand railings.

- (vi) Kerbs to be provided below the hand railing on the catwalks/pathways should be as per relevant sections of the Factory Act.
- (vii) Glass shall be minimum 5 mm thick, pin headed or opaque.
- xii. **Plinth level of Buildings:** -The average plinth level of all the buildings within the OHSR shall be 0.6m above the natural ground level.
- xiii. **Brick masonry:** -Brick work shall be done in C.M. 1:4 richer mix in masonry shall be done only if the structural design requires so and with prior approval of the Engineer-in-charge. The width of all walls done with brick-masonry shall be minimum 250mm for all buildings.
- xiv. **Flooring:** -The flooring of Gurad Room, sanitary block shall be of vitrified tiles. Rest of the floors in building shall also be done with 30 mm thick kota stone.
- xv. **Plastering:** The brick masonry walls of building should be plastered with 1:3 cement mortar. The thickness of plaster from outer face of wall should be 20 mm and on inner face the thickness of plaster should be 13 mm. In chlorine room, sump well and wash water tank, due consideration shall be given to provide protective measures in R.C.C. work plastering etc. to prevent the corrosive effect of chlorine.
- xvi. **Doors and windows:** -The opening area (doors/windows/ventilators) shall be 30%.
- xvii. **Painting and colour wash:** -Doors and windows shall be painted inside and outside in two coats after priming coat as per the directions of the Engineer-in-charge. The wall shall be provided with **two coats of approved quality emulsion paint with 05 years guarantee** of painting on the outside as per the direction of the Engineer-in-charge.
- xviii. **Roofing:** The roof shall be casted in R.C.C. M-25 mix with 20 mm gauge graded metal as per thickness and reinforcement, details to be shown in the drawings and designs. All roofs and civil structures would be guaranteed for leakages as per relevant I.S.S. suitable treatment for water proofing shall be provided for roof slab
- 1.19.9. **Access Openings and Cover** - Each compartment of a septic tank shall be provided with at angular access opening measuring not less 455 X 610 mm or a circular opening 500 mm diameter. The cover to access openings shall be of reinforced concrete or of cast iron. A cover shall incorporate a suitable lifting device and when in place after installation of the septic tank shall fit neatly and be sealed to prevent the ingress of water.

The floor may be of cement concrete of minimum M 20 grade and a minimum slope of 1:10 may be provided towards the sludge outlet to facilitate desludging.

Walls built out of brick should not be less than 200 mm thick and should be plastered to a minimum thickness of 12 mm inside and outside with cement mortar not weaker than 1: 3; where they are built out of the stone masonry. They should have a minimum thickness of 370 mm Sludgewithdrawal: Half yearly or yearly desludging of septic tank is desirable. Small domestic tanks, for economic reasons, may be cleaned at least once in 2 years provided the tank is not overloaded due to use by more than the number for which it is designed.

1.19.10. Miscellaneous requirements: -

All followings also deemed to be included in lump Sum offer

- i. Roads and pathways-
- ii. Wastewater conveyance & disposal

The foul drainage system shall accept discharge from toilets, washrooms, offices and the laboratory. The foul drainage system shall discharge to a septic tank of appropriate capacity and the supernatant shall discharge into a soak pit.

1.19.11. Safety requirements at site

The Contractor shall be responsible for safety of his staff on Site during the execution and O&M

period.

The Contractor's duties with respect to Safety shall include the following:

1. Utilize safety awareness procedures in every element of Operation and Maintenance.
2. Give emphasis to site safety including:
 - a) Safe working procedures.
 - b) Cleanliness and care of site as a whole.
 - c) Accident and hazardous conditions reporting.
 - d) Organise Safety discussion meeting with all the personnel weekly.

Formal discussions on safety shall be held with all concerned agencies at least once a month.

The Contractor shall provide Notice Boards/ Display Boards at appropriate location detailing precautions to be taken by Operation and Maintenance personnel in work in conformity to regulation and procedures.

The Contractor shall notify the EIC immediately, if any accident occurs, whether on-site or off-site in which the Contractor is directly involved which results in any injury to any person, whether directly concerned with the Site or a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

The contractor shall have to provide and maintain a suitable First Aid Box at the office. The first aid box shall be equipped but not limited to, with following medicine and first aid materials:

- a) Different sizes of sterilized dressings
- b) Sterilized dressing for burns
- c) 30ml bottle containing 2% alcoholic solution of iodine
- d) 30gm bottle of potassium permanganate crystal
- e) Scissors
- f) Boric cotton
- g) Ointment of burns
- h) A bottle of suitable surgical antiseptic solution

1.19.12. Maintaining Utility Services during Construction

i. General

Services like water pipes, sewers, cables owned by Public Undertakings, and Local Authorities included in the Contract Documents shall be verified by the Contractor for the accuracy of the information prior to the commencement of any work.

If any government, publicly and privately-owned service for drinking water, electricity, drainage, irrigation channels, sewers, telecommunication cables/lines and other services and structures, passing through the site is affected by the works, the Contractor shall provide a satisfactory alternative service in full working order to the satisfaction of the owner of the services and of the Engineer before terminating the existing service.

The Contractor must also allow for shifting of these services and alternations upon the works and for arranging regular meetings with the various bodies at the commencement of the contract and throughout the period of the works in order to maintain the required co-ordination.

Any services affected by the works shall be restored immediately by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the works.

The Contractor may be required to carry out the permanent removal or shifting or diversion of certain services/utilities on specific orders from the Engineer for which payment shall be made to him. Such works shall be taken up by the Contractor only after obtaining clearance from the Engineer and ensuring adequate safety measures.

ii. Temporary Support

Any services affected by the Works must be temporarily supported by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the Works.

The Contractor may be required to carry out certain Works for and on behalf of the various bodies and he shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorised by the Engineer.

1.19.13. General Requirements

All flanges of DI fittings shall be of PN-25. DI fittings shall be manufactured and tested in accordance with IS: 9523 and shall include the following types of specials:

- Flanged socket / spigot
- Double socket bends (90°, 45°, 22½°, 11¼°)
- double socket branch flanged tee
- All socket tees
- Double socket taper
- All Flanged Tee
- Flanged Socket and Spigot
- Mechanical collar joint
- Duck foot bend

1.19.14. Butterfly Valves: -

- i. **Scope:** -The scope covers manufacture, supply, and installation of Butterfly valves confirming to IS: 13095/ BS: 5155/ DIN: 3354/ AWWA-C-504, suitable for bi-directional flow. The flanges and their dimensions of drilling shall be in accordance with IS: 1538 (part-I to XXII). Valves shall have a nominal pressure rating PN 10 unless otherwise specified.
- ii. **General Requirements:** -The valves will operate smoothly and steadily in both the direction, free from flow induced vibration. The valves will be provided with light shut-off closures suitable for frequent operation. The valve disc will rotate 90° from full open to full close and is suitable for throttling duty also. The valves will be of double flanged ends and the body will be provided with lifting lugs. The valve disc will be of solid streamlined slab design with no ribs. The seat ring will be replaceable type and will be bolted on the body. The rubber seal on the disc will be easily replaceable type to facilitate removal at site. The seat design shall be of non-jamming and self-cleaning type. The valves shall be manufactured with integral body seats, suitable for open-closed and throttling service. Each valve shall be capable of withstanding the rated pressure from either side.

The valves, where specified shall be electrically (motor) operated. Valves on pump discharge piping and transmission mains shall be furnished with extension spindles. The extension

spindle shall be furnished with a universal coupling and intermediate supports. Electric actuators mounted shall be mounted on floor stands at floor level. Butterfly valves with motor operators shall be mounted with the valve stem facing horizontally.

Butterfly Valves to be installed on mains shall be of the metal seated type generally as per BS EN 593. Butterfly Valves to be installed in the discharge piping of pumps shall have seat of elastomer (EPDM rubber) seats as per IS 1309 and AWWA C504 (Resilient Seated Butterfly Valves). Valves shall be suitable for mounting in any position. The valve seat shall be of integrally cast and of replaceable design. When the valve is fully closed, the seal shall seat firmly. The seat surfaces shall be machined smooth to provide a long life for the seal. All fasteners shall be set flush so as to offer the least possible resistance to the flow through the valve. All valves shall be suitable for throttling purpose. All valve spindles and hand wheels shall be positioned to give good access for operational personnel. Valve of diameter 400 mm and above shall be provided with an enclosed gear arrangement for ease of operation. The gearing shall be such that the valve can be opened and closed by one man against an unbalanced head of 1.15 times the specified rating. Valve and gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 80 N. All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

iii. Material of construction

The material for different components parts of valve shall conform to requirements as given below:

Sl. No.	Component	Material Composition
1	Body, Disc, Thrust plate	Body--Ductile Iron (Body – DI (EN-JS-1030 GGG-50) Disc-- SS: IS 3444(1987)
2	Shaft	Stainless Steel SS, ASTM A276 Type 410 IS 6603 Seat Ring/Seat retaining-- SS, ASTM A276 Type 304 SI: 6603 Bearing: SS, banked PTFE
3	Body Seat Integral	Micro finished Chromium Steel plated / Nickel weld overlay
4	Shaft Bearing Bushes	Phosphor Bronze
5	Disc seal, O Ring	EPDM rubber
6	Internal Fasteners	Stainless Steel AISI 304 External Bolt, Nuts---- Carbon Steel IS: 1363-1967 Internal fastening, SS135:970Gr 304 Electrically operated of IS 13095 Auxiliary hand wheel to be provided for manual operation clause 16.1 of IS 13095 Gear box shall conform to the provisions of AWWA C504.

iv. Gearboxes for Butterfly Valves

Gearboxes shall be of the self-locking type, with a continuous indicator. Traveling nut and screw type of gearboxes shall not be acceptable

Each gearbox must conform to the provisions of AWWA C504. 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. Operating torque must be as per requirements given in AWWA C504.

The operator shall be of worm and worm wheel design, self-locking type with or without an additional spur gear arrangement to ensure that the effort on the 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 a needle roller bearing to take 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 idleness and there shall be no ingress of rainwater. Operator for valves, which are likely to be submerged in water for any period of time, shall be watertight.

Valves for exposed service or in vaults shall be equipped with a hand wheel. The hand wheel may be provided with an 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 shall ensure clockwise closing and this shall be indicated on the housing. A mechanical indicator is to be provided to show disc position and end of travel.

v. Coating

Valves shall be coated (inside and outside) with (food grade) epoxy powder of minimum Dry Film Thickness of 250micron.

vi. Marking, Testing and Inspection

The following information shall be cast on each valve body:

- Manufacturers' Name or trade mark
- Nominal pressure of valve
- Size of Valve
- Year of manufacture
- Serial number in punch on top of flanges

Valves shall be tested for Hydro-static test and flaw detection test in accordance with IS: 14846. Inspection shall be carried out at manufacturer's works to test the valves, as per requirement.

The design, construction material, manufacture, inspection, performance and testing shall comply with all applicable Standards and Codes. Nothing in the specification will be construed to relieve the supplier of this responsibility regarding performance of the valves during the contract period.

1.19.15. Sluice Valves

- i. **Scope:** -This section covers the requirements for Sluice valve shall be as per IS: 14846 and their latest revision, compatible for buried applications. The pressure rating of the valve shall be as per the specific standard followed taking into account the operating pressure. Wherever specifically mentioned, the valve shall be fitted with extended spindle, head stock along with hand wheel for easy operation from the operating platform. There will be no play in the 'XX' and 'YY' axes of the valve gate within the guide channel of the valve. The valves above and including 400 DN shall be provided with spur/ bevel gear arrangement for ease in operation and be fitted with by-pass arrangement. Valves shall have two positions marked at the closed end of the scale. The first position corresponding to the position of the gate tangential to the bore of the seating and the second position below the first, corresponding to the position of the gate as it sits on the seat after moving a further distance equal to the depth of the seating. The gate face rings shall be securely pegged over the full circumference of the valve. Valves shall be equipped

with electrical (motor) actuators, if so specified or shown on the drawings. Valves in buried service or in vaults shall be furnished with extension spindles. Each extension spindle shall be furnished with a universal coupling and intermediate supports. The following codes are applicable for Sluice valves.

Codes	Description
IS: 14846	Sluice valve for water works purposes
IS: 2906	Specifications for sluice valves for water works purposes

- ii. **Nominal Pressure and Dimensions:** The dimension and mass of the sluice valves shall be in accordance with IS: 14846. The flanges and their dimensions of drilling shall be in accordance with IS: 1538 (part-I to XXII).

iii. **Material of Construction**

The material for different components parts of sluice valve shall conform to requirements as given below:

Sl. No.	Component	Material
1.	Body, bonnet, Wedge, Gland, hand Wheel	Ductile Iron
2.	Seat Ring/ Wedge Seat Ring	SS: AISI: 304
3.	Spindle / Stem	SS: AISI:410
4.	Stem nut	Stainless steel, IS-6603.
5.	Bonnet Gasket	EPDM rubber (Approved for drinking water)
6.	Internal fasteners, Bolts, Nuts	Carbon Steel IS: 1363-1967
7.	Wedge nuts	Aluminium Bronze.
8.	Packing	Carbon Steel IS: 1363-1967
9.	Gasket	Rubber: IS:638-1979, Type-B
10.	Hand Wheel	CI, IS: 210.
11.	Gland Packing	Rubber, IS-638.
12.	Gear	Spheroidal graphite iron, IS-1865, Grade 500.
13.	Gear Housing	CI, IS-210, FG 200.
14.	Pinion Shaft	SS 420
15.	Power drive etc.	Power drive [Electric] as per clause A-1.1.7 of IS-14846[2000] ---Gearing arrangement—as per clause A-1.1.2 of IS-14846[2000].

The valves should be with replaceable stem nut and replaceable sliding shoes. Valve stems shall be of single piece thread rolled. Valve shall have 3 “O” rings of NBR for stem sealing.

iv. **Coating**

Valves shall be coated (inside and outside) with (food grade) epoxy powder of minimum Dry Film Thickness of 250micron.

v. **Marking, Testing and Inspection**

The following information shall be cast on each valve body:

- Manufacturers' Name or trade mark
- Nominal pressure of valve (PN 1.6)

- Size of Valve
- Year of manufacture
- Serial number in punch on top of flanges

Valves shall be tested for Seat leakage test, Body hydrostatic test, Valve operation and flaw detection test in accordance with IS: 14846. Inspection shall be carried out at manufacturer's works to test the valves, as per requirement.

The design, construction material, manufacture, inspection, performance and testing shall comply with all applicable Standards and Codes.

vi. Installation of Valves

Valves shall be installed between flanges according to the instructions of the manufacturer and the Engineer in Charge. Valves shall be placed on a support of concrete so that no shear stress is in the flanges. In case of axial thrust due to closure of a valve against pressure the valve shall be anchored in the support in a suitable manner to transfer the thrust into the floor slab of the chamber.

1.19.16. Technical requirements for General Civil Works

1.19.16.1. General

The Technical requirement for Civil Works outlines the details of materials, equipment, workmanship, and quality control guidelines for the major items contained in the Bill of Quantities (BOQ) for the works. The "Central Public Works Department (CPWD) Specifications: issued by CPWD shall also be referred to along with this General Civil Works, wherever appropriate.

The Technical requirements and Bill of Quantities (BOQ) shall be read in conjunction with the other Contract Documents. All the documents and drawings are to be regarded as mutually explanatory. In the event of any discrepancy or assumed discrepancy being found between them, the Contractor shall immediately inform the Engineer of the matter in writing and the Engineer will issue his instructions in the matter in accordance with the Conditions of Contract/Special conditions of Contract.

In general, other than CPWD Specifications, provisions of the Indian Standard Codes, Indian Roads Congress Codes, and MoRTH Specifications for Roads and Bridge Works, and other national standards have been followed. These Specifications are not intended to cover the minute details. The work shall be executed in accordance with best modern practices. All codes and standards referred to in these Specifications shall be the latest revision thereof.

1.19.16.2. Materials for Civil Structures

Materials to be used in the work shall conform to the Specifications mentioned in the document, the requirements laid down in this section and Specifications for relevant items of work covered under the Specifications.

If any material, not covered in these specifications, is required to be used in the work, it shall conform to relevant Indian Standards or International Standards (in the absence of Indian standards) or to the requirements specified by the Engineer.

1.19.16.3. Sources of Materials

The Contractor shall notify the Engineer of his proposed sources of materials prior to delivery. If it is found after trial that sources of supply previously approved do not produce uniform and satisfactory products, or if the product from any other source proves unacceptable at any time, the Contractor shall furnish acceptable material from other sources at his own expense.

1.19.16.4. Bricks

Burnt clay bricks shall be hand or machine moulded conform to the requirement of IS: 1077, except that the minimum compressive strength when tested flat shall not be less than 75 kg/cm² for average of 5 specimens and individual brick strength not less than 70 Kg/cm². They shall be free

from cracks and flaws and nodules of free lime. Frog shall be 1 to 2 cm in depth. The brick shall have smooth rectangular faces with sharp corners and emit a clear ringing sound when struck. The tolerance of $\pm 8\%$ shall be permitted over the average size of the bricks specified by the Engineer for the work. The bricks shall not absorb more than 20% of water by weight when immersed in water for 24 hours.

Mandatory tests as required shall be done. All Bricks brought to site, shall be stacked and shall be got checked through visual inspection and subsequent testing in the laboratory by the Engineer before commencement of work.

1.19.16.5. Cement

The cement required for the work will be arranged by the contractor at his own cost. Cement to be used in the works shall be Ordinary Portland Cement (OPC) conforming to IS:12269 OR Portland Slag Cement (PSC), conforming to IS: 455.

These shall have to be procured from reputed ISO: 9000/ 14000 organizations. Every batch of cement delivered at site should accompany the manufacturer's test certificate. In addition to this, cement samples from each batch shall be got tested by Engineer at cost of contractor from approved testing laboratory

1.19.16.6. Coarse Aggregates

For plain and reinforced cement concrete (PCC and RCC) works, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone, crushed gravel, natural gravel or a suitable combination thereof or other approved inert material. They shall not consist of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the steel reinforcement.

Coarse aggregate having positive alkali silica reaction shall not be used. All coarse aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386 Parts I to VIII.

The maximum value for flakiness index for coarse aggregate shall not exceed 35 percent. The coarse aggregate shall satisfy the following requirements of grading:

IS Sieve Size	Percent by Weight Passing the Sieve		
	40 mm	20 mm	12.5 mm
63 mm	100	-	-
40 mm	95-100	100	-
20 mm	30-70	95-100	100
12.5 mm	-	-	90-100
10 mm	10-35	25-55	40-85
4.75 mm	0-5	0-10	0-10

1.19.16.7. Fine Aggregates

For plain and reinforced cement concrete (PCC and RCC) works, fine aggregate shall consist of clean, hard, strong, and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. They shall not contain dust, lumps, soft or flaky, materials, mica, or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the embedded steel. Motorized sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregate shall conform to IS: 383 and test for conformity shall be carried out as per IS: 2386 (Part I to VIII).

The Contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383. The fineness modules of fine aggregate shall neither be less than 2.0 nor greater than 3.5. Not more than 10% shall be retained on 4.75 mm IS Sieve. The sum of the percentage of all deleterious

materials shall not exceed 5%. It shall not contain harmful organic impurities in such form or quantities as to affect adversely the strength and durability of concrete or mortar. It shall not contain any acidic material, which is likely to attack steel reinforcement.

The fineness modulus of sand to be used in plaster shall be between 1.0 and 1.5. The fineness modulus of sand to be used in concrete and for mortar required for masonry shall be between 2.0 and 3.1. The maximum quantity of silt shall not exceed 8%. Quantity passing through 150 microns IS Sieve shall not be more than 10%. Tests as required under the section 5 "Mandatory Tests" shall be carried out. For masonry work, sand shall conform to the requirements of IS: 2116. Sand/fine aggregate for structural concrete shall conform to the following grading requirements:

IS Sieve Size	Percent by Weight Passing the Sieve		
	Zone I	Zone II	Zone III
10 mm	100	100	100
4.75 mm	90-100	90-100	90-100
2.36 mm	60-95	75-100	85-100
1.18 mm	30-70	55-90	75-100
600 microns	15-34	35-59	60-79
300 microns	5-20	8-10	12-40
150 microns	0-10	0-10	0-10

1.19.16.8. Water

Water used for mixing mortars and concrete shall be clean and reasonably free from injurious quantities of deleterious materials such as oils, acids, alkalis, salts and vegetable growth. Generally potable water shall be used. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, the Engineer may refuse to permit its use. As a guide, the following concentrations may be taken to represent the maximum permissible limits of deleterious materials in water.

- Limits of acidity: - To neutralize 200 ml sample of water, it should not require more than 2 ml of 0.1 N caustic soda solutions.
- Limits of Alkalinity: - To neutralize 200 ml sample of water it should not require more than 0.1 ml of 0.1 N hydrochloric acid.
- Percentage of solids should not exceed: -
 - Organic 200 ppm (0.02%)
 - Inorganic 3000 ppm (0.30%)
 - Sulphates 500 ppm (0.05%)
 - Alkali chlorides 1000 ppm (0.1%)

Water found satisfactory for mixing is suitable for curing concrete. However, the water used for curing should not produce any objectionable stain or deposit on the concrete surface. The pH value shall not be less than 6.5.

1.19.16.9. Steel Reinforcement

For reinforced cement concrete (RCC) works, the reinforcement/ un-tensioned steel as the case may be shall consist of the following grades of reinforcing bars:

Grade designation	Bar type conforming to governing IS specification	Yield strength (f_y) (MPa)	Elastic modulus (GPa)
S 240	IS:432 Part I – Mild steel bar	240	200
TMT500	IS:1786 – High yield strength deformed bars	500	200

Other grades of bars conforming to IS:432 and IS:1786 shall not be permitted.

All steel shall be procured from original producers, or their authorized re-rollers.

Only new steel shall be delivered to the site. Every bar shall be inspected before assembling on the work and defective, brittle or burnt bar shall be discarded. Cracked ends of bars shall also be discarded.

Whenever specified, either in drawings or BOQ, reinforcement steel i.e., high yield strength deformed bars shall be coated with fusion bonded epoxy coating conforming to IS: 13620. The coating shall be applied to the abrasive blast cleaned heated rod as an electrostatically charged dry powder sprayed on to the grounded steel bar. The coating thickness shall be varying between 0.1 to 0.3 mm after curing. Damaged areas shall be patched up with epoxy patching material as per IS: 13620. Mandrel bending machines shall be used for bending end. Utmost care should be taken for not damaging the coated surface during fabrication and placement of bars. Utmost care shall be taken so that bars are not damaged during handling and transportation.

1.19.16.10. Structural Steel

All structural steel shall before fabrication comply with the requirement of the following Indian Standards:

Code No.:	Title / Specification
IS:808	Dimensions for hot rolled steel beam, column, channel and angle sections
IS:1148	Hot rolled rivet bars (upto 40 mm dia) for structural purposes
IS:1149	High tensile steel rivet bars for structural purposes
IS:1161	Steel tubes for structural purposes – Specification
IS:1239	Steel tubes, tubulars and other wrought steel fittings – Specification
IS:1730	Dimensions for steel plates, sheet strips and flats for general engineering purposes
IS:1732	Dimensions for round and square steel bars for structural and general engineering purposes
IS:1852	Rolling and cutting tolerances for hot rolled steel products
IS:2062	Hot rolled low, medium and high tensile structural steel
IS:4923	Hollow steel sections for structural use
IS:11587	Structural weather resistant steels

1.19.16.11. Stainless Steel

Stainless steel shall be austenitic chromium-nickel steel, possessing rust, acid and heat resistant properties conforming to IS: 6603 and IS:6911. Mechanical properties/ grade for such stainless steel shall be as specified by the accepting authority, but in no case be inferior to mild steel. Generally, stainless steel is available as per AISI grades. AISI 304 which is equivalent to grade 04Cr18Ni110 of IS: 6911 satisfies the requirements of mechanical properties of structural steel. Other grades of stainless steel for specific purposes may be provided as per specific requirements. For application in adverse/ corrosive environment, stainless steel shall conform to AISI 316 or equivalent.

1.19.16.12. Concrete Admixture

Concrete admixtures are proprietary items of manufacture and shall be obtained only from established manufacturers with proven track record, quality assurance and full-fledged laboratory facilities for the manufacture and testing of concrete. The manufacturer should be ISO: 9000/ 14000 certified.

The Contractor shall provide the following information concerning each admixture after obtaining

the same from the manufacturer:

- (a) Normal dosage and detrimental effects, if any, of under dosage and over dosage
- (b) The chemical names of the main ingredients in the admixtures
- (c) The chloride content, if any, expressed as a percentage by weight of the admixture
- (d) Values of dry material content, ash content and relative density of the admixture which can be used for uniformity tests
- (e) Whether or not the admixture leads to the entrainment of air when used as per the manufacturer's recommended dosage and if so to what extent
- (f) Where two or more admixtures are proposed to be used in any one mix, confirmation as to their compatibility
- (g) There should be no increase in risk of corrosion of the reinforcement or other embedment as a result of using the admixture.

Admixtures shall conform to the requirements of IS:9103. In addition, the following conditions shall be satisfied:

- 1) 'Plasticisers' and 'Super-plasticisers' shall meet the requirements indicated for 'water reducing admixture'.
- 2) Except where resistance to freezing and thawing and to disruptive action of deicing salts is necessary, the air content of freshly mixed concrete in accordance with the pressure method given in IS:1199 shall not be more than 2 per cent higher than that of the corresponding control mix and in any case not more than 3 per cent of the test mix.
- 3) The chloride content of the admixture shall not exceed 0.2 per cent when tested in accordance with IS:6925.
- 4) Uniformity tests on the admixtures are essential to compare qualitatively the composition of different samples taken from batch to batch or from the same batch at different times. The tests that shall be performed along with permissible variations in the same are indicated below:
 - Dry material content: to be within 3 per cent and 5 per cent of liquid and solid admixtures respectively of the value stated by the manufacturer.
 - Ash content: to be within 1 per cent of the value stated by the manufacturer.
 - Relative density (for liquid admixtures): to be within 2 percent of the value stated by the manufacturer.
- 5) All tests relating to the concrete admixtures shall be conducted periodically at an independent laboratory and compared with the data given by the manufacturer.

1.19.16.13. Plain Cement Concrete

a. Scope

The works consists of providing and placing Plain cement concrete as leveling course in base of foundations, footings, of civil structures (Like buildings, pump houses, in trenches for filling of pockets and depressions, for flooring, as screed concrete / damp proof courses on top of brick walls, concrete blocks, cradles and or on top of slabs as base courses and all miscellaneous works) as shown in drawings and or as directed by the Engineer. Concrete shall be prepared by mixing graded stone aggregate or gravel of normal size as specified with fine aggregate and cement in specified proportions with required quantity of water.

The specific scope includes Providing and placing cement concrete in base / footing / foundation of Valve chambers, Pipe pedestals, Thrust Blocks, Anchor Blocks, Concrete cradles or similar appurtenances structures for laying of pipes as shown in the Drawings and or as per site conditions and or as directed by the Engineer. All Cement Concrete works shall be as per IS: 456.

b. Proportioning

Unless mentioned otherwise, Proportioning shall be done by volume. Boxes of suitable size shall be used for measuring fly ash, sand and aggregate. The internal dimensions of the boxes shall be

generally 35x25x40 cm. deep or as otherwise approved by the Engineer. The unit of measurement of cement shall be a bag of 50 kg and this shall be taken as 0.035 cum. While measuring the aggregate, shaking, ramming, or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand; allowances for bulkage shall be made as given in the chapter for mortar.

c. Placing and Compaction

The concrete shall be deposited as nearly as practicable in its final position to avoid re-handling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. As a general guidance, the maximum free fall of concrete may be taken as 1.5 metre.

Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Compaction shall be done by mechanical vibrator of appropriate type till a dense concrete is obtained. To prevent segregation, over vibration shall be avoided. Compaction shall be completed before the initial setting starts.

For leveling course, the Engineer may permit compaction by manual compaction by tamping. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

1.19.16.14. Reinforced Cement Concrete: -

Reinforced cement concrete work may be cast-in-situ or Precast as may be directed by Engineer according to the nature of work and shall consist of providing and placing cement concrete in foundations, footings, columns, pillars, beams, slabs and other miscellaneous structures as shown in the Drawings and or as directed by the Engineer.

The specific scope of the work shall include providing and placing concrete in Civil Structure (Like Service reservoirs, Buildings, Valve chambers, Raft, slab etc), Thrust Blocks, Pipe Pedestal etc and other ancillary structures as shown in the Drawings and or as directed by the Engineer.

Concrete Grade with Mix proportion lower than, 1:2:4 shall not be used in Reinforced Concrete Works. All Reinforced Concrete works shall be as per IS: 456.

1.19.16.15. Design Mix Concrete

Design Mix Concrete is proposed to be used in construction of reservoirs (Foundations, Walls, and Domes etc). Since the structures are proposed to be water retaining structures, the concrete mix should further confirm to requirements of IS: 3370.

The minimum quantity of cement in the Design mix shall be not less than 330 kg/ m³ in reinforced concrete work. The maximum quantity of cement in the concrete mix shall preferably not exceed 530 kg/m³ of concrete.

Thus, the design of the mix shall be such that the resultant concrete is sufficiently impervious. The mix obtained in accordance with the above, if fully compacted, will generally give a degree of impermeability adequate for all ordinary purposes. In special circumstances, the engineer-in-charge should satisfy himself that an adequate permeability is obtained by percolation tests.

It is necessary that concrete should be such that concrete in which the design of mix, i.e., determination of proportions of cement, aggregate, & water is arrived as to have target mean strength for specified grade of concrete. **Minimum mix shall be used as per IS:3370, IS:10262 for water retaining structures.**

1.19.16.16. Concrete Mix Design

Mix design shall be done by an expert or a concrete technologist. Mix proportions shall be designed to ensure that the workability of fresh concrete is suitable for conditions of handling and placing, so that after compaction it surrounds all reinforcements and completely fills the formwork. When concrete is hardened, it shall have the stipulated strength, durability, and impermeability.

Determination of the proportions by weight of cement, aggregates, and water shall be based on design of the mix. As a trial the manufacturer of concrete may prepare a preliminary mix according to provisions of SP: 23-1982. Reference may also be made to ACI 211.1-77 for guidance. Mix design shall be tried and the mix proportions checked on the basis of tests conducted at a

recognized laboratory approved by the Engineer. All concrete proportions for various grades of concrete shall be designed separately and the mix proportions established keeping in view the workability for various structural elements, methods of placing and compacting

The producer/manufacturer/contractor of concrete shall submit details of each trial mix of each grade of concrete designed for various workability conditions to the Engineer for his comments and approval. Concrete of any particular design mix and grade shall be produced / manufactured for works only on obtaining written approval of the Engineer.

For any change in quality/quantity in the ingredients of a particular concrete, for which mix has been designed earlier and approved by the Engineer-in-Charge, the mix has to be redesigned and approval obtained again. Mix design shall be got approved by Govt. Engg College in Chattisgarh/NIT Durg at the cost of contractor approved by engineer-in-charge.

1.19.16.17. Machine Mixing

Concreting for the tank proper and major concreting works (Raft Foundation, Column, Bracingetc) shall be prepared using Batching Plant.

1.19.16.18. Placing

The concrete shall be deposited through concrete pumps in its final position to avoid rehandling. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains.

Concreting shall commence only after Engineer has inspected the centering, shuttering and reinforcement as placed and passed the same. Shuttering shall be clean and free from all shavings, saw dust, pieces of wood, or other foreign material.

The concrete shall be deposited in its final position in a manner to preclude segregation of ingredients. In deep trenches and footings concrete shall be placed through chutes or as directed by the Engineer. In case of columns, Pillars, walls, the shuttering shall be so adjusted that the vertical drop of concrete is not more than 1.5 metres at a time.

1.19.16.19. Compaction

Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations. Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. To prevent segregation, over vibration shall be avoided. Compaction shall be completed before the initial setting starts.

For levelling course, the Engineer may permit compaction by manual compaction by tamping. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

The Engineer may however relax this condition at his discretion for certain items depending on the thickness of the members and feasibility of vibrating the same and permit hand compaction instead. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed. The vibrators shall maintain the whole of concrete under treatment in an adequate state of agitation; such that de-aeration and effective compaction is attained at a rate commensurate with the supply of concrete from the mixers. The vibration shall continue during the whole period occupied by placing of concrete, the vibrators being adjusted so that the centre of vibrations approximates to the centre of the mass being compacted at the time of placing.

Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped in case of vibrating tables and external vibrators. Needle vibrators shall be withdrawn slowly so as to prevent formation of loose pockets in case of internal vibration. In case both internal and external vibrators are being used, the internal vibrator shall be first withdrawn slowly after which the external vibrators shall be stopped so that no loose pocket is left in the body of the concrete. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with. Shaking of reinforcement for the purpose of compaction should be avoided. Compaction shall be completed before the initial setting starts, i.e. with 30 minutes of addition of water to the dry mixture.

1.19.16.20. Curing

Green work shall be protected from rain by suitable covering. The work should also be protected

from damage and rain during construction. After the concrete has begun to harden i.e., about 1 to 2 hours after its laying, it shall be protected with moist gunny bags, sand or any other material approved by the Engineer against quick drying. After 24 hours of laying of concrete, the surface shall be cured by flooding with water of minimum 25mm depth, or by covering with wet absorbent materials. The curing shall be done for a minimum period of 14 days. In special cases, curing may have to be done for a greater number of days as required by the Engineer.

Over the foundation concrete, the masonry work may be started after 48 hours of its laying, but the curing of cement concrete shall be continued along with the masonry work for minimum period of 14 days. Where cement concrete is used as sub-grade for flooring, the flooring may be commenced before the curing period of sub-grade is over but the curing of sub-grade shall be continued along with the top layer of flooring for a minimum period of 14 days. The water used for curing shall not produce any objectionable stains or unsightly deposit on concrete surface. In special circumstances and locations curing by other means such as sealing material insulating blankets etc. may be adopted with the specific prior approval of the Engineer.

1.19.16.21. Testing of Concrete Cubes

Number of sample cubes cast shall be as specified in IS: 456. A minimum of 6 sample cubes shall be cast, three cubes shall be tested at seven (7) days, and three cubes shall be tested at twenty-eight (28) days. Proper detail record of pour card and testing result should be maintained.

1.19.16.22. Formwork

i. Scope

Form work shall include all temporary or permanent forms or moulds required for forming the concrete (Plain cement Concrete or Reinforced Cement Concrete) which is cast-in-situ, together with all temporary construction required for their support.

The specific scope shall include providing all temporary and permanent forms for casting of concrete in position for Civil structures, pipe pedestals, thrust blocks, Anchor Blocks, valve chambers, drains, coping concrete, and all miscellaneous appurtenant structures as shown in the drawings and or as per site requirement and or as directed by the Engineer.

ii. General Requirements

It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

Form shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections, care shall be taken to see that no piece is keyed into the concrete.

The formwork shall consist of shores, bracings, sides of walls, beams, bottom of slabs; domes etc including ties, anchors, hangers, inserts and shall be properly designed and planned for the proposed reservoirs and brake pressure tank. False work shall be so constructed that vertical adjustments can be made to compensate for take up and settlements. Wedges may be used at the top or bottom of timber shores, but not at both ends, to facilitate vertical adjustment or dismantling of the formwork.

iii. Materials of Formwork

Propping and Centering – All propping and centering should be either of steel tubes with extension pieces or built-up sections of rolled steel.

Shuttering - Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. If required, rubberized lining of material as approved by the Engineer shall be provided in the joints.

Normally Steel Shuttering shall be used. Steel shuttering used for concreting should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing; seepage of slurry through joints etc. of the required size shall be used. For, very small works 12 mm thick water proofing ply of approved quality may be used with approval of the Engineer. For special finishes the formwork may be lined with plywood, steel

sheets, oil tempered hard board, etc. Sliding forms and slip forms may be used with the approval of Engineer.

Form work shall be properly designed for self-weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment).

iv. Camber

Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The formwork shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per metre (1 to 25) or as directed by the Engineer, so as to offset the subsequent deflection. For cantilevers the camber at free end shall be 1/50th of the projected length or as directed by the Engineer.

v. Removal of Formwork

Contractor shall record on the Drawing or on a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed there from.

In no circumstances shall forms be struck until the concrete reaches strength of at least twice the stress due to self-weight and any construction / erection loading to which the concrete may be subjected at time of striking formwork.

Informal circumstances (generally where temperatures are above 20°C) forms may be struck after expiry of the following periods:

Type of Formwork	Minimum Period before Striking Formwork
Vertical Formwork to Columns, Walls and Beams	16 – 24 Hours
Soffit Formwork to slabs (Props to be re-fixed immediately after removal of Formwork)	3 days
Soffit Formwork to Beams (Props to be re-fixed immediately after removal of Formwork)	7 days
Removal of props to slabs: - Spanning up to 4.5 m - Spanning over 4.5 m	7 days 14 days
Removal of props to beams & arches: - Spanning up to 6 m. - Spanning over 6 m.	14 days 21 days

Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration, by gently easing the wedges. If after removing the formwork, 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 Engineer, to facilitate removal of formwork which otherwise may be inaccessible.

Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structures shall be loosened neither sooner than 24 hours nor 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 walls and grade beams will not be permitted.

1.19.16.23. Brick Masonry

i. Scope

This work shall consist of construction of general load bearing structures with brick jointed

together by cement mortar as specified in accordance with the details shown on the Drawings, Specifications or as directed by the Engineer. The grade or class of bricks should be as per material specification.

The specific scope includes construction of various civil structures (like pump house, office building etc) including pipeline appurtenant structures (viz., chambers, pipe supports, road-side drains, etc) of class designation as shown in the Drawings / BoQ and or as directed by the Engineer.

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

Codes	Description
IS – 1077	Specifications for common burnt clay building bricks
IS – 1200	Measurements for Building works
IS – 1905	Code of practice for structural safety of buildings: Masonry walls.
IS – 2116	Sand for masonry mortars
IS – 2212	Code of practice for brick work
IS – 3466	Specification for masonry cement

Others IS Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes form part of these Specifications.

ii. Soaking of Bricks

Bricks shall be soaked in water before use for a period for the water to just penetrate the whole depth of the bricks. Alternatively, bricks may be adequately soaked in stacks by profusely spraying with clean water at regular intervals for a period not less than six hours. When the bricks are soaked, they shall be removed from the tank sufficiently early so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not again spoiled by dirt earth etc.

iii. Cement mortar for Brickwork

Cement and sand shall be mixed in specified proportions given in the Drawings. Cement shall be proportioned by weight, taking the unit weight of cement as 1.44 tonne per cubic metre. Sand shall be proportioned by volume taking into account due allowance for bulking. All mortar shall be mixed with a minimum quantity of water to produce desired workability consistent with maximum density of mortar. The mix shall be clean and free from injurious type of soil/acid/alkali/organic matter or deleterious substances.

The mixing shall preferably be done in a mechanical mixer operated manually or by power. Hand mixing can be resorted to as long as uniform density of the mix and its strength are assured subject to prior approval of the Engineer. Where permitted by the Engineer, Hand mixing operation shall be carried out on a clean water-tight platform, where cement and sand shall be first mixed dry in the required proportion by being turned over and over, backwards and forwards several times till the mixture is of uniform colour. Thereafter, minimum quantity of water shall be added to bring the mortar to the consistency of a stiff paste. The mortar shall be mixed for at least two minutes after addition of water.

Mortar shall be mixed only in such quantity as required for immediate use. The mix which has developed initial set shall not be used. Initial set of mortar with ordinary Portland cement shall normally be considered to have taken place in 30 minutes after mixing. In case the mortar has stiffened during initial setting time because of evaporation of water, the same can be re-tempered by adding water as frequently as needed to restore the requisite consistency, but this re-tampering shall not be permitted after 30 minutes. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.

iv. Joints

The thickness of joints shall not exceed 10 mm. All joints on exposed faces shall be tooled to give concave finish. All face joints shall be raked to a minimum depth of 15mm by raking tool during the progress of work when the mortar is still green so as to provide proper key for the plaster or

pointing to be done. Where, plastering or pointing is not required to be done the joints shall be struck flush and finished at the time of laying.

v. Laying

All brickwork shall be laid in an English bond, even and true to line, in accordance with the Drawing or as directed by the Engineer, plumb and level and all joints accurately kept. Half-cut bricks shall not be used except when necessary to complete the bond. Closer in such cases shall be cut to the required size and used near the ends of the walls. The bricks used at the face and also at the angles forming the junction of any two walls shall be selected whole bricks of uniform size, with true and rectangular faces.

All bricks shall be laid with frogs up on a full bed of mortar except in the case of tile bricks. Each brick shall be properly bedded as set in position by slightly pressing while laying, so that the mortar gets into all their surface pores to ensure proper adhesion. All head and side joints shall be completely filled by applying sufficient mortar to brick already placed and on brick to be placed. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left. No bats or cut bricks shall be used except to obtain dimensions of the different courses for specified bonds or wherever a desired shape so requires.

The brick work shall be built in uniform layers, and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. Corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate courses shall come directly one over the other. During construction, no part of work shall rise more than one metre above the general construction level, to avoid unequal settlement and improper jointing. Where this is not possible in the opinion of the Engineer, the works shall be raked back according to the bond (and not toothed) at an angle not steeper than 45 degrees with prior approval of the Engineer. Toothing may also be permitted where future extension is contemplated.

Before laying bricks in foundation, the foundation slab shall be thoroughly hacked, swept clean and wetted. A layer of mortar not less than 12 mm thick shall be spread on the surface of the foundation slab and the first course of bricks shall be laid.

vi. Curing

Green work shall be protected from rain by suitable covering and shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. Top of the masonry work shall be left flooded with water at the close of the day. Watering may be done carefully so as not to disturb or wash out the green mortar. During hot weather, all finished or partly completed work shall be covered or wetted in such a manner as will prevent rapid drying of the brickwork.

During the period of curing of brick work, it will be suitably protected from all damages. At the close of day's work or for other period of cessation, watering and curing shall have to be maintained. Should the mortar perish i.e., become dry, white or powdery, through neglect of curing, work shall be pulled down and rebuilt as directed by the Engineer. If any stains appear during watering, the same shall be removed from the face.

vii. Finishing of Surfaces

All brickwork shall be finished in a workmanlike manner with the thickness of joints, manner of striking or tooling as described in these above Specifications. For a surface which is to be subsequently plastered or pointed, the joints shall be squarely raked out to a depth of 15 mm, while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned, and wetted.

Jointing - In jointing, the face of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work. The faces of brick work shall be cleaned to remove any splashes of mortar during the course of raising the brick work.

Pointing - Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the Drawing. The mortar shall be filled and pressed into the raked joints

before giving the required finish. The pointing shall be ruled type for which it shall, while still green, be ruled along the centre with half round tools of such width as may be specified by the Engineer. The super flush mortar shall then be taken off from the edges of the lines and the surface of the masonry shall be cleaned of all mortar. The work shall conform to IS: 2212.

1.19.16.24. Cement Plaster

i. Scope

The work shall constitute of providing Cement plaster over exposed concrete or brick surfaces (of thickness 6mm, 12 mm, 15 mm or 20 mm) and or as per the required mix proportion stated as specified in the item, drawing and or directed by the Engineer.

The specific scope includes providing cement plaster over exposed brick surfaces of buildings (for Office Building, Pump house, valve chambers or chamber for flow-meters etc) and other appurtenant structures as shown in the drawings and or as directed by the Engineer.

ii. Preparation of Surfaces

For, brick surfaces, the joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scraping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced.

In case of concrete surface, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarder is left on the surface. The joints of masonry shall be raked out properly so that the plaster is well keyed with the masonry.

iii. Mortar

The mortar of the specified mix described in the item shall be used. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

iv. Scaffolding

For all brick work, double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/column less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

v. Application of Plaster

Plaster on top (ceiling) shall be completed before commencement of plaster on sides (walls). Plastering shall be started from the top and worked down towards the bottom (floor). All put-log holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one metre long to ensure through filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally, the surface shall be finished off true with trowel or wooden float according as a smooth or sandy granular texture is required. Excessive troweling or over working the float shall be avoided. During this process, a solution of lime putty shall be applied on the surface to make the later workable.

All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, provision of grooves at junctions etc., where required shall be done without any extra payments. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. No portion of the surface shall be left out initially to be patched up later on.

vi. Finish and Thickness

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jams and corners with a plumb bob as the work proceeds.

The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e., grooves or open joints in brick work. Average thickness of plaster shall not be less than the specified thickness of 12mm. The minimum thickness over any portion of the surface shall not be less than specified thickness by more than 3 mm. The average thickness should be regulated at the time of plastering by keeping suitable thickness of the gauges. Extra thickness required in dubbing behind rounding of corners at junctions of wall or in plastering of masonry cornices etc., will be ignored. Thickness of plaster greater than 12mm shall be done in two layers.

vii. Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The same may be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of seven days. During this period, it shall be suitably protected from all damages at the Contractor's expense by such means as the Engineer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

viii. Precautions

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer.

- When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly, when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.
- To prevent surface cracks appearing between junctions of column/beam and walls, the plastering of walls and beam/column in one vertical plane junction should be carried out in one go.

1.19.16.25. Pipelines, Pipe work & Fittings

i. General

All Ductile iron pipes shall be Double flanged as specified conforming to IS: 8329. All Ductile iron fittings shall conform to IS: 9523.

Socket and Spigot type shall consist of elastomeric rubber ring gasket for forming an integral joint

between pipes or pipe and fitting shall conform to IS: 12820. Flanged Joints, wherever specified in the drawings, shall conform to IS: 8329.

All pipes and fittings shall be internally lined with sulphate resistant cement mortar in accordance with ISO 4179/IS: 11906. Sulphate resistant Cement mortar lining shall be applied at the factory in accordance with the above-mentioned standards. Pipe linings shall be inspected and any damage or defective areas shall be made good to the satisfaction of the Engineer.

On completion of the work, the contractor shall remove any oil stains or paint spots, leaving the pipes and fittings in a clean and acceptable condition

ii. Pipes and Piping arrangement

There shall be suitable arrangement for routing the overflow pipe into the delivery pipe. All pipes (Inlet / Outlet / Wash-out / Overflow) shall be suitably clamped with GI flat hoops/supports.

To avoid any accident at the time of cleaning or maintenance of the tank, the opening of the outlet and wash-out pipes should be covered with aluminium mesh of suitable size. Suitable provision for flushing and disinfection of water tank shall be considered with the wash-out pipes. The wash-out pipes shall eventually allow easy passage for the water to drain out.

All proposed pipes, shall be Dual flanged Ductile Iron (Class K-9) pipes, confirming to IS: 8329

The works shall also include, Supply and laying including DI pipe fittings confirming to IS: 9523.

All Gaskets shall be supplied by the pipe manufacturer. The length of pipeline to be considered / laid shall be within the boundary area / premises of the service reservoirs

iii. General Requirements

The pipes will be centrifugally cast (spun) Ductile Iron pipes for Water Supply confirming to the IS 8329: 2000. The pipes used will be flanged joints. EPDM rings / gaskets shall conform to IS: 5382 and shall be supplied by the manufacturer of the pipes.

Code No.:	Title / Specification
IS:5382	Specification of rubber sealing rings for gas mains, water mains and sewers
IS:8329	Centrifugally cast (spun) ductile iron pressure pipes for water, gas and sewage – Specification
IS:9523	Ductile iron fittings for pressure pipes for water, gas and sewage – Specification
IS:12288	Code of practice for use and laying of ductile iron pipes

iv. Storage and stacking of DI pipes

DI pipes shall be unloaded on level ground. The stacking area must be flat and it must not contain any corrosive material and suitable approach road for vehicles. During stacking and removal operations, safe access to the top of the stack is essential. Pipes should be stacked on a base of raised wooden battens at least 100 mm. thick and 225 mm. wide.

To avoid any damages to the internal coating of the pipes, shaped hooks covered with special protection of plastic material or rubber should be used. The bottom layer of pipes should be securely anchored. The following types of stacking are recommended:

- ☐ Square stacking: Up to and including DN 400
- ☐ Parallel stacking using timber: Suitable for pipes of all sizes
- ☐ Pyramid stacking: Suitable for pipes of all sizes

The preferred stacking height is as stated follows:

Pipe Dia. (mm)	150	200	250	300	350/400	450/500	600
No. of layers	14	12	10	8	7	6	4

The pipes shall be stacked at locations identified by the Contractor with prior intimation and consent of the Engineer. No extra payment shall be made to the Contractor for carriage of pipe from the factory to the stack-yard or from the stack-yard to the work site.

v. Inspection and Testing

The pipes will be subjected to following tests for acceptance:

1. Visual and dimensional check as per Clause 13 and 15 of IS 8329
2. Mechanical Test as per Clause 10 of IS 8329
3. Hydrostatic Test as per Clause 11 of IS 8329
4. The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5832. The sampling shall be as per the provisions of the IS 8329

All pipes will be marked as per Clause 18 of IS 8329 and show as below:

- ☐ Manufacturer name/ stamp
- ☐ Nominal diameter
- ☐ Class reference
- ☐ A white ring line showing length of insertion at spigot end

- vi. **Joints and Lubricants** The lubricants shall assist to easily slide the pipe without any damage to sealing rings and shall not have any effect known to be harmful to health and shall be resistant to bacterial growth. The lubricant shall be supplied by the manufacturer of the pipe. The lubricant has to have the following characteristics:
- (a) must have a paste like consistency and be ready for use
 - (b) has to adhere to wet and dry surfaces of DI pipes and rubber rings
 - (c) to be applied in hot and cold weather; ambient temperature 0 - 50 °C, temperature of exposed pipes up to 70 °C
 - (d) must be water soluble
 - (e) must not affect the properties of the drinking water carried in the pipes
 - (f) must not have an objectionable odour
 - (g) has to inhibit bacterial growth
 - (h) must not be harmful to the skin
 - (i) must have a shelf life not less than 2 years

Acceptance tests shall be conducted in line with the provisions of the IS 9523 **Laying and jointing** Pipe laying and jointing shall confirm to the requirements of IS: 12288. Pipes should be lowered into the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 200 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes suitable mechanical equipment have to be used. All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This is done by passing a pull-through in the pipe, or by hand, depending on the size of the pipe. All persons should vacate any section of trench into which the pipe is being lowered

On gradients of 1:15 or steeper, precautions should be taken to ensure that the spigot of the pipe being laid does not move into or out of the socket of the laid pipe during the jointing operations. As soon as the joint assembly has been completed, the pipe should be held firmly in position while the trench is back filled over the barrel of the pipe. 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 and using the suitable tools. The socket and spigot end of the pipes shall be brushed and cleaned. The chamfered surface and the end of the spigot end has to be coated with a suitable lubricant recommended by the manufacturer of the pipes. Oil, petroleum bound oils, grease or other material which may damage the rubber gasket shall not be used as lubricant. The rubber gasket shall be inserted into the cleaned groove of the socket. It has to be checked for correct positioning. The two pipes shall be aligned properly in the pipe trench and the spigot end shall be pushed axially into the socket either manually or with a suitable tool specially designed for the assembly of pipes and as recommended by the manufacturer. The spigot has to be inserted up to the insertion mark on the pipe spigot. After insertion, the correct position of the socket has to be tested with a feeler blade. Deflection of the pipes -if any- shall be made only after they have fully been assembled. The deflection shall not

exceed 75 % of the values indicated by the pipe manufacturer. **Hydraulic testing of pipes** After laying and jointing the pipeline shall be tested for tightness of joints, in sections approved by the Engineer in Charge. The length of the sections shall be decided based on the topographical conditions. Preferably the pipeline stretches to be tested shall be between two chambers (air valve, scour valve etc). The water required for testing shall be arranged by the contractor himself. The Contractor shall fill the pipe and compensate the leakage during testing. The Contractor shall provide and maintain all requisite facilities, instruments, etc. for the field testing of the pipelines. The testing of the pipelines generally consists in three phases: preparation, pre-test/saturation and test, immediately following the pre-test. Following steps are to be followed which shall be monitored and recorded in a test protocol if required:

- Complete setting of the thrust blocks, with partial backfilling and compaction to hold the pipes in position while leaving the joints exposed for leakage control.
- Opening of all intermediate valves (if any) and fixing the end pieces for tests and after temporarily anchoring them against the soil (not against the preceding pipe stretch)
- at the lower end with a precision pressure gauge and the connection to the pump for establishing the test pressure
- at the higher end with a valve for air outlet
- If the pressure gauge cannot be installed at the lowest point of the pipeline, an allowance in the test pressure to be read at the position of the gauge has to be made accordingly
- Slowly filling the pipe from the lowest point(s).
- Complete removal of air through air valves along the line and closing all air valves and scour valves.
- Slowly raise the pressure to the test pressure while inspecting the thrust blocks and the temporary anchoring.
- Keeping the pipeline under pressure for the duration of the pre-test / saturation of the lining by adding make-up water to maintain the pressure at the desired test level. Make up water to be arranged by Contractor himself at his own cost.

After pipeline is completely filled, it shall remain to stay for minimum period of 18 hours for the cement mortar lining to absorb water to its saturation point. Before the pressure test refill, the pipeline to compensate the absorb quantity and gradually pressurize the pipeline so that it reaches the required test pressure and allow to stabilize at the test pressure. Record the water added and the pressure in intervals of 15 minutes at the beginning and after 2 hours at the end of the test period. Without any additional requirement of make-up water, the test pressure should not fall more than 0.2Kg/cm² at the end of one hour. No section of the pipe-work shall be accepted by the Engineer-in-charge until all requirements of the test have been obtained. **Supply and Laying of Ductile Iron Fittings** The scope covers the general requirements for Ductile Iron (DI) fittings suitable for Tyton / flanged joints to be used with DI pipes and or for interconnecting to valves, flow-meters, fire hydrants etc. The item relates to providing and fixing of DI fittings and specials for interconnection with the existing system and or new system with DI pipes and pipeline appurtenances, including testing and commissioning all complete. DI specials to be used shall be of the same diameter as the pipeline to which it is fixed unless mentioned otherwise. The DI pipe fittings shall confirm to IS: 9523. All DI fittings shall be of class K-12. DI fittings shall be manufactured and tested in accordance with IS: 9523 and shall include the following types of specials:

- Flanged socket / spigot
- Double socket bends (900, 450, 22½ 0, 11¼ 0)
- double socket branch flanged tee

- All socket tees
- Double socket taper
- All Flanged Tee
- Flanged Socket and Spigot
- Mechanical collar joint
- Duck foot bend

All flanges of all ductile iron products shall be of integrally cast type or screwed or factory welded (flanges are welded at the point of manufacture under factory conditions with inspection agency certification) complete with all nuts, bolts, gaskets and two washers per bolt unless otherwise stated. Nuts, bolts and washers for flanged joints shall be of high tensile steel and shall comply with BS EN 14399 – Part II – 2005. The bolting shall be complied with ISO 2531(2009) or BS EN 1092-2. Restrained joints are required to avoid settlement in weak soil area without thrust blocks and shall comply with ISO 10804-1 or equivalent. Rubber gasket for these joints shall be of neoprene rubber with ductile iron locking rings, nuts and bolts. **Supply** All the DI fittings shall be supplied with EPDM rubber rings. Flanged fittings shall be supplied with EPDM gasket per flange and the required number of nuts and bolts. The EPDM ring / gaskets shall conform to IS: 12820 and IS: 5382. DI fittings shall be properly packed with jute cloth. EPDM rings shall be packed in polyethylene bags. EPDM rings in PE bags and nuts, bolts etc. shall be supplied in separate jute bags.

1.19.16.26. Minimum Requirements given in offer tenders:

- | | | | |
|-------|--------------------------------------------------------|---|------------------|
| i. | Minimum size of Columns | - | 400 mm circular |
| ii. | Minimum size of Beams | - | 300x200 mm |
| iii. | Minimum grade of concrete to be used | | |
| | For, foundation, columns, beams, slab, container, etc. | - | M-30 |
| | Minimum grade of conc. For PCC under foundation | - | M-15 |
| iv. | INTZ type tank | - | Not Allowed |
| v. | Minimum steel in Column | - | 0.8% of concrete |
| vi. | Minimum thickness of wall | - | 250 mm |
| vii. | Minimum Thickness of Roof Slab | - | 150 mm |
| viii. | Minimum thickness of the Bottom slab of Tank | - | 300 mm |
| ix. | Minimum depth of footing at any cross section | - | 250 mm |
| x. | Minimum depth of Chhajja at Balcony | - | 125 mm |

1.19.16.27. Container Height: -Height of container can be fixed in consonance with the design requirement taking cognizance of the availability of land for construction. Maximum height of container shall not exceed 7m.

1.19.16.28. Scour Valve Chamber: -Additional DI pipe of length minimum 5 meters shall be provided beyond Scour Valve Chamber to wash out the water from the boundary of OHSR.

ANNEXURE - “E-6”**Scope of work and technical Specifications: -****PLC & SCADA AUTOMATION, MONITORING AND CONTROL SYSTEM**

Scope of work: The following scope of work deemed to be included in the contractor's Lump sum offer.

1. Supply, installation, testing and commissioning of control instrumentation and PLC-SCADA based automation with monitoring and control Design for all components of Bhakhara water supply scheme including Sump well, RWPS, WTP, CWPS, OHSRs, Bulk flow meters, EMFs, Pressure transmitters, Level transmitters, Online water quality analysers (PH, Turbidity, Chlorine etc) ,FCVs, Pressure gauges, actuators etc with facility of centralized monitoring and control and as per technical specifications in NIT complete with trial run for 03 months followed by 09 Months of complete O & M including & replacement and warranty . The components wise scope is broadly described as below: -
 - i. SCADA System at Sump well including supply, installation, testing & commissioning of Pressure Transmitters (for each individual pump discharge & common header), Electro-magnetic Flow meter, Level Transmitter, PLC/RTU, HMI, GSM Router, Panel for PLC/RTU, Earthing, Cabling etc actuators of pumps discharge line.
 - ii. SCADA System at WTP including supply, installation, testing & commissioning of Raw Water Inlet Flow Meter, Raw Water pH & Turbidity analysers, Clear Water pH, Turbidity & residual Chlorine analysers, Backwash level transmitter, Wash water & Blower pumps, pressure transmitters & Actuators, Filter Beds actuators & rate of flow transmitters and all actuator for all valves, Clariflocculator motors operation, chlorinator, flash mixer, chemical dosing pumps (Alum, lime, PE etc.)
 - iii. SCADA System at Clear Water Pumping including supply, installation, testing & commissioning of Pressure Transmitters (for each individual pump discharge & common header), inlet EMF meters for pumping stations, Level Transmitters, Actuators of pumps suction & delivery side, Flow transmitters, HMI, HMI Panel cum Cabling Junction Box, Earthing, Cabling etc
 - iv. SCADA System at OHSRs (existing and proposed) including supply, installation, testing & commissioning of Level Transmitter, pressure Transmitters, FCVs, inlet & Outlet Flow meters, inlet & Outlet Actuators, PH & Residual chlorine analysers, PLC/RTU, HMI, GSM Router, Panel for RTU, Earthing, Cabling etc
 - v. Supply, installation, testing & commissioning of Central SCADA including SCADA Software, Workstation Computer, Large Screen, Network, AC, UPS, Furniture etc.
 - vi. Supply, installation, testing & commissioning CCTV surveillance at Sumpwell, WTP, Clearwater pumping station & all OHSRs
 - vii. The job implies all works from preliminary investigation to the final commissioning. Scope of Automation & Instrumentation includes the design and installation of system, sufficient to monitor the designated flows of raw/clear water. This System envisages a Master Control Centre (SCADA) to be established in an existing constructed building in WTP.
 - viii. The tenderer is required to arrange complete automation work, until the whole system is handed over to the Department. Testing will also have to be carried out at contractor's cost and it will be the responsibility of tenderer to ensure that respective guarantees are achieved.
 - ix. The work includes providing redundant PLC's / RTU's to collect the data and transmitting it on GSM backbone to LCS to be installed at all pumping stations and further transmitting the data on GPRS backbone to MCS to be installed at WTP. The work also includes supply of electromagnetic flowmeter, pressure sensors, water level sensors, valve actuators and for distribution outlet at OHSR's (all existing and

proposed), auto-phase reversal relays including Supply of all equipment and connected hardware & software for MCS and LCS like LCD monitors, UPS and connected software & hardware, cabling and related licences if required so, complete in all respect.

PLC- SCADA Automation system should be able to control the functioning of all raw water pumps, all treatment units of WTP, Clear water pumps and the valves at the inlet and outlet valves of all connected OHSRs & their digital level indicators, FCVs, pressure gauges and all bulk flow meters.

- x. For selection of field instruments and control system or anything related to instrumentation, the Contractor shall follow the specifications contained herein. The Contractor shall be required to provide all equipment, accessories, cabling, earthing, providing necessary transducers/sensors, system hardware/software, programming logic etc. to achieve the functional requirements described herein. The civil and electromechanical work associated with installation of the instrumentation equipment shall be in the Contractor's scope.
 - xi. Minimum size of Screen in central SCADA room shall be 70 inches for monitoring the activities and performance of installed water supply system.
 - xii. Contractor to plan the size of SCADA room in such a manner so as to host a meeting of atleast 20 persons at a time, the room shall be equipped with min. 4 Nos. tables (working station), chairs minimum 30 Nos., a projector with screen, microphone facility, Air conditioners (min. 4 Nos. of 2 Ton capacity each) etc. The above-mentioned quantities are minimum and may increase as per requirement and discretion of EE/CMO/Nodal.
 - xiii. The scope of work of SCADA also includes set up remote monitoring over static IP in addition to the automation and SCADA for access and integration of data.
2. The scope for Control Instrumentation and PLC-SCADA based automation System shall include but not limited to: PLC panel, SCADA Workstation, Control Desks, Control & Signal Cables and Accessories and associated equipments and appurtenances (Valve actuators, electric motors, blowers etc).
- The specific Scope of the PLC-SCADA System for WTP shall involve:
1. Monitoring and Visualization of normal filter cycle of each bed.
 2. Monitoring and Control of Backwash Cycle of each bed based on loss of head
 3. Monitoring and Visualization of Water Quality and Flow parameters including recording and retrieval in the form of Shift / day / monthly reports.
 4. Manual Operation through Control desks.
 5. Monitoring and operation of Chemical house (Allum, lime, PE & Chlorine etc), Clarifloculator, Backwash and Air blower pumps, actuators.

Note: The scope also includes the integration of existing OHSR (if any as per scope of work) RTU panel & instrument parameters with the central SCADA.

The Contractor shall provide on-Site training during Trial run and commissioning to Engineers and Process Operators.

Instrumentation at RWPH shall include: -

Ultrasonic Level Transmitters for Sump well/Sump well
Pressure transmitters for individual pump discharge side & common header
EMF for common header
Actuators for Each pump discharge side
Vibrating & temperatures sensors of Motors

Instrumentation at WTP shall include:

- Ultrasonic Level Transmitters for Filter beds level (LOH)
- Filter bed Control panels

- Turbidity & pH Analyzer at Raw water inlet.
- Turbidity, pH&chlorine analyzer at Clear water.
- Level transmitter at Wash water tank
- Open channel flow meter at RAW water inlet channel (Parshall flume shall be provided with Flow Vs Head Data).
- Open channel flow meter at Clear water channel (Par flume shall be provided with Flow Vs Head Data).
- LED Display Panel to display Parameters at office room of WTP.
- Level transmitter at clear water sump / tank
- Pressure transmitters of Wash water pumps, Air blowers
- Electrical Actuators on all valves in the WTP (Every butterfly, Gate & Sluice valve in the WTP, RWPH, CWPH, OHSRs shall have electric Actuators).
- Chemical dosing Levels
- Clarifloculator, Chlorination plant operation
- **Instrumentation at CWPH shall include:**
- Level transmitter for Clear water sump
- Pressure transmitters for individual pump discharge side & common header
- EMF for common header
- Actuators for Each pump suction & discharge side
- Vibrating & temperatures sensors of Motors
- **Instrumentation at OHSR (existing & proposed) shall include**
- Level transmitter for OHSR
- Pressure transmitters for OHSR inlet & Outlet
- EMF meters for OHSR inlet & Outlet
- Actuators for OHSR inlet, Outlet & bypass
- PH & chlorine Analyser at OHSR outlet
- FCV for OHSR inlet

The scope includes providing SCADA software for real-time monitoring, data acquisition, data monitoring etc. Detailed Specifications are spelt herein

3. General requirements: -

The control systems for the Water Treatment Plant (WTP) shall be based on the use of Programmable Logic Controllers (PLCs). The various modes of controls shall be Auto, Semi-automatic and Manual. Remote operation facilities shall be provided for operating the equipment from the local SCADA system.

In future, the Employer's Representative proposes to install a Master SCADA system for central monitoring and for remote operations of the WTP, CWPS, OHSRs and all the water-works in the water supply system and the distribution system. The local SCADA systems and the PLCs shall be capable of interfacing / networking with the future industry standard SCADA system.

In the event of failure of the automatic controls or by operator choice it shall be possible to revert to semiautomatic or manual operation of each item of Plant independent of the PLC functions. The field instruments shall also form an integral part of the control system.

4. Design requirements of Instrumentation and Control: -

Instrumentation and Control system shall be designed, manufactured, installed and tested and approved by Engineer-in-Charge by an experienced system integrator to ensure high standards of operational reliability. Instruments mounted in field and on panels shall be suitable for continuous operation. All electronic components shall be adequately rated and circuits shall be designed so that change of component characteristics shall not affect plant operation.

All I&C equipment shall be new, of proven design, reputed make, and shall be suitable for

continuous operation. Unless otherwise specified, all instruments shall be tropicalised. The outdoor equipment shall be designed to withstand tropical rain and temperature variation from 0 to + 50⁰ C, wherever necessary, space heaters, dust and waterproof cabinets shall be provided. Instruments offered shall be complete with all the necessary mounting accessories. The control equipment installed inside the control room should be designed to work at 35⁰ C and the instruments in sheltered place outside the control room at 45⁰ C.

Electronic instruments shall utilize solid state electronic components, integrated circuits, microprocessors, etc, and shall be of proven design.

For transmitting instruments, output signal shall be 4-20 mA DC linear having two wire systems.

Unless otherwise stated, overall accuracy of all measurement systems shall be $\pm 1\%$ of measured value, and repeatability shall be $\pm 0.5\%$.

After a power failure, when power supply resumes, the instruments and associated equipment shall start working automatically.

The instruments shall be designed to permit maximum interchange ability of parts and ease of access during inspection and maintenance.

Unless otherwise stated, field mounted electrical and electronic instruments shall be weatherproof to IP-68.

The instruments shall be designed to work at extremes of the ambient conditions of temperature, humidity, and chlorine contamination that may prevail. The instruments shall be given enough protection against corrosion.

Lockable enclosure shall be provided for the field mounted instruments wherever required.

All field instruments, and cabinets / panel-mounted instruments shall have tag plates / name plates permanently attached to them.

The performance of all instruments shall be unaffected for the $\pm 10\%$ variation in power supply voltage and $\pm 5\%$ variation in frequency simultaneously.

All wetted parts of sensors shall be made out of non corrosive material capable of working with chlorine content of 5 ppm.

For all instruments (transmitting analogue signals) installed in the field (outside pump house), surge protection devices (SPDs) shall be provided at both ends of the connecting cable for the protection against static discharges / lightning and electromagnetic interference.

Pressure transmitters shall be provided with two valve manifold and a test port, so that in situ calibration can be carried out.

Two wire transmitters shall be provided with on-line test terminals.

The ranges of all instruments shall be suitable for the application in the process.

Instruments of similar type shall be of same make for appropriate inventory of spares, ease of maintenance and training.

The Indian agents of imported equipment shall have establishment to provide after sales maintenance facilities.

5. Erection requirements: -

The locally mounted instruments shall be installed on appropriate rigid supports, having minimum vibrations. The instruments shall be installed away from hot objects.

The instruments shall be protected against physical damage or liquid splashing by providing metallic/ fibre glass enclosures or canopies.

All transmitters / transducers shall be installed nearest to the sensing point and at a place convenient to get access for maintenance.

The field instruments i.e. the instruments mounted outside the control panel shall be mounted at a convenient height of approximately 1.5 m above grade platform.

While installing the instrument, provision shall be made to carry out in-situ calibration. Isolation valves and drain valves shall be provided to the field instruments wherever required.

Instrumentation cables shall be separately laid, away from electrical cables. The instrumentation cables from the field mounted instruments shall be terminated on the

control panel without any joints.

Double compression glands shall be used for glanding the cable in field instruments and instrument control panel.

Metallic tag number plate shall be provided for each instrument.

Instrument Power Supply Cables and Instrumentation Signal Cables

Cables shall be capable of satisfactorily withstanding without damage, transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected when operating under the climatic conditions prevailing at the site as indicated in this specification.

Cable joints in instrument signals and power supply cables shall not be permitted.

Cables shall be capable of satisfactory performance when laid on trays, in trenches, conduits, ducts and when directly buried in the ground.

Cables shall be capable of operating satisfactorily under a power supply system voltage variation of $\pm 15\%$, a frequency variation of $\pm 5.0\%$.

6. Laying Of Cables

A distance of minimum 300mm shall be maintained between the cables carrying low voltage AC and DC signals and a distance of minimum 600mm shall be maintained between HT cables and signal cables. In outdoor areas, the cables shall be directly buried. Each instrumentation and power supply cable shall be terminated to individual panel/ terminal box. Identification of each cable shall be by proper ferrules at each junction as per cable schedule to be prepared by Contractor.

Cables shall be laid in accordance with layout drawings and cable schedule which shall be prepared by Contractor and submitted for approval.

All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. Various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. A loop of 1 meter shall be left near each field instrument before terminating the cable. Cables shall be complete uncut lengths from one termination to the other.

All cables shall be identified close to their termination point by cable numbers as per cable interconnection schedules. Identification tags shall be securely fastened to the cables at both the ends.

7. Programmable Logic Controllers

i. Codes and Standards

The design material, construction features, manufacture, inspection and testing of Programmable Logic Controllers (PLC) shall comply with all currently applicable statutes, regulations and safety codes. The PLC shall comply with the latest applicable standards and codes. If any such standards are not applicable then the same shall comply with the available recommendations of professional institutes like NEMA, IEC, ANSI, ISA, IEEE, DIN and VDE.

ii. Design and Installation requirements

This shall comprise of programmable systems based on operational logic for safe and automatic operation of the pumping stations and the treatment plant to produce required quantity of drinking water of specified parameters. PLC shall be provided as a stand-alone controller to perform combinational and sequential logic functions, status monitoring and reporting functions with counter and timer facilities, for each station.

PLC shall comprise of necessary processors, Input /Output (I/O) modules, communication interface modules and man-machine interface required to perform the desired functions.

PLC shall have the following attributes as a stand-alone controller:

1. It shall carry out sequential start/stop logic implementation for operation of the pumps.
2. It shall carry out computation and interfacing for data acquisition, data storage and retrieval.
3. It shall accept downloaded program from a programmer.
4. It shall have different functional modules to perform the desired functions.
5. It shall scan the inputs in time cycles and update the status of inputs/outputs.
6. To avoid spurious output because of output module failure, all commands shall be associated with release signals. Release signals shall include information on healthiness of the hardware, software and power supply modules.
7. It shall have relays, counter/timer functions, internal registers/ flags, watch dog timer, set/reset facilities, up-down counter etc.
8. It shall have provision for spare input and output modules.

The PLC system shall be expandable and shall be modular in construction so as to carry out the future expansion without any hardware modifications.

The PLCs shall have analog and digital signal monitoring capability for checking the healthiness of the signals. In case of detection of any unhealthy signal "PLC trouble" alarm shall be generated. In case of failure of a PLC, the status of all the outputs of the PLC shall be stay put.

PLC shall be 32-bit microprocessor based with state-of-the-art technology. System components shall be carefully chosen so that the reliability of the PLC shall be high. PLC shall use open standard bus protocols and structures for all communication within and outside the system.

In case of system failure or power supply failure all the outputs shall attain pre-determined fail-safe condition. Spurious signals shall not cause equipment operation. Check back before execution features shall be incorporated.

The PLC used shall have a proven record in the type of application concerned and in the prevailing environmental conditions.

It shall be possible to perform the simulation functions and testing the program by changing the status of contacts and monitoring the output.

The PLC system shall support 'hot swapping' of I/O modules i.e., removal and insertion of I/O modules under power on condition.

The design of system configuration and development of PLC software shall be undertaken by the PLC manufacturer or System Integrator authorized by the PLC manufacturer. They shall have previous experience in similar applications and shall have a service center at a reasonable distance so as to provide services at a short notice.

iii. Particular requirements for PLC

Sl. No	Description / Component	Requirement
1.	Functions	As per the control logic and input/output list
2.	Expandability	50% of installed capacity
3.	Interposing relays	Shall be provided for all the digital outputs (DO) including spare DO and for digital inputs wherever required.

Sl. No	Description / Component	Requirement
4.	Optical isolation for all digital inputs and outputs and galvanic isolation for analog inputs	Required
5.	Mounting	Inside the control panels with viewing glass on the door
6.	CPU and power supply module redundancy	Required (In hot standby mode)
7.	Processor with online editing	
a)	Diagnostic function performance	Required
b)	Minimum 32-bit performance with floating point capability	Required
c)	Memory module	To store programs, standard software to perform logic functions and diagnostic functions
8.	Inputs and Outputs	Refer I/O schedule in the respective sections of the pumping stations and WTP
9.	System Loading/ CPU loading	Max. 60% under worst loading Conditions
10.	Power supply to sensor / transmitters	Required
11.	Type of input	Binary, analog and pulsed as required.
12.	Outputs	Binary signals (Relay outputs for driving MCC Starter coils, driving motorized valves etc.); analog and pulsed as required.
13.	Spare I/O	20% of each type, wired to terminal block
14.	Accessories	Laptop computer for programming along with all necessary adapter, laptop carrying kit, cables, connectors and accessories (1 No. common for RWPS , WTP and CWPS) Proprietary PLC programming and documentation software along with all cables and connectors for loading on laptop computer and on local PC based SCADA system
15.	Interface (Hardware and Software) to Local SCADA system	RJ 45 with TCP/IP Protocol
16.	Communication port to be provided for interface to Local SCADA system	RS 232/ RS 485communication with local SCADA is required to be provided (with suitable converters as applicable)
17.	Communication port for interfacing with temperature scanners (for pumping stations)	Required
18.	Communication port for interfacing with Multifunction	Required

Sl. No	Description / Component	Requirement
	meters/ Motor Protection Relays	
19.	Communication port for interfacing with flow indicator totalisers	Required

8. Central Processing Unit

The Central Processing Unit (CPU) shall be high performance processor with modular configuration suitable for real time process. High inherent reliability, self checking, error-recovery and trouble-shooting features shall be source of the features of CPU.

Communication between CPU and peripherals shall be by an I/O bus. The individual device, interfaces shall be capable of being plugged into the I/O bus.

CPU shall have a real time clock capability to accept a time synchronization pulse from external communication system and adjust its internal clock with the pulse.

CPU shall have extensive self diagnostic facilities and watch dog timers to identify faults at card levels.

The CPU word length shall be 32 bit or more. The CPU shall have at least 50% spare capacity after commissioning of the application.

Automatic restart of the system on resumption of power shall be provided.

a) Memory Unit

Memory unit shall comprise of highly reliable memory chips which are industry standard, proven design with fast random access and suitable for operation in process environments. Main memory shall be modular and facility shall be provided for upgradation and expansion of memory to meet future demands.

Sufficient program memory and data memory space shall be provided. At least 50% extra memory space shall be provided over the actual requirements. System initialization and application software shall be stored in EEPROM or EPROM with necessary hardware. Running data shall be stored in a RAM with internal battery back-up. The battery back-up provided shall last for at least one month with life of battery a minimum of 3 years. Appropriate programs for application software modification shall be provided.

b) Input Output modules

(i) Standard rack mounted I/O modules with plug-in cards shall be provided. Field wiring shall be terminated in screwed terminal blocks and interconnected to the processor I/O system with pre-fabricated cables and plug in card type connectors.

(ii) 20% extra I/Os of installed capacity for each type shall be provided as spares and shall be wired to the terminal block of the control panel. Provision shall be made for future expansion of extra I/O modules of the installed capacity.

(iii) Some of the common features of the I/O modules shall be as follows:

- All inputs shall be terminated with input protective network and necessary isolating barriers.
- Filters for noise rejection.
- Provision for isolation of faulty channels.
- Input /output status shall be indicated by LEDs.
- Test points and fault indication LEDs shall be provided to carry out module testing.
- Surge withstands facility as per IEEE standards.
- All the modules shall be of addressable type.
- Protection for continuous overload upto 20% of all input ranges.
- All outputs shall be provided with fuse protection and fuse failure detection. The fuses may be mounted externally from the output module.
- All the modules shall be of addressable type.

- (k) The I/O modules shall have diagnostic features i.e., in case of failure of any I/O channel an alarm "PLC trouble" shall be generated automatically.
- (l) Internal battery back up.

(iv) Analog input modules

They shall consist of an input isolation unit, signal conditioning unit and an analog to digital converter (ADC). In addition, the following features shall be provided:

- (a) Cross talk attenuation.
- (b) Provision for monitoring of the ADC for overflow detection.
- (c) Gain amplifier with high common mode rejection ratio.
- (d) Accuracy for analog signals shall be minimum + 0.5%.
- (e) Screwed terminals with fuse and LED for indication of 'fuse blown' shall be provided for each analog input.

(v) Digital input modules

The following design features shall be provided.

- (a) Contact bounce protection.
- (b) Choice of type of contacts.
- (c) Screwed terminals with fuse and LED for indication of 'fuse blown' shall be provided for each digital input.

(vi) Digital output modules

The digital output module shall provide contact closure output by driving relays. The features to be provided are as follows:

- (a) Contact bounce protection.
- (b) Relay output to operate pump motors and motorized valve actuators.
- (c) Fail safe position in case of output module failure and fault indication.

The digital input and digital output modules shall not have more than 16 channels in each module. The analog input modules shall not have more than 8 channels in each module.

c) Default values

Every operator selectable parameter shall be provided with a default value held in EPROM or EEPROM in the relevant PLC.

The default value shall be used if no other value has been entered through the local SCADA system or if the value entered through the local SCADA system has been lost. The default values shall be made available for interrogation by the local SCADA system at all times.

Sensible and logical default values shall be inserted prior to the start of system tests. The default values at the time of handing over the plant shall be those found operationally suitable during commissioning.

The PLCs shall make available for interrogation by the local SCADA for bits corresponding to the following PLC faults:

- a) Failure of PLC as indicated by the PLC watchdog relay;
- b) Failure of each I/O card;
- c) Failure of communication link
- d) Status of 24 V DC power supply for I&C system.

d) Software

The on line real time operating system supplied shall be proven for similar application and shall be able to support all the equipment/peripherals.

PLC programming shall be carried using latest available industrial standard formats for logic. The PLC programming shall be prepared using the PLC manufacturers recommended windows-based PLC coding and documentation software. The PLC code shall be structured in the manner of the best industry standard and have comprehensive subroutine and rung annotation. Ladder program will be preferred.

The PLC shall be commissioned using RAM memory storage modules which shall be replaced with an Erasable read only memory (EPROM) or electrically erasable read only memory (EEPROM) when testing is complete.

9. Programming Unit

The Contractor shall supply a laptop computer (common for use at WTP and CWPS, ESR) preloaded with required softwares. The configuration of the laptop PC shall be latest available at the time of execution of Contract. The licensed copies of the various softwares shall be provided which will include software for programming and operating system for PLC, proprietary PLC programming and documentation, SCADA application, latest Office software, latest Antivirus, latest Adobe Acrobat Reader and Diagnostics software.

The laptop computer shall be provided with all necessary adapter, laptop carrying kit, cables, connectors and accessories.

The proprietary PLC programming and documentation software shall have facilities for:

- (a) Carrying out program revision management
- (b) Insertion of comprehensive program subroutine and rung comments
- (c) Search and find and search and replace 'contacts' and 'coils'
- (d) Simulation functions and testing of the program by changing the status of contacts and monitoring the outputs
- (e) Preparation of coil and contact list and their locations and memory maps.
- (f) Make system backup copies while the system is online
- (g) Upload and down load programs to the PLC on line
- (h) Carry out on line monitoring and fault finding on the PLC.

a) Operator Interface Unit

OIU shall be provided for the PLC system on the front facia of the control panel.

The OIU shall consist of panel mounted industrial grade unit with Color LCD screen and tactile key pad. It shall be environmentally protected and designed for plant room use with a 'wipe clean' finish.

The OIU shall provide facilities to:

- (a) Display status of Plant in a graphical and tabular format (i.e. running, stopped, fault etc.)
- (b) Display analog values on the appropriate graphic screen (displays shall change color when in fault conditions or when data is suspect);
- (c) Annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred
- (d) Provide facilities for the operator to:
 - adjust process set points;
 - select process modes;
 - select number of running pumps;
 - provide all other facilities required for operation of the Plant;
 - acknowledge alarms;
 - view a journal of unacknowledged alarms;
 - view a journal of the alarms acknowledged and unacknowledged.
 - Display process set points;
 - Display a total running hours log of local transmission pump drives.
 - Provide real time and historic data
 - Any additional features required to assist in the effective and efficient operation of the plants.
 - Security systems shall be provided to prevent unauthorized adjustment of process set points.
- b) Graphic screens shall be provided as follows:
 - (a) Main and subsystem menus;
 - (b) Pumping system overview (i.e. providing details of Nos. of pumps running, total flows, reservoir/ sump level, power supply status etc.)
 - (c) Transmission main local surge suppression equipment tabular status format screen;
 - (d) Screens to permit viewing and modifying of process set points
 - (e) Tabular screen of pumping plant status and values

(f) Running hours log for pumping stations.

The screens shall display data commensurate with their size and the area of and the number of Plant items covered. The Contractor, in addition to the specific screen requirements stated above shall be responsible for providing any additional screens to ensure comprehensive coverage of the Works.

The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

Tests for Programmable Logic Controller (PLC)

The following tests shall be carried out for the PLC

- Scanning rate check for analog signals
- Scanning rate check for digital signals
- PLC cycle time check
- Processor redundancy check
- Power supply redundancy check
- Processor failure alarm check
- Power supply failure alarm check
- Card level failure detection check
- Failsafe output check on failure of output module
- Sensor failure detection check
- Status indication check for healthiness of each input/output channel and module
- Status indication check for power supply for each module
- Isolation check for input/output module
- Input filtering check for noise level
- Processor – battery back-up check
- Controller functioning check on under voltage and over voltage
- Ladder logic program check by simulation of inputs and outputs
- Functional check of programming units.

10. **PC Based Local SCADA**

The PC based local SCADA system shall consist of an industrially rugged Personal Computer and shall be a high-performance processor with modular configuration suitable for real time process applications. The SCADA system shall consist of following:

- i. 21” (color, low radiation) VDU with rack mounted shall be latest at the time of supply
- ii. Printers1 No. 132 column printer shall be provided for on line printing of alarms and event logging.
- iii. 1 No. A3 size color graphic laser printer shall be provided for report generation and color screen printing.
- iv. Keyboard and Mouse: - The keyboard and mouse shall be industrially rugged having built in touch pad and 3 keys for mouse functions.
- v. 21” color monitor or better shall be provided.
- vi. A separate control desk shall be provided for the PC along with 21” color monitor, key board, mouse and 2 numbers printers.

The system shall be provided with open system standards windows based supervisory, control and data acquisition (SCADA) software and shall support industry standard protocols for third party interfacing required in future for master SCADA system connectivity. The software package chosen shall be a market leader and have a proven record of use within the water industry for similar applications.

The PC based SCADA system shall provide facilities to:

- i. Provide color graphic screen representation each plant area and system.
- ii. overviews
- iii. Display status of Plant in a graphical and tabular format (i.e. running, stopped, fault etc.);
- iv. display analog values on the appropriate graphic screen (displays shall change color when in fault conditions or when data is suspect);
- v. Display status and values at other down stream plants as required.
- vi. annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred;
- vii. provide facilities for the operator to:
 - adjust process set points;
 - select process modes;
 - provide all other facilities required for operation of the Plant;
 - acknowledge alarms;
 - view a journal of unacknowledged alarms;
 - view a journal of the last 200 alarms acknowledged and unacknowledged.
 - display process set points;
 - provide real time and historic trending of local analogue values;
 - issue commands for start-stop operation of pumps;
 - Issue commands for opening/ closing of motorized valves;
- viii. provide data archiving of all local analogue values;
- ix. prepare daily, weekly and monthly reports (providing details of daily, monthly and weekly throughputs against numbers of pump running hours and power usage);
- x. display a total running hours log of local transmission pump drives;
- xi. any additional features required to assist in the effective and efficient operation of the pumping station and water treatment plant;
- xii. Power monitoring using various analogue/ digital inputs provided from the HT switchgear as listed in the I/O list;
- xiii. Security systems shall be provided to prevent unauthorized adjustment of process set points.
- xiv. Provide continuous and effective monitoring and control of equipment.
- xv. On-line data monitoring and control
- xvi. Database for both real time and historical data management
- xvii. Safety tagging and interlocks operation
- xviii. PLC program uploading and downloading
- xix. Interoperability with the other packages such as Geographic information system (G.I.S.), Water demand forecast, Management Information System (MIS) for effective Water Management etc.

Notes:-Graphic screens shall be provided as follows:

- main and subsystem menus;
 - Pumping system overview (i.e., all pumping stations providing details of No. of pumps running and standby, total flows, reservoir levels, power supply status etc.);
 - Treatment plant overview (i.e. Clariflocculators in use, number of filters in operation, backwash, maintenance, recycling reservoir level and backwash reservoir level, input raw water flow to treatment plant, output flow of treated water from treatment plant and turbidity, pH of raw and clear water etc.);
- over view of the local pumping station providing details of reservoir level, total flow and Nos. of pumps running;
- overview of power system;

- overview of control system;
- screens to permit viewing of process set points;
- tabular screen of Pumping Plant status and values;
- The time and power frequency shall always be displayed in a corner or reserved space on the screen.
- running hours log for Pumping.

The screens shall display data commensurate with their size and the area of and number of Plant items covered. The Contractor, in addition to the specific screen requirements stated above shall be responsible for providing any additional screens to ensure comprehensive coverage of the Works.

A comprehensive screen navigation system shall be provided giving access to all screens via a system of menus and short cuts (i.e. it shall be possible to follow the process from one screen to another by clicking the mouse cursor on screen 'hotspots' to effect the move from one screen to another).

The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

The sample rates required for the displaying of trends shall be software settable with predefined access level and shall typically be as follows:

- One sample every 15 seconds for flow values;
- One sample every 30 seconds for levels;
- The system shall be capable of storing real time data for one day and historic data for 60 days.

The sample rates for archiving shall be the same as for trending. The archives shall be stored in daily files. The system shall provide capacity to store archives for 60 days. A warning alarm shall be provided to the operator to advise that archiving to disk should take place or archived data will be overwritten. It shall be possible to:

- Reintroduce the data derived from archiving to the PC based local SCADA system and the archived data viewed using the trend facility;
- Display the data using industry standard spread sheet or database software in tabular format on a third-party machine.

The Contractor shall provide latest technology (at the time of supply) based industrial Magneto-Optical (MO) disc drive or DAT drive with the PC based SCADA system in order to download archive data or to upload previously stored archive data onto electronic storage media. The MO or DAT disc drive shall be suitably protected against the environment. It shall be built as an integral part of the industrial PC offered for the local SCADA system.

11. Design requirements of the system shall take into consideration following criteria:
 - (1) Fail Safe Design
 - (2) System Availability
 - (3) Equipment Reliability
 - (4) Expandability
 - (5) User friendly to operate and maintain
 - (6) Fault Monitoring and Diagnostic Capability
12. Time Stamping and Synchronization
 - i) Real time clocks shall be provided in all PLCs as well as in the local SCADA stations.
 - ii) The local SCADA system and PLCs shall be synchronized. Further facility shall be provided in local SCADA system to synchronize it's time with Master SCADA system time (in future).

- iii) Time Synchronization with all PLCs in a plant (e.g. WTP) shall be done at start-up and periodically. Contractor shall indicate the corresponding period.
 - iv) The maximum time error at any time between PLCs and the local PC based SCADA system shall not exceed 5 m-sec.
 - v) The time stamping of PLC shall be made available to the local SCADA system for the data, alarms, events etc. logged in database.
13. Test on local SCADA
The following tests for various items of local SCADA system including power supply system shall be carried out as a part of FAT in addition to other tests indicated by Contractor in FAT document.

Functional

All cubicles shall be energized and the power supplies tested on the panel and internal lighting arrangements examined.

The boards shall be examined to check that there are no Status Error LEDs lit.

The peripherals like printers etc. shall be energized and proper operation of peripheral checked by self tests on equipments which have the facilities and others like VDUs, by connecting them to the system.

The system I/O shall be simulated and checked upto LOCAL SCADA system database.

By varying the different inputs at random and checking to ensure that right status reporting is done on the LOCAL SCADA system, the healthiness of all channels shall be checked with rated load connected.

Displays: The following shall be functionally checked

Mimic display: Symbols, colors, for correct/ approved format etc.

Control Operations: Simulated command operations from SCADA without any malfunctioning.

Status changes: Representation of open/close facility and mode of operation

Variables: Engineering units, updating representation

Events and alarms: Generating of alarms, events by verifying inputs at random, color code, formatting, and printing

Trend: proper selection, presentation under different time scales and printing

Reports: Reports shall be checked for correct/ approved format, logging intervals, printing intervals, data accuracy etc.

Response Time Checking:

System response time shall be tested after simulating the full I/O and Man machine interface system.

Time taken from object status change to the presentation of object status on the display.

Time taken to generate and display single alarm and multiple alarms (upto50) from the time of alarm condition.

Time taken to display a complex picture with all variables from the time of calling the display.

The accuracy of alarms on VDU and printer.

Time stamping accuracy between LOCAL SCADA and PLC times.

Other Tests on local SCADA

Fail safe operation of local SCADA system during total (including battery) backed power failure and restoration.

Fail-safe operation during on-line connection and removal of hand-held maintenance unit, if any.

Check of detecting and reporting of failure of subsystem connected to the network on VDU status display.

Check of error free data transfer on Communication system along with modems/communication interfaces.

Check of hard copy unit functions by printing of process pictures.

Check of maintenance, backup (logic/programs, IO database, historical database, system configuration etc.) functions by connecting them to the system.

14. Instrument Control Panel

General

Control Panel shall be CNC machine prefabricated out of CRCA sheet steel of thickness not less than 2 mm, modular in construction, properly reinforced, powder coated and having rigid frame structure. Internal mounting plate including the gland plate shall be 3 mm thick. The control panel shall have dimensions as per system requirement. However, the control panel height shall not exceed 2200 mm.

The exterior corners and edges shall be rounded to give a smooth overall appearance with projections kept to a minimum.

Lifting lugs shall be provided for installation purposes and shall be replaced with corrosion resistant bolts after installation.

Control Panel shall be completely metal enclosed and shall be dust, moisture and vermin proof. Control Panels and instrument enclosures shall provide a degree of protection as follows:

- Indoor Installation: IP 52
- Outdoor Installation: IP 65

Control Panel shall be free standing type. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation.

Metal sills in the form of metal channels properly drilled shall be furnished along with anchor bolts and necessary hardware for mounting the control panels. These shall be dispatched in advance so that they may be installed and leveled when concrete foundations are poured.

Cable entries to the panels shall be from the bottom with fire retardant spray compound sealing. Control panels shall be provided with louvers along with washable micron filters AIRIN – AIROUT fans. The control panels shall be designed for front as well as rear access.

The CP shall provide separate areas for the PLC, internal power distribution, instrumentation, field cabling termination and for Surge protection devices (SPDs).

Mounting

All equipments on front of panel shall be mounted flush or semi-flush. In case of semi-flush mounting, only flange or bezel shall be visible from the front. Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment.

Equipment mounted inside the panel shall be so located that terminals and adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible. Cut-outs and wiring for free issue items, if any, shall be according to corresponding equipment manufacturer's drawing. Cut-outs, if any, provided for future mounting of equipment shall be properly blanked-off. Wherever required, panels/desks shall be matched with other adjacent panels/desks in respect of dimensions, color, appearance and arrangement of equipment on the front.

Earthing for Instruments

The panel shall be equipped with an earth bus securely fixed along the inside base of panel.

All metallic cases of relays, instruments and other panel mounted equipment shall be connected to the instrument earth bus.

Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken shall not be permitted. However, looping of earth connections between equipment to create alternative paths to earth bus shall be provided.

A separate instrument earth bus will be created which will be floating and all the cable shields will be terminated onto this bus. This bus will be connected to an electronic earth pit.

Frame Earthing

All metal parts other than those forming part of an electrical circuit shall be connected to a copper earth bar run along the inside bottom of the panel. The minimum section of the earth bar shall be 25 mm x 3 mm. A 15 mm diameter hole is to be provided at each end of the bar. Connection of the earth bar to the station earth shall be carried out by Contractor.

Space Heater

Strip type space heaters of adequate capacity shall be provided inside control panels to prevent moisture condensation on the wiring and panel mounted equipment when the panel is not in operation. The heaters shall operate on 230 V AC. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. The operation of heaters shall be controlled by thermostats.

Interior Lighting and Receptacles

Each panel shall be provided with a LED lighting fixture rated for 20 watts, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each panel section shall be provided with separate lighting.

Each panel shall be provided with 230V, 1 phase, 50 Hz, combined 5 amps and 15 amps, 3 pin receptacle with a switch and neon indication. The receptacle with switch shall be mounted inside the panel at a convenient location. If the panel has front and rear doors then maintenance socket shall be provided at both locations.

Voltage Level and Power Supply Units

The incoming power supply to the control panel shall be 230 VAC, 50 Hz. Contractor shall provide necessary transformers, converters, inverters and other associated hardware required to generate the requisite power supply. Generally, voltage levels for control schemes and power supply for instruments shall be 24 V DC. Power supply to all the instruments mounted outside the control panel shall be provided from the power supply units in the control panel. In case the instruments require power supply other than 24 V DC, the Contractor shall provide the necessary convertors. The power supply to all the instruments shall be without interruption and shall be continued even in

case of failure of 230 V A.C. power supply. The battery and battery charger shall be provided for this purpose and sizing of the same shall be based on the entire load of instrumentation system.

Level measuring system

Level measurement system shall consist of level transducer, level transmitter, digital level indicator and any other items required to complete the level measuring system.

To reduce the effect of water turbulence in reservoirs / tanks, averaging facility should be provided in the transmitter unit for providing steady readings. Stilling pipe shall be provided for level electrodes.

The design and application of the level measuring system shall take into account the reservoir construction, the material, size, shape, environment, process fluid or material, the presence of foam, granules, size etc.

For ultrasonic type and radar level transducers, the design and installation shall avoid any degradation of instrument performance due to spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and condensation. Facilities shall be provided for rejection of spurious reflection.

The level transmitters shall be mounted in suitable weatherproof lockable pedestal enclosures near the level sensor.

On-line pH Measuring System

- (a) The pH measuring system shall consist of a pH electrode, pH transmitter, digital pH indicator, electrode holder assembly and any other item required to complete the pH measuring system.
- (b) The pH transducer shall be rugged in construction and shall be suitable for continuous operation. pH transducer shall include measuring electrode, reference electrode, and a temperature compensator electrode. All wetted parts of the transducers shall be of non-corrosive material.
- (c) The pH transmitter output shall be isolated, and shall be suitable for transmitting over long distances.
- (d) The electrode holder assembly shall be of such a design that it contains some water even when sampling pump is cut off and shall be provided with flow regulating device.
- (e) A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing pH analyzer equipment and pH transmitter.

<u>I) General</u>		
1	Overall accuracy of measurement loop	±1% of measured value
2	Standard pH solutions for on site calibration	For pH 4,7 and 10 shall be provided
<u>II) pH Sensor</u>		
1	Type	Encapsulated combined electrode
2	Mounting	On flow through assembly
3	Automatic temperature compensation	Required
4	Standard cable for connecting sensor and transmitter	Required
<u>III) pH Transmitter</u>		
1	Type	Indicating type with Back-lit LCD / LCD display
2	Mounting	Field
3	Input	From pH electrodes and temperature compensator
4	Zero and span Adjustment	Required
5	Enclosure material	Non corrosive

6	Enclosure Protection	IP-68 of IS 13947 Part I
7	Output	4 to 20 mA (Isolated) for connecting to pH indicator
IV) Digital pH Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

Online Residual Chlorine meter

Residual chlorine (RCl) measuring system shall consist of RCl transducer, RCl transmitter, digital RCl indicator and any other item required to complete the RC measuring system.

RCl transducer shall be rugged in construction and shall be suitable for continuous operation. RCl transducer shall work on Amperometric/ Colorimetric Principle. It shall also consist of an integral pH sensor for compensating against pH changes and integral temperature sensor for compensating against temperature changes.

A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing RCl analyzer equipment and RCl transmitter.

The RCl sensor enclosure shall be of such a design that it contains some water even when sampling pump is cut off and shall be provided with flow regulating devices.

The RCl transmitter output shall be suitable for transmitting over long distance.

I) General		
1	Overall accuracy of measurement loop	± 5% of measured value
II) Residual Chlorine Sensor		
1	Type	Amperometric/ Colorimetric
2	Automatic Temperature Compensation electrode	Required
3	Automatic pH compensation electrode	Required
4	Range	Adjustable over full span
5	Sensitivity	0.1 mg/Lit
6	Standard Cable Connecting sensor and Transmitter	Required
III) Residual Chlorine Transmitter		
7	Type	Indicating type having back-lit LCD/LED display
8	Mounting	Field
9	Input	From Residual chlorine sensor
10	Output	4-20 mA (Isolated)
11	Zero and Span Adjustment	Required
12	Enclosure material	Non corrosive
13	Enclosure Protection	IP-68 of IS 13947 Part I
IV) Digital Residual Chlorine Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

Online Turbidity Measuring System

Turbidity measuring system shall consist of turbidity detector assembly, turbidity transmitter, digital turbidity indicator, and any other item required to complete the turbidity measuring system

Turbidity detector shall operate on Nephelometric measurement principle. Turbidity detector shall

have ratiometric measurement system and shall be suitable for insertion / flow through type mounting. It shall be possible to calibrate the turbidity meter at site, with a formazine standard or a glass cube.

Turbidity detector shall be rugged in construction and shall be suitable for continuous operation. It shall have an integral bubble trap arrangement.

Turbidity transmitter output shall be isolated and shall be suitable for transmitting over long distances.

A sampling system consisting of sampling pump / pressure reducing valves, flow regulator, rotameter, filter assembly etc. shall be provided. The sample water will be connected to a cabinet containing Turbidity analyzer equipment and turbidity transmitter.

I) General		
1	Overall accuracy of measurement loop	$\pm 2\%$
II) Turbidity Sensor		
1	Type	Optical sensor
2	Material For Wetted Parts	Non corrosive
3	Cleaning Facility	Required
4	Bubble Trap	Required
5	Measuring Principle	Ratio-metric
6	Color Compensation	Required
7	Range setting	Selectable
8	Calibration Standard	Required, Standard Formazine solution or Glass cube.
9	Accessories	
	Standard cable for connecting sensor and transmitter	Required
	Standard Glass cube or formazine solution for calibration	Required
III) Turbidity Transmitter		
1	Type	Indicating with back-lit LCD /LED display
2	Mounting	Field
3	Input	From Turbidity sensor
4	Output	4-20 mA DC (Isolated)
5	Zero and Span Adjustment	Required
6	Enclosure material	Non corrosive
7	Enclosure Protection	IP-68 of IS 13947 Part I
IV) Digital Turbidity Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

Drawings for Instrumentation and SCADA

The following drawings for the instrumentation and control, SCADA and associated communication and power supply systems covered under this specification shall be submitted for review and approval:

Sr. No.	Description
1.0	P&I Diagram

Sr. No.	Description
2.0	Instrument list with tag numbers, range, sizes, makes and model numbers
3.0	Data sheets and catalogues for all instruments, alarm annunciator and instrumentation and control cables
4.0	<u>Control Panel</u>
4.1	Overall dimensional drawing, fabrication details and Bill of material for the instruments mounted on the front facia and inside the control panel.
4.2	Front facia layout showing all instruments with cut-outs and bezel dimensions, construction details and interior G.A. drawings for control panels/ consoles
4.3	Wiring diagram with terminal details of each component, terminal block details, power supply distribution scheme with loads and bill of quantities of all panel mounted instruments for control panels/ consoles.
4.4	Bill of material for the instruments mounted on the front facia and inside the control panel.
5.0	Loop diagrams for all field mounted instruments. (The loop diagram shall contain tag numbers, terminal number, I/O address, cable no. etc.)
6.0	List of alarms provided on alarm annunciator
7.0	<u>PLC System</u>
7.1	Input / Output list for PLC indicating grouping of various signals in each module
7.2	PLC system configuration indicating interfacing
7.3	PLC block logic diagram with descriptive control logic write-up and software program listing
7.4	System hardware details along with bill of material for PLC system
7.5	Screens of Operator Interface Unit (OIU)
8.0	Installation sketches of instruments
9.0	Battery and Battery Charger
9.1	Front facia layout, overall dimensions, wiring diagram, indicating terminal details and bill of quantities for battery charger panels
9.2	Calculation of Ampere Hour capacity for the battery backup.
9.3	Catalogues and Data sheet
10.0	I&C system configuration drawing indicating instruments, PLCs and PC based local SCADA system.
11.0	Functional Design Specification containing summary of the Contractor's proposal for the sequence of operation and design intent (For CWPS and WTP, ESR)
12.0	<u>PC based local SCADA system</u>
12.1	Data sheet and catalogues for PC, printers and DAMS software
12.2	Details of communication protocol and data structure
12.3	Screens of the PC based local SCADA system
13.0	Catalogues, data sheet and sizing calculations for UPS and battery for PC based local SCADA system
14.0	Detailed cable installation layout drawings indicating route of cables, type of laying, etc.

Sr. No.	Description
15.0	Cable Schedules and Interconnection cable schedules
16.0	Operation and maintenance manuals for PLCs, local PC based SCADA system, battery and battery charger panel, UPS and all instruments
17.0	Control room layout drawing
18.0	Data sheets, catalogues, control wiring drawings with terminal details for motorized valve actuators.
19.0	List of spares for I&C system, PC based local SCADA system including power supply systems
20.0	Operation and Maintenance and Instructions Manuals
21.0	As built drawings
22.0	Documents for system training

Inspection requirements

All tests as required, both at the factory i.e. Factory Acceptance Test (FAT) before dispatch, and at site after installation i.e. Site Acceptance Tests (SAT), shall be carried out. Detailed Test reports and certificates shall be submitted. Test reports and test certificates for bought out components shall be submitted for approval by engineer-in-charge. These components shall also be included in the integrated FAT.

The list of tests to be carried for both FAT and SAT along with test instruments to be used shall be furnished with the Bid for review by the Employer's Representative. Contractor shall indicate the place of FAT and the test facilities available.

Prior to testing, all relevant documentation and sufficient briefing about the tests shall be given to Employer's Representatives who would witness the testing.

In addition, testing done during manufacturing and assembly in the factory such as heat run, component testing, circuit testing etc, for similar equipment shall be demonstrated to the Employer's Representative.

Instrumentation and Control

To ensure that a well engineered and contractually compliant system is delivered by the Contractor, the Factory Acceptance Tests (FAT) shall be performed

Factory Acceptance Test (FAT-Applicable for Inspection Category A)

- A Factory Acceptance Test, which shall be witnessed by Employer's Representative, is required for the system. No equipment shall be shipped without written confirmation by the Employer's Representative that the system has successfully passed its factory acceptance test.
- The purpose of the FAT is to qualify the system as meeting all contractual requirements. The test shall verify the performance and functional integrity of the individual subsystems, including active interfaces between subsystems and shall demonstrate the proper operation of equipment/systems.
- Factory Acceptance Tests shall be conducted according to test plan with detailed test procedures. The test plan and procedures shall be submitted by the Contractor for review and shall be subject to approval by the Employer's Representative.
- In order to ensure that the FAT will be successfully and expeditiously completed, it shall commence only after the successful completion of a preliminary FAT (Pre-FAT). The intent is for the Contractor to detect and correct most design, integration and performance problems before the Employer's Representative come to the factory for the FAT. The Pre-FAT shall be supervised by the person designated to serve later as the Contractor's Inspector of the FAT, and each test shall be formally signed off by that person. The signed

- off test results shall be sent to the Employer's Representative for review before the Employer's Representative comes to Contractor's factory for FAT.
- (e) A complete set of system documentation, including design and maintenance documents, user manuals and the test plan and procedures shall be available during the FAT.
 - (f) The list of tests to be carried for both Factory Acceptance Test (FAT) along with test instruments to be used shall be furnished for review by the Employer's Representative. Contractor shall indicate the place of inspection and the test facilities available.
 - i) The testing of all the equipment and accessories shall be carried out as per latest applicable Indian/International standards recommendations.
 - ii) Prior to testing, all relevant documentation and sufficient briefing about the tests shall be given to Employer's Representative's who would witness the testing.
 - iii) The FAT to be performed in the factory shall include but not be limited to following:
 - a) Tests for guaranteed technical parameters
 - b) Integrated functional tests
 - c) Burn-in tests
 - d) Hydrostatic tests
 - e) Calibration tests
 - f) Power supply variation test
 - g) Alarm/Diagnostic check

Tests on Instrumentation System

(1) Type Tests

The Contractor shall submit the test certificates for the 'Type Tests' to the Employer's Representative for approval. The type tests (as applicable) for the instruments shall be as follows:

- 'Burn In' test for electronic components
- Humidity test for electronic instruments
- Weather protection as per IS 13947
- Hysteresis test
- High voltage test
- Short circuit protection test
- Material test

(2) Routine Tests

All instruments shall be subjected to the routine tests (as applicable) mentioned below at the manufacturers works (Factory Acceptance Tests) to ensure correct functioning.

- i. Calibration of the instruments
All the instruments shall be calibrated for accuracies as per applicable standards. The calibration shall be carried out at 0%, 25%, 50%, 75% and 100% of the range of the instrument in both increasing and decreasing directions. The instrument shall be acceptable if the accuracy and repeatability are better than those specified. The instrument used for testing shall hold a valid calibration certificate from a recognized laboratory.

(3) Over range protection test

All transmitters, digital panel meters, digital flow indicator cum integrator shall be subjected to the over range protection test.

(4) Performance test

All the instruments shall be tested by connecting to the specified power supply for the performance test.

(5) Power supply variation test

All the instruments shall work satisfactorily for the specified power supply variation.

Accuracy and linearity shall not change.

(6) Hydrostatic test

All flow sensors and pressure sensors shall be tested to withstand 150% of the rated pressure. The sensitivity, accuracy and calibration of the sensors shall not deteriorate at this over-range. There shall not be physical damage.

(7) Repeatability test

All instruments shall be subjected to repeatability test over the full range at 0%, 25%, 50%, 75% and 100 % of the full range in both increasing and decreasing directions. Readings for each measurement mentioned above shall be taken for establishing the repeatability.

(8) Dimensional check

The dimensions of all the instruments shall be checked thoroughly and shall be tabulated in a good format.

- i. Wherever applicable, following dimensions shall be checked/ noted
 - Total length
 - Insertion length
 - Diameter
 - Mounting head
 - Process connection size etc.
- ii. For panel mounted instruments and transmitters following dimensions shall be checked
 - Width
 - Height
 - Depth

Bezel dimensions and cut-out dimensions for panel mounted instruments etc.

Uninterruptible Power Supply

The Contractor shall provide Uninterruptible Power Supply (UPS) unit for providing power supply to the local SCADA system.

- The UPS shall be sized to **provide 4 hours of full load.**
- The UPS shall have the following features:
- The UPS shall be on-line type and shall be microprocessor controlled. It shall contain a static bypass switch which shall operate in the event of UPS failure, overload or manual initiation in order to transfer the load to mains without interruption to power supply.
- The door of the enclosure shall be in the front.

Note:

- I. All SIM cards to be used in the GSM/GPRS module at each location shall be purchased/procured in the name of concerned CMO only. All expenses related to purchase of SIM cards & Static IP network (central SCADA location) and their installations, activation etc. and data/tariff expenses etc. during O&M period shall be borne by the contractor. No extra cost shall be paid by the department. The department will only assist and provide necessary documentation for purchasing of SIM cards.
- II. GPRS Router at each remote site must be capable of carrying two SIM Cards each from different ISP. Router must keep watch on the service availability and should switch between the ISP's based on their network availability. It should follow the Primary & Secondary philosophy for switching or fall back on Primary Service Provider. All remote GPRS routers should support dynamic IP assignments from ISP's, based on Public as well as Private APN Configurations.
- III. The PLC-SCADA software should have provision of report generation tool to store the WTP plant, pumping stations, overhead tanks, MBRs, DMA locations data periodically in MS excel/PDF format for water quality analysis of current & past periods as well as smooth operation of plant machinery. The SCADA system should have provision of data

logging facility of following parameters of WTP, RWPH, CWPH, OHTs, MBRs, DMAs but not limited.

- a) Flow (Instantaneous & Total) through flow meters.
- b) Pressure through all the Pressure Transmitters
- c) Level through all the Level Transmitters
- d) Water quality parameters (PH, Turbidity, Chlorine etc....) at WTP inlet for Raw water, WTP outlet for clear water & Overhead tanks outlet for clear water.
- e) Monitoring of running hours of all the motors.
- f) Monitoring / data logging of Energy management system for KW, KVA, KVAR, A, V, PF, winding temperature of motor, vibration etc.

IV. Contractor shall hand over the SCADA design & Drawings, Engineering Logix, Screens, I/O list, Tags, passwords.

V. **CCTV cameras:** -Supply, installation, testing and commissioning of day/night surveillance cameras near the security guard room, Pump floor level of Sump well, Motor floor level and Electrical Panel, WTP clarifloculator, filter house, Chemical house, WTP entrance gate, Clear water pump house, PLC -SCADA room & all OHSRs. The cameras shall be placed in such a manner so as to cover the entire area required to be secured. The system will be used for monitoring at a predetermined place within the plant. The proposed surveillance system shall consist of camera and DVR (Digital Video Recorder). The DVR unit should direct recording of cameras in real time. The resolution of the picture should be high and have clarity in pictures. Multiple monitors should be used for effective monitoring. The operator should have the facility to choose any given camera for viewing on the other monitor. Each image should be recorded with a camera number, title, time, date and recording speed. The contractor shall provide the data sheet and number of cameras to the Employer for approval.

I. General and Specific requirements: -

- a) Design, Supply, Laying, Installation, Testing, Implementation and successful Commissioning of CCTV surveillance system at Raw water Pumping Station, WTP, Clear water pumping station and all OHSRs is in the scope of contractor and deemed to be included in the Lump-sum offer.
- b) The surveillance system is required to ensure effective surveillance of Raw water Pumping Station, WTP, Clear water pumping station and all OHSRs as well as to create a tamper proof record for post event analysis.
- c) The System shall provide an online display of video images on TFT monitors located in control room.
- d) System should facilitate viewing of live and recorded images of all Cameras by the authorized users
- e) System should provide inter-operability of hardware, OS, software, networking, printing, database connectivity, reporting and communication protocols.
- f) System expansion should be possible through off-the-shelf available hardware.
- g) The Indoor CCTV cameras shall be installed at strategic locations in Sump well, filter house, Clear water pumping station, MCC room, chemical house floor and PLC/SCADA control room etc.
- h) Outdoor CCTV camera shall be installed at Gate Entry/Exit WTP & Sump well, Clarifloculator & all OHSRs.

- i) Interlinking of CCTV system at Sump well, WTP, clear water pump house and all OHSRs shall be provided, server of CCTV at Central SCADA room or any other location shall be decided by the Engineer in Charge.
- j) All the equipments of CCTV namely Indoor/outdoor cameras, DVR and monitoring software shall be of one make only.
- k) Manufacturer products shall have quality system compliance with the ISO/BIS etc.
- l) All the CCTV products quoted must be UL approved or equivalent
- m) All the equipments of external fitment and should be IP-66 complied.
- n) Manufacturer must provide reference list of installation for similar products/ components.
- o) All software and firmware upgrades shall be free of charge.
- p) The entire indoor and outdoor CCTV camera shall be IP based and can be monitor from central room with internet.

II. Technical Specifications: -

- a) This section of the specifications includes the furnishing, installation, and connection of the CCTV system equipment required to form a complete coordinated system ready for operation. CCTV system shall comprise of the following: -
 - IP CCTV CAMERA
 - 1/3-inch CCD sensor,
 - Day/Night Colour Camera,
 - High sensitivity 0.001 Lux
 - 540 TVL resolution
 - CS Lens Mount (max lens protrusion 5mm, 0.2 inch),
 - Night sense with S/N ratio of >50 dB & Autogain (maximum level selectable to 28 dB),
 - Operating temperature with LENS 1/3", 3 to 9 mm F1.4 IR corrected lens with Outdoor weather proof housing.
 - UL approved or equivalent.
- b) Digital video recorder
 - 16 channel Hybrid DVR with 2 TB hard disk
 - Real time recording and playback in genuine 4 CIF resolution
 - Advanced H.264 hardware is compression
 - Pre alarm recording upto 120s. 2 spot monitor outputs
 - Hybrid DVR supports up to 16 analogue and 16 IP cameras upto 16 alarm inputs and 10 relay outputs. UL approved or equivalent
- c) TFT Monitor
 - Screen diagonal: 50"
 - Display: XGA or better
 - External controls: Brightness, Contrast, etc.
 - Power Supply: 240V AC, 50Hz, 1 Phase
 - Ambient temperature: 0-50°C & Humidity: 95% non-condensing.

- Version: Tosuit industrial application
- Power cable (3x1.5sq.mm.)
- Video cable (RG11 Armored), GI conduit

III. Data Sheet of CCTV camera: -

Sr.no	Description	Particulars
1	Make	As per approved vendor list
2	Service/Applications	Capturing Image in premises area
3	Image sensor	1/3-inch Digital CCD sensor with Dynamic range.
4	High sensitivity LIX level	0.001
5	Type of camera	Colour fixed Day/Night Camera.
6	Switching system for IR filter at day/Night	Auto
7	Resolution	540TVL
8	Mounting	Specify during detail engineering
9	Night sense with S/N ratio	>50dB with Auto gain control.
10	Picture element	Specify during detail engineering
11	Input Voltage	12V SPMS
12	Power consumption	>4 Watt
13	Ambient temperature & relative Humidity	50°C & more than 95%
14	Qty	Specify during detail engineering
15	Protection	IP-66

IV. Data sheet of Digital video manager: -

Sr.no	Description	Particulars
1	Make	As per approved vendor list
2	Service/Applications	Recording of Video appears in all CCTV areas
3	Image sensor	1/3-inch Digital CCD sensor with Dynamic range.
4	Video input	16 Analog + 16 I/P
5	Resolution	Specify during detail engineering
6	Remote connection	LAN/WAN/TCP/IP
7	Network connection	RJ-45
8	Audio channel	2 Nos
9	Alarm input & output	16 & 4
10	Ambient temperature & relative Humidity	50°C & more than 95%
11	Power supply	96 to 265 VAC
12	Model no	Specify during detail engineering

13	Computersystem	
a	Monitor	TFT50”inch,
b	Make	As per approved vendor list
c	Harddisk	2 TB hard disc
d	Qty	1No
14	Power supply unit	12Volt DC from SPMS
15	UL approved	Required

Operation and Maintenance

The contractor shall provide 9 Months spares at the SCADA station proper upkeep of the SCADA automation station. List of spares shall be as follows:

For any one day non functioning of the SCADA system will result in the deduction of 1/30th of the monthly payment due to the contractor.

Atleast two trained supervisors shall be deputed by the contractor for proper functioning and preparation and supervision of the daily reports indicating treatment efficiency of each unit Daily reports shall be submitted to the Engineer in Charge.

ANNEXURE – E-7
WORK & SPECIFICATION FOR ALLIED WORKS

- (1) The scope of work includes Engineering, Procurement, and Construction. testing Commissioning, trialrun of following works:

- (i) Panel rooms at each OHTs locations (Proposed and Existing) inclusive of all associated civil, mechanical, Electrical and finishing works as per approved drawings)
- (ii) Preparation of As-built drawings after completion of the all the works, duly approved by the Engineer-in-charge.

Preparation and submission of “As Built Drawings” for approval of the Engineer-in-charge.

All works shall be executed as per the directions of the Engineer-in-charge.

- 1.1. Design and Drawings: The contractor shall have to submit his own design for all works under this sub work showing plan elevation and section and the design of Panel room drawing and items it wants to incorporate in the said works and execution thereof. Detailed calculations and drawings shall have to be submitted by him for scrutiny within a month from the date of issue of work order. Detailed designs shall include calculations for foundation for RCC work and for other structures provided in the drawings. The responsibility for the designs, constructions structural stability shall however rest solely with the contractor and he shall have to make good any damage or loss to the govt. due to defects if any in the above mentioned or any other work carried out by him. The contractor shall submit four sets of completion drawings immediately after completion of the work.
- 1.2. The complete guidance as to the pattern of landscaping shall be obtained from Engineer-in-charge who will earmark the positions of structures in available land in consultation of all concern and the available space left for landscaping and area beautifications fall under this sub work, which is binding to the contractor.

1.3. SPECIFICATIONS GOVERNING BUILDING WORKS AND SUCH ITEMS
ITEM OF EXCAVATION IN ALL TYPES OF SOFT AND HARD STRATA
GENERAL

The Excavation shall be applicable for all types of strata by manual / machine means. The item will also includes bailing out of water by manually or pumps to keep the trenches reasonably dry for all further works of foundation.

The item includes all shoring and strutting that may be required during as per drawing excavation, and for this purpose shoring and strutting shall also be carried out by the contractor.

1.4. ITEM OF PLAIN / REINFORCED CEMENT CONCRETE

PROPORTIONS OF CONCRETE FOR TYPES OF WORK

- i) M-10 – For leveling course and foundation of building footing etc.
- iii) M-25 for Construction of foundation in framed structure of Quarters and Compound Wall

GENERAL SPECIFICATIONS OF THIS WORK SHALL BE AS PER STANDARD

SPECIFICATION OF PUBLIC WORKS DEPARTMENT

SAND AND METAL

All fine aggregate shall confirm to IS 383 and test for conformity shall be carried out as per IS 2386 (Part I to VIII). The finess modulus of fine aggregate shall neither be less than 2 nor be greater than 3.5.

Well graded B. T. metal confirming to IS 383 shall be used. Tests for conformity shall be carried out as per IS 2386 (Part I to VIII).

CEMENT

Ordinary Portland cement confirming to IS of 43 grade / 53 grade shall only be used. 43 grade cement shall be as per IS 8112-1989 and 53 grade shall be as per IS 12269 – 1987. Every batch of cement delivered at site should accompany the manufacturer's test certificate. In addition to this, cement samples from each batch shall be got tested by Engineer at cost of contractor from approved testing laboratory.

REINFORCEMENT

The contractor has to procure the M.S. reinforcement bars from open market at his cost. Re-rolled steel bars will not be accepted. The bars shall be scrapped thoroughly for removing any scale, rust, etc. before use in work. Bars that may be found defective in any way shall not be allowed to be used. The reinforcement is to be fabricated and placed in position as per the approved design

COVER BLOCKS

For bottom covers of beams, slabs etc. separators or cover blocks of precast cement mortar of suitable size with wire embedded as directed will be used and tied to the reinforcement bars between layers of reinforcement.

CONCRETE

The PCC / RCC works shall be as per IS 456-2000. Design mix M-20 and M-25 shall be used for construction as specified. Minimum cement consumption for M-20 and M-25 concrete shall be 350 Kg/cum and 375 Kg/cum respectively. Mix design shall be prepared by the contractor and got approved from Proof Consultants or approved testing laboratory.

WATER

The water shall be used as per clause IS 456-2000. The pH of water shall be in the range of 6.5 to 8.00

MIXING

Normally the standard cement consumption will be as under for one cum of concrete with finishing.

1:3:6(M-10)	1:2:4 (M-15)	1:1.5:3 (M-20)	1:1:2 (M-25)
4.40 bags	6.40 bags	7.9 bags	8.90 bags

For any other mix the cement consumption shall be decided by the Engineer. The consumption is mentioned above shall be for the gross RCC work actually cast. The cement required for finishing, rendering cement wash etc. should be in addition to above.

Concrete laying

The forms shall first be lightly moistened before laying concrete. The concrete shall be placed in position within 20 minutes after adding water to the mix and shall be slowly deposited in it place and not thrown or dumped from a height shall be placed in uniform layers. For vertical wall of water retaining structure, water stoppers shall be provided.

Tamping, ramming and consolidating

For all R.C.C. works, which are considered by the Engineer to be important mechanical

vibrators, shall be invariably used by the contractor at his cost. The contractor shall provide at least 2 vibrators in good working condition, so as he has one as a stand by and to prevent interruption in work. The concrete being laid shall be vigorously vibrated during laying and also rodded by bars where vibrator can not reach so that dense and complete fillings are assured. The contractor shall make his own arrangement for procuring vibrators at his cost.

Curing

All R.C.C. work will be watered and kept constantly wet for 28 days after initial set casting by means of wet gunny bags and ponding as directed by the Engineer-in-charge. This operation shall start immediately after initial set of the concrete. Should the contractor fail to water the concrete continuously it may be done by the department immediately at contractor's cost. Any defect observed due to lack of proper curing of concrete shall be rectified / work redone by the Contractor at his cost.

Removal of form

It shall be generally as under subject to the written approval and modification by the Engineer-in-charge.

Vertical form works to walls, beams	16-24 hours
Soffit form works to slabs (prop.to be refixed immediately after removal of formwork)	3 days
Soffit form works to beams (prop.to be refixed immediately after removal of formwork)	7 days
1. Spanning up to 4.5 m.	7 days
2. Spanning over 4.5 m.	14 days
1. Spanning up to 6.0 m.	14 days
2. Spanning over 6.0 m.	21 days

1.5. Item of tor steel Reinforcemet for RCC works

- The item provides for supply of **Tor Steel bars**, cutting, bending, binding with wire and placing in position.
- For plain and reinforced cement concrete works, the reinforcement steel shall consist of following grades of reinforcing bars.

Grade Designation	IS Specification	Strength (Mpa)	Elastic Modulus
T.M.T.	I.S.1786	500	200

- The binding wire shall confirm to Specification A-15 of Standard Specification of Public Works Department, Latest Edition.
- Bending reinforcements confirm accurately to the dimensions and shapes in the details drawings (approved) or as directed by the Engineer-in-charge.
- Bars shall be bend cold only. In no way bending by heat will be allowed.

Bard with kinks, bends or cracks shall not be used.

Details of length, size, laps and bending diagram shall be got approved from the Engineer.

As far as possible full length of bars shall be placed as per drawing details. When full

lengths are not available, bars with short lengths be supplies only after written permission of the Engineer. Bars shall be lapped as specified in IS: 456-2000 with due regards to the grade of concrete. Welding may be used for large diameter of bar only after permission of Engineer.

Welding, if permitted shall conform to PWD specifications.

All reinforcement shall be accurately placed in position with spacing and cover shown in detailed drawing and firmly held during the placing and setting of concrete. Bars shall be tied at all intersections. Binding wire of 1.63 mm or 1.22 mm diameter (about 16 or 18 gauge) shall be used. Spacing of the bars shall be maintained by means of stays, blocks, ties, spacers, hangers or other approved supports at sufficient close intervals so that bars will not be displaced during placing. Vibrating or compacting concrete, placing bars for reinforcement on a layer of fresh concrete, as the work progress will not be permitted. The use of pieces of broken stones or bricks or wooden blocks for maintaining spacing or cover shall not be permitted. Layers of bars shall be separated by precast cement blocks, spacer bars or other devices.

Full details of numbers, sizes, lengths, weights, laps, welds, spacing of bars placed in position in different parts of the work shall be recorded by the contractor and furnished to the Engineer or his representative to show that all reinforcement has been placed correctly as per sanctioned drawing or as directed by the Engineer in writing before placing concrete. No concrete shall be placed in position until the correctness of reinforcement is checked by the Engineer and has given permission in writing to place concrete. Even after approval of reinforcement as above, it will be the contractor's responsibility to seal that the spacing of reinforcement and arrangements are not tampered with in any way before or during concreting.

The contractor has to supply required steel. He shall produce the test certificate. In addition, actual test shall be carried out according to IS : 432 – 1982 in an approved Proof Consultants or test laboratory and the cost of test shall be borne by the Contractor including all transport etc.

The items includes ...

- a) Cost of labour materials, use of tools, plant and tackle and other incidental items to complete the work satisfactorily.
 - b) Supplying, conveying, cleaning, cutting, bending, binding with (1.63 mm or 1.22 mm diameter – 16 to 18 gauge) wire on spot welding and placing reinforcement in position and maintaining it clean and in position till the concrete is laid.
 - c) Cost of sampling and testing as required.
14. In no case, any foreign material e.g., oil, grease, etc., which prevent bonding between steel and concrete, shall remain on steel-on-steel bars during placing of concrete.

1.6. ITEM OF REFILLING

- 1** After concreting work refilling with available excavated stuff shall be done.

The available excavated stuff shall be laid in layers of 15 cm to 20 cm. Each layer shall be watered and compacted before the upper layer is laid till the required level is reached.

The filling shall be done 30 to 40 cms above natural ground level.

Sinking below the road or ground level, if noticed till the completion of work, shall have to be levelled by the Contractor at his cost.

This item includes....

- a. Cleaning useful excavated material, braking of clods, Removal of stone. Etc.
- b. Conveying the useful excavated material up to 200 M and filling in layers, watering and compacting.
- c. All labour, equipment and other arrangements necessary for the satisfactory compaction and completion of the item.

Surplus excavated material is the property of CMO NAGAR PANCHAYAT/COMPETENT AUTHORITY. Therefore, the contractor is not empowered to sell this excavated material to any other agency. However, as per instructions of the Engineer, the Contractor at the place indicated by the Engineer shall dispose off such surplus material.

This disposal will not be considered for initial 200 M lead and so will not be paid for.

The material shall be conveyed by means of suitable devices/manner.

The material conveyed to the place of disposal shall either be stocked or spread as directed by Engineer-in-charge or his representative.

1.7. ITEM OF M. S. GRILL WORK

i. GENERAL

The item provides for mild steel grill prepared to the designs shown in the drawings or as directed by the Engineer, for fixing to windows, ventilators, gates etc., including the specified mild steel sections, fabrication, fixing in the frame, fixtures and painting with three coats of oil paint of approved shade.

ii. MATERIALS

The mild steel sections as mentioned in the item shall comply with the relevant PWD specifications. The sections shall be squares, flats, rounds, etc. of the specified dimensions shown in the drawings or as directed by the Engineer. Standard screws, rivets, welding rods etc. shall be used.

Oil paint shall comply with the PWD specifications. The priming coat shall be of read led and the other two coats shall be of a shade approved by the Engineer.

a. CONSTRUCTION

The fabrication of the specified sections of mild steel shall be according to the PWD specifications.

The grill shall be fabricated to the designs and patterns shown in the drawings or as directed by the Engineer, the weight corresponding to that mentioned in this item and the joints shall be riveted and welded as directed by the Engineer. The grill so formed shall be fixed into the frames of windows, ventilators, etc., before they are erected in position. The out side strip frame of the grill shall be housed to its full thickness into the recess cut into the frame of the windows, ventilators etc. The grill shall be fixed to the frame with screws at the rate of 1 screw per 30 cm of the length of the outer strip subject to a minimum of 2 nos. in each side of the frame or as indicated in the drawings. The screws shall be

countersunk and shall be fixed with the tops of their heads flush with the outer face of the frame strip.

The grill shall be painted with one coat of red lead oil paint and 2 coats of oil paint of approved shade when the entire work is completed. Painting shall confirm to the PWD specifications

b. ITEM TO INCLUDE

- All materials such as mild steel sections of specified sizes, oil paints, screws, rivets, welding rods etc. including wastage for completing the item satisfactorily.
- All labour for cutting grooves in the frame fabrication of the grill by riveting and welding, fixing the grill into the frame, painting, hoisting, erection etc. for completing the item satisfactorily.
- Use of tools and equipments necessary for the job.

ITEM OF B. B. MASONRY IN SUPERSTRUCTURE

DESCRIPTION

This work shall consist of construction of structures with bricks jointed together by cement mortar in accordance with the details shown on the Drawings or as approved by the Engineer.

APPLICABLE CODES

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable.

In all cases, the latest revision of the codes shall be referred to:

- IS - 1077 Specifications for common burnt clay building bricks
- IS - 1200 Measurements for Building works
- IS - 1725 Specifications for solid cement blocks used in general building construction
- IS - 1905 Code of practice for structural safety of buildings: Masonry walls.
- IS - 2116 Sand for masonry mortars
- IS - 2180 Specification for heavy duty burnt clay building bricks
- IS - 2185 Specification for concrete masonry units: Hollow and solid concrete blocks
- IS - 2212 Code of practice for brick work
- IS - 2222 Specification for burnt clay perforated building bricks
- IS - 2691 Specification for burnt clay facing bricks
- IS - 3115 Specification for lime-based blocks
- IS - 3414 Code of practice for design and installation of joints in buildings
- IS - 3466 Specification for masonry cement
- IS - 3861 Method of measurement of plinth, carpet and rentable areas of buildings.
- IS - 3952 Specification for burnt clay hollow blocks for walls and partitions
- IS - 4098 Specification for lime-pozzolana mixture
- IS - 4139 Specification for sand lime bricks
- IS - 4441 Code of practice for use of silicate type chemical resistant mortars.
- IS - 4442 Code of practice for use of sulphur type chemical resistant mortars

Others I.S. Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes form part of these Specifications.

MATERIALS

All materials to be used in the work shall confirm to the standard requirements laid down

in PWD Specifications.

PERSONNEL

Only trained personnel shall be employed for construction and supervision.

CEMENT MORTAR

Cement and sand shall be mixed in specified proportions given in the Drawings. Cement shall be proportioned by weight, taking the unit weight of cement as 1.44 tonne per cubic metre. Sand shall be proportioned by volume taking into account due allowance for bulking. All mortar shall be mixed with a minimum quantity of water to produce desired workability consistent with maximum density of mortar. The mix shall be clean and free from injurious type of soil/acid/alkali/organic matter or deleterious substances.

The mixing shall preferably be done in a mechanical mixer operated manually or by power. Hand mixing can be resorted to as long as uniform density of the mix and its strength are assured subject to prior approval of the Engineer. Where permitted, specific permission is to be given by the Engineer. Hand mixing operation shall be carried out on a clean water-tight platform, where cement and sand shall be first mixed dry in the required proportion by being turned over and over, backwards and forwards several times till the mixture is of uniform colour. Thereafter, minimum quantity of water shall be added to bring the mortar to the consistency of a stiff paste. The mortar shall be mixed for at least two minutes after addition of water.

Mortar shall be mixed only in such quantity as required for immediate use. The mix which has developed initial set shall not be used. Initial set of mortar with ordinary Portland Cement shall normally be considered to have taken place in 30 minutes after mixing. In case the mortar has stiffened during initial setting time because of evaporation of water, the same can be retempered by adding water as frequently as needed to restore the requisite consistency, but this re-tampering shall not be permitted after 30 minutes. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.

SOAKING OF BRICKS

All bricks shall be thoroughly soaked in a tank filled with water for a minimum period of one hour prior to being laid. Soaked bricks shall be removed from the tank sufficiently in advance so that they are skin dry at the time of actual laying. Such soaked bricks shall be stacked on a clean place where they are not contaminated with dirt, earth, etc.

JOINTS

The thickness of joints shall not exceed 10 mm. All joints on exposed faces shall be tooled to give concave finish.

LAYING

All brickwork shall be laid in an English bond, even and true to line, in accordance with the Drawing or as directed by the Engineer, plumb and level and all joints accurately kept. Half and cut bricks shall not be used except when necessary to complete the bond. Closer in such cases shall be cut to the required size and used near the ends of the walls. The bricks used at the face and also at the angles forming the junction of any two walls shall be selected whole bricks of uniform size, with true and rectangular faces.

All bricks shall be laid with frogs up on a full bed of mortar except in the case of tile bricks. Each brick shall be properly bedded as set in position by slightly pressing while laying, so that the mortar gets into all their surface pores to ensure proper adhesion. All

head and side joints shall be completely filled by applying sufficient mortar to brick already placed and on brick to be placed. All joints shall be properly flushed and packed with mortar so that no hollow spaces are left. No bats or cut bricks shall be used except to obtain dimensions of the different courses for specified bonds or wherever a desired shape so requires.

The brick work shall be built in uniform layers, and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. Corners and other advanced work shall be raked back. Brickwork shall be done true to plumb or in specified batter. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate courses shall come directly one over the other. During construction, no part of work shall rise more than one metre above the general construction level, to avoid unequal settlement and improper jointing. Where this is not possible in the opinion of the Engineer, the works shall be raked back according to the bond (and not toothed) at an angle not steeper than 45 degrees with prior approval of the Engineer. Toothing may also be permitted where future extension is contemplated.

Before laying bricks in foundation, the foundation slab shall be thoroughly hacked, swept clean and wetted. A layer of mortar not less than 12 mm thick shall be spread on the surface of the foundation slab and the first course of bricks shall be laid.

JOINTING OLD AND NEW WORK

Where fresh masonry is to join the masonry that is partially/entirely set, the exposed jointing surface of the set masonry shall be cleaned, roughened and wetted, so as to effect the best possible bond with the new work. All loose bricks and mortar or other material shall be removed.

In the case of vertical or inclined joints, it shall be further ensured that proper bond between the old and new masonry is obtained by interlocking the bricks. Any portion of the brickwork that has been completed shall remain undisturbed until thoroughly set.

In case of sharp corners specially in skew bridges, a flat cutback of 100 mm shall be provided so as to have proper and bonded laying of bricks.

CURING

Green work shall be protected from rain by suitable covering and shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. Top of the masonry work shall be left flooded with water at the close of the day. Watering may be done carefully so as not to disturb or wash out the green mortar.

During hot weather, all finished or partly completed work shall be covered or wetted in such a manner as will prevent rapid drying of the brickwork.

During the period of curing of brick work, it will be suitably protected from all damages. At the close of day's work or for other period of cessation, watering and curing shall have to be maintained. Should the mortar perish i.e., become dry, white or powdery, through neglect of curing, work shall be pulled down and rebuilt as directed by the Engineer. If any stains appear during watering, the same shall be removed from the face.

SCAFFOLDING

The Scaffolding shall be sound, strong and safe to withstand all loads likely to come upon it. The holes which provide resting space for horizontal members shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled with dense concrete and made good. Scaffolding shall be got approved by the Engineer. However, the Contractor shall be responsible for its safety.

EQUIPMENT

All tools and equipment used for mixing, transporting and laying of mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

FINISHING OF SURFACES

General

All brickwork shall be finished in a workmanlike manner with the thickness of joints, manner of striking or tooling as described in these above Specifications.

The surfaces can be finished by “joining” or “pointing” or by “plastering” as given in the Drawings.

For a surface which is to be subsequently plastered or pointed, the joints shall be squarely raked out to a depth of 15 mm, while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

The mortar for finishing shall be prepared as per PWD specifications.

Jointing

In jointing, the face of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work. The faces of brick work shall be cleaned to remove any splashes of mortar during the course of raising the brick work.

Pointing

Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the Drawing. The mortar shall be filled and pressed into the raked joints before giving the required finish. The pointing shall be ruled type for which it shall, while still green, be ruled along the centre with half round tools of such width as may be specified by the Engineer. The super flush mortar shall then be taken off from the edges of the lines and the surface of the masonry shall be cleaned of all mortar. The work shall conform to IS: 2212.

Plastering

Plastering shall be done where shown on the Drawing. Superficial plastering may be done, if necessary, only in structures situated in fast flowing rivers or in severely aggressive environment.

Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering while the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 to 4 meters apart, to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster's float and pressing the mortar so that the raked joints are properly filled. The plaster shall be finished off with a wooden straight

edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and sideways motion 50 mm to 75 mm at a time. Finally, the surface shall be finished off with a plasterer's wooden float. Metal floats shall not be used.

When recommencing the plastering beyond the work suspended earlier, the edges of the old plaster shall be scrapped, cleaned and wetted before plaster is applied to the adjacent areas.

No portion of the surface shall be left unfinished for patching up at a later period.

The plaster shall be finished true to plumb surface and to the proper degree of smoothness as directed by the Engineer.

The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than the specified by more than 3 mm.

Any cracks which appear in the surface and all portions which should hollow when tapped, or are found to be soft or otherwise defective, shall be cut in rectangular shape and re-done as directed by the Engineer.

Curing of Finishes

Curing shall be commenced as soon as the mortar used for finishing has hardened sufficiently not to be damaged during curing. It shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages.

Scaffolding for Finishes

Stage scaffolding shall be provided for the work. This shall be independent of the structure.

ACCEPTANCE OF WORK

All work shall be true to the lines and levels as indicated on the Drawing or as directed by the Engineer, subject to tolerances as indicated in these Specifications.

Mortar cubes shall be tested in accordance with IS: 2250 for compressive strength, consistency of mortar and its water retentivity. The frequency of testing shall be one sample for every 2 cubic metres of mortar, subject to a minimum 3 samples for a day's work.

1.8. ITEM OF EXTERNAL SAND FACED PLASTER

Sand Faced plaster comprises of a mixture of sand and gravel in specified proportions dashed over a freshly plastered surface.

SCAFFOLDING

For all exposed brick work or tile work, double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for

scaffolding purposes shall be filled and made good before plastering.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

PREPARATION OF SURFACE

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced. In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

MORTAR

Mortar of specified mix using the type of sand described in the item shall be used, where coarse sand is to be used, the fineness modulus of the sand shall not be less than 2.5 mm.

APPLICATION OF PLASTER

The plaster base over which rough cast finish is to be applied shall consist of two coats, under layer 12 mm thick and top layer 10 mm.

Ceiling plaster shall be completed before commencement of wall plaster.

Plastering shall be started from the top and worked down towards the floor. All put-log holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beaten with thin strips of bamboo about one metre long to ensure through filling of the joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or sandy granular texture is required. Excessive troweling or over working the float shall be avoided. During this process, a solution of lime putty shall be applied on the surface to make the later workable.

All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arrises, provision of grooves at junctions etc., where required shall be done without any extra payments. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with lime putty before plaster is applied to the adjacent areas, to enable the two to properly joint together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages.

No portion of the surface shall be left out initially to be patched up later on.

Top layer

The top layer shall be applied a day or two after the under layer has taken initial set. The latter shall not be allowed to dry out, before the top layer is laid on. The mortar used for applying top layer shall be sufficiently plastic and of rich mix 1:3 (1 cement, 3 fine sand) or as otherwise specified so that the mix of sand and gravel gets well pitched with the plaster surface. In order to make the base plastic, about 10 % of finely grinded hydrated lime by volume of cement, shall be added when preparing mortar for the top layer.

FINISH

It shall be ensured that the base surface which is to receive cast mixture is in plastic state. The rough cast mixture shall consist of sand or gravel or crushed stone of uniform colour from 2.36 mm to 12.5 mm or as specified and in the proportions as specified accurately to the effect required. The mixture shall be wetted and shall be dashed on the plaster base in plastic state by hand scoop so that the mix gets well pitched into the plaster base. The mix shall again be dashed over the vacant spaces if any so that the surface represents a homogeneous surfaces of sand mixed with gravel. A sample of rough cast plaster shall be got approved by the Engineer.

PRECAUTIONS

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer.

When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly, when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green. To prevent surface cracks appearing between junctions of column/beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be made separately.

1.9. ITEM OF FLOORING

- All building works shall be of Vitrified tiles (60 cm x 60 cm)
- For Stairs –Granite shall be used
- Pump house shall be of Ironiteflooring
- Chlorine & Alum -Kota stone shall be used

1.10. TOLERANCE

- Tolerances on length and breadth shall be plus or minus one millimeter, and tolerance on thickness shall be plus 5 mm. The range of dimensions in any one delivery of tiles shall not exceed 1 mm on length and breadth and 3 mm on thickness.
- The tiles shall be manufactured in a factory under pressure process subjected to hydraulic pressure of not less than 140 kg per square centimeter and shall be given the initial grinding with machine and grouting of the wearing layer before delivery to site. The wearing layer shall be free from projections, depressions, depressions, cracks, holes, cavities and other blemishes. The edges of wearing layer may be rounded.
- The proportion of cement to aggregate in the backing of tiles shall be not leaner than 1:3 by weight. Where colouring material is used in the wearing layer, it shall not exceed 10 per cent by weight of cement used in the mix.

- The finished thickness of the upper layer shall not be less than 5 mm for size of marble chips from the smallest upto 6 mm and also, not less than 5 mm for size of marble chips ranging from the smallest upto 12 mm, and not less than 6 mm for size of marble chips varying from the smallest upto 20 mm.

1.11. LAYING

The ingredients shall be thoroughly mixed by volume in dry form. Care shall be taken to ensure that there are no hard lumps present. Water shall then be added and the ingredients thoroughly mixed.

The bedding for tiles shall be cement mortar 1:3 (1 cement: 3 coarse sand) bedding may also be used with prior approval of the Engineer.

The average thickness of the bedding mortar shall be 30 mm and the thickness at any place shall not be less than 10 mm.

The surface of the flooring during laying shall be frequently checked with a straight edge atleast 2 metres long, so as to obtain a true surface with the required slope.

Where full tiles of half tiles cannot be fixed, tiles shall be cut (sawn) from full tiles to the required size and their edges rubbed smooth to ensure a straight and true joint;

Tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without waviness.

After the tiles have been laid, surplus cement grout that may have come out of the joints shall be cleared off.

CURING, POLISHING AND FINISHING

The day after the tiles is laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with filler of same colour as that of tiles. If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when topped with a wooden mallet.

1.12. ITEM OF WATER PROOF CEMENT PAINT

GENERAL

This specification lays down the requirement of applying cement-based paint in specified coats to concrete or masonry surface.

MATERIALS

Cement paint with a base of white Portland cement of approved manufacture. Colour and shade shall be used. Approval quality cement-based paint shall be brought to site in original air tight containers with seal intact.

SCAFFOLDING

Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed.

For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

For white washing the ceiling, proper stage scaffolding shall be erected.

PROTECTIVE MEASURES

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashings and droppings, if any shall be removed by the Contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the Contractor.

PREPARATION OF SURFACE

The surface to be painted shall be cleaned of all loose dust, and dirt paints and all cracks, holes and surface defects shall be repaired with cement plaster cured and allowed to set hard. Before the painting is commenced the surface is wetted well and water is allowed to run off. Any grease, oil paint, shall be removed by approved methods.

APPLICATION OF PAINT

Mixing of paint and procedure of painting shall be as specified by the manufacture when no specification is following specification shall be generally applying.

The dry cement shall be thoroughly mixed with clean fresh water to produce paint of required consistency (normally that of ordinary paints). The paint shall be kept stirred and used within one hour of mixing hardened or damaged paint shall not be used. Brushes in the manner specified by the manufacturer shall apply the paint.

The number of coats is specified elsewhere of the item. When more than one coat is to be given the subsequent coats shall be applied after the preceding coat has thoroughly hardened inspected and approved.

Only emulsion paint is to be used.

CURING:-

Each application of paint should be wetted at the end of the day with a fine water spray, depending on climatic conditions. Wetting shall be done only after an interval of at least 6 to 8 hours after the applications. In dry weather the painted surfaces shall be kept dump for at least two days and provided from direct sun.

1.13. ITEM OF ALUMINUM WINDOWS AND VENTILATORS

ALUMINIUM WINDOWS AND VENTILATORS Aluminium Windows and ventilators shall conform to IS:733, IS 1948, IS:1949, and IS:1081 shall be as per drawings issued by the Engineer. The contractor shall submit for EIC's (Engineer-in-charge) approval the shop drawings covering all dimension details of fabrication, construction and installation. After approval of shop drawings, the contractor shall submit one or more samples of the fabricated item of each type for the EIC's approval before mass fabrication.

6.1 Material Aluminium Alloy Extruded Sections Aluminium alloy used in the manufacture of doors, windows and ventilators shall conform to IS designation HE 9-WP of IS:733 or HV9-WP of IS 1285. Aluminium Alloy AA 6063 of hardness T5 or T3 which has the following properties is also acceptable,

Density, kg/mm ³	Modulus of Elasticity	Mpa Ultimate Tensile Strength	Mpa Coefficient of Linear	0.2% Proof Stress, Mpa
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			Expansion m/m.k	
2.7×10^{-8}	69×10^3	185	23×10^{-8}	110

The sectional properties of extruded sections shall be as given in IS 733 or as manufactured by Jindal, Hindalco or Boruka. The section shall be uniform in appearance, free from die lines and handling marks

Glass panes

Glass panes shall be annealed or float glass as specified in the drawing and shall weigh at least 7.5 kg / m². Glass panes shall also be free from flaws, specks or bubbles. All panes shall have properly squared corners and straight edges. The sizes of glass panes for use shall be in accordance with Table I of IS:1948.

Thickness of glazing to be used for various pane sizes shall be as follows:

Size of Pane Thickness of glazing

up to 1.2 sq.m 4 mm float glass

1.2 sq.m to 2.0 sq.m 5.5 mm float glass

above 2.0 sq.m 8 mm float glass

twin style entrance door 12 mm float glass

Heat strengthening or toughening of glass wherever required shall be as indicated on drgs.

Screws, Fasteners

Screws and fasteners shall be of aluminium alloy or brass oxidised. Screw thread of machine screws used in the manufacture of aluminium doors, windows and ventilators shall conform to the requirement of IS:4218. For opaque portion of shutters panels can be of 12 mm thk marine ply clad on both sides with 24-gauge aluminium sheet. 6.2 Standard sizes, tolerances and desi

Size

Overall dimension of windows, doors, ventilators, shall be derived from masonry opening minus an allowance of 1.25 cm clearance on all sides for the purpose of fitting. However, type and overall sizes shall be in accordance with IS:1948.

Tolerances

The sizes for doors, windows or ventilator frames shall not vary by more than ± 1.5 mm from overall size as specified in drawing.

Designation

windows and ventilators shall be designated by symbol denoting their width, type and height in succession as per IS: 1948.

Sectional dimensions and weights

Sectional dimensions and weights per unit length of the section shall conform to design drawing. However, uses of specific sections for specified units as per manufacturers' standard may be used with prior approval of Engineer.

Fabrication

Frames

Frames shall be square and flat; the corners of frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections which have been cut to length, mitered and screwed at the corners.

Shutters

All hinges, pivots, etc. shall be provided and fabricated in accordance with provisions given in IS:1948. However, reference standards and drawings are also to be read in conjunction with the IS code.

Finishing

The aluminum sections to be used shall be properly buffed, cleaned by using mild acids and water. Then the same shall be anodised to have average anodic film thickness of 25 microns. To prevent damage to metal surfaces, a protective tape shall be applied after manufacturing and same shall be removed at site only after completion of rough trades.

Handling, Storage

The extruded section or the fabricated windows/doors shall be protected against abrasions, waterstains and any other damages caused by acids or alkaline chemicals. Cold metal shall preferably be placed in a dry storage area avoiding contact between it and other metals. Use of

wood face shelving racks is recommended. It shall also be kept away from caustics, nitrates, phosphates, acids and cement.

Installation

The fabricated and assembled windows or door units (without glazing) shall be installed in accordance with IS 1081 being fixed in masonry opening properly plastered and finished. Straightness and diagonal dimensions of the opening shall not have tolerance more than ± 2 mm. Aluminium screws or bolts are to be used with teak wood block on the back of the sections to avoid dents and other mechanical damages during tightening of screws/bolts. All gaps between the aluminium section and the masonry surface must be sealed with gun grade polymer-based sealant viz., silicone compound, polysulphide compound.

Cement mortar grout or cement mortar finishing of gaps after installation of aluminium units shall strictly be restricted to protect the surface treatments given to the aluminium like anodising, precoating, etc.

All glass panes shall be fixed only after major activities are over in the area. Glazing gaskets for doors and frames shall be EPDM elastomeric extrusions. All screws and miscellaneous fasteners shall be aluminium, stainless steel or zinc plated.

Hardware

Necessary hardware for aluminium doors and windows shall be compatible with the basic material and shall be provided along with the doors, windows and ventilators. Minimum hardware necessary to be provided shall be as specified in Table

Drawings/Documents

Prior to fabrication, Contractor shall submit shop drawing indicating details of all members, sections and hardware for EIC's approval. All certificates against tests for anodising and other physical properties of material shall be produced to the Engineer for acceptance.

Fitting	Casement Windows	
	Single Shutter	Double Shutter
300mm 1 3 - - Butt Hinges (heavy)	2	4
Two-point nose handle with striking plate	1	2
Peg Stay 300mm	1	2

1.14. PRODUCT SPECIFICATIONS of Computer Hardware, Software and Peripherals required:

TECHNOLOGY

Printing Method On-demand inkjet (Piezo electric)

Minimum Droplet Size 3 pl, With Variable-Sized Droplet Technology

Ink Technology Dye Ink

Printing Resolution 5,760 x 1,440 dpi

PRINT

Printing Speed ISO/IEC 24734 9.2 Pages/min Monochrome, 4.5 Pages/min Colour

Maximum Printing Speed 33 Pages/min Monochrome (plain paper), 15 Pages/min Colour (plain paper), 69 Seconds per

10 x 15 cm photo (Epson Premium Glossy Photo Paper)

Colours Black, Cyan, Yellow, Magenta

For detailed information on printing speeds please visit <http://www.epson.eu/testing>.

SCAN

Scanning Resolution 1,200 dpi x 2,400 dpi (Horizontal x Vertical)

Scanner type Contact image sensor (CIS)

PAPER / MEDIA HANDLING

Number of paper trays 1

Paper Formats A4, A5, A6, B5, C6 (Envelope), DL (Envelope), No. 10 (Envelope), Letter, 10 x 15 cm, 13 x 18 cm, 16:9, User defined, Legal

Duplex Manual

Paper Tray Capacity 100 Sheets Standard, 100 Sheets maximum, 20 Photo Sheets

GENERAL

Energy Use 11 W (standalone copying, ISO/IEC 24712 pattern), 1.3 W (sleep mode), 3.6 W (Ready), 0.3 W

Product dimensions 482 x 300 x 145 mm (Width x Depth x Height) or compatible

Country of Origin Philippines

Pallet Size Euro 40 Units

HP LaserJet Pro M1213nf Multifunction Printer (CE845A) **or Equivalent**

Functions

Functions

- Print, copy, scan, fax
- Multitasking supported
- Yes

Printing specifications

Print speed black:

Normal: Up to 18 ppm

(Exact speed varies depending on the system configuration, software program, and document complexity.)

First page out (ready)

Black: As fast as 8.5 sec

(Exact speed varies depending on the system configuration, software program, and document complexity.)

Duty cycle (monthly, A4)

Up to 8000 pages

(Duty cycle is defined as the maximum number of pages per month of imaged output.)

Recommended monthly page volume

250 to 2000

(HP recommends that the number of pages per month of imaged output be within the stated range for optimum device performance, based on factors including supplies replacement intervals and device life over an extended warranty period.)

Print technology

- Laser
- Print quality black (best)
- Up to 600 x 600 dpi (1200 dpi effective)
- Resolution technology
- HP FastRes 1200, HP FastRes 600
- Print languages
- Host-based
- Display
- 2-line LCD
- Processor speed
- 400 MHz
- Automatic paper sensor
- No
- Replacement cartridges
- HP LaserJet Black Print Cartridge CC388A

(Average introductory cartridge yield 700 standard pages. HP LaserJet Black Print Cartridge CC388A replacement cartridge yields approximately 1500 pages (average

cartridge yield 1500 standard pages. Declared yield values in accordance with ISO/IEC 19752).)

Connectivity

HP ePrint capability

- No

Mobile printing capability

HP ePrint, Apple AirPrint™

(May require a firmware upgrade to be HP ePrint or AirPrint™ compatible, download at <http://www.hp.com/go/support>)

Additional information about Eco

- <http://www.hp.com/ecosolutions>

Wireless capability

- No

Connectivity, standard

- Hi-Speed USB 2.0 port
- 10/100Base-T Ethernet network port
- RJ-11 Telephone port

Network ready

- Standard (built-in Ethernet)

Connectivity, optional

- None

Minimum system requirements

- Microsoft® Windows® 7, Windows Vista®, Windows® XP, Windows® Server 2003: 1 GHz processor, 1 GB RAM, 700 MB free hard disk space, SVGA 800 x 600 with 16-bit colour display, Internet Explorer 5.5 or higher, USB or Ethernet port

Mac OS X v 10.4, v 10.5, v 10.6

- PowerPC G3, G4, G5, or Intel processors
- 1 GB RAM
- 200 MB available hard disk space
- CD-ROM drive
- USB or network port

Compatible operating systems

Windows 8, Windows 7, Windows Vista, Windows XP, Windows Server 2008, Windows Server 2003

Mac OS X v10.4, v10.5, v10.6

Linux (see hplip.net)

(For Windows® Server 2003 and Windows® Server 2008, add Print and Scan drivers only)

Memory specifications

Memory card compatibility

- No

Memory, standard

64 MB

Maximum memory

64 MB

Scanner specifications

Scanner type

- Flatbed, ADF

Scan file format

- JPEG, TIF (compressed and uncompressed), PDF, GIF, BMP

Scan resolution, optical

- Up to 1200 dpi
Scan size (flatbed), maximum
- 216 x 297 mm
Scan size (ADF), maximum
- 216 x 356 mm
Scan size ADF (minimum)
- 152 x 114 mm
Scan speed (normal, A4)
Up to 7.4 ppm (b&w), up to 3 ppm (color)
(Scan speeds measured from ADF. Actual processing speeds may vary depending on scan resolution, network conditions, computer performance, and application software.)
Duplex ADF scanning
- No
Automatic document feeder capacity
- Standard, 35 sheets
Digital sending standard features
- Scan to E-mail
- scan to application
- scan to file
File formats, supported
- PDF
- TIF
- BMP
- GIF
- JPG
Scan input modes
- Scanning via HP LaserJet scan application or TWAIN—or WIA-compliant application software

Copier specifications

- Copy speed (normal)
Black: Up to 18 cpm
Copy resolution (black text)
- Up to 600 x 400 dpi
Copy resolution (color text and graphics)
- Up to 600 x 400 dpi
Copy reduce / enlarge settings
- 25 to 400%
Copies, maximum
- Up to 99 copies

Fax specifications

- Faxing
- Yes
Fax transmission speed
33.6 kbps
(Based on standard ITU-T test image #1 at standard resolution. More complicated pages or higher resolution will take longer and use more memory.)
Fax memory
- Up to 500 pages
Fax resolution
- Up to 300 x 300 dpi
Speed dials, maximum number
- Up to 100 numbers

1.15. Rain water Harvesting Structures at WTP; - The major scope of work for 2 no Rain harvesting at WTP but not limited to followings: -

Design, construction, installation, testing, Commissioning, trial run etc for 2 no Rain water harvesting at WTP as per tender drawings and as per the direction of Engineer in Charge.

1	Tube well and rain water harvesting.
1A	Carrying out the resistivity survey by VES method using Schlumberger configuration for locating the proper spot for drilling of tube well with in the selected habitation, including photography, interpretation of resistivity data and submission of report in the desired format along with resistivity readings, necessary graph and photographs.
2	Boring/drilling bore well perfectly vertical for the specified depth suitable to receive required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer-in-charge upto 90 metre depth below ground level.
3	Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed.
4	Earth work in excavation for pipe trench in Hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed
5	Filling available excavated earth in trenches, lead up to 50m and lift up to 1.5m in all kind of soil excluding Watering and ramming.
6	Brick work with well burnt chimney bricks having crushing strength not less than 25 kg/cm ² and water absorption not more than 20 % in foundation & plinth i/c curing etc. Complete
7	12mm thick cement plaster in single coat including finishing even, smooth and curing complete.
8	Providing and laying mechanically mixed cement concrete with crushed stone aggregate excluding centering and shuttering (with 40mm nominal size graded stone aggregate)
9	Providing & laying mechanically mixed R.C.C. excluding centering & shuttering and reinforcement in superstructure up to 4 mtr. Height above plinth level (20mm graded metal)
10	Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage.
11	Providing & fixing of ISI marked pre cast reinforced cement concrete manhole cover including frame and transporting at site, cost of all material etc.
12	Media used in Recharge Pit Gravel 5 mm to 10 mm, Gravel 1.5 mm to 2 mm, Gravel 3 mm to 6 mm, Grading- II (53 to 22.4 mm size aggregate), Gravel 10 mm to 20 mm
13	Providing MS foot rests i/c fixing in manhole with 20x20x10cm CC blocks of 1:3:6 (1 cement:3 coarse sand: 6 graded stone aggregate 20mm nominal size) 300 mm c/c , 20 mm dia, square bar foot rest

14	Supplying, assembling, lowering and fixing in vertical position in bore well unplasticized PVC medium well screen (RMS) slotted pipes with ribs, conforming to IS: 12818, including hire & labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer-in-charge. 150 mm nominal size dia.
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1.16. OTHER GENERAL REQUIREMENTS - The followings requirements/works deemed to be included in the Lump Sum offer of contractor.

The Contractor shall carry out confirmatory Topographic survey including trial trenching (For location of existing utilities), before commencement of the works. In case, the shifting of any existing, water pipe line/ utility is considered necessary by the Department /ULB, such service lines will have to be shifted by the contractor for which the payment shall be made for the actual work done as per approved rate.

The contractor shall set up an office with an access to ULB official with proper seating arrangements.

During the Contract period, the contractor has to procure and install informatory board displacing Name of work (and specific details) at the location given by ULB at his own cost.

The trial pits/ trenches shall be excavated by the Contractor after mutual agreement and approval of the Engineer along the alignment of the proposed pipelines. The trial pits / trenches including utility survey shall be carried out in advance of the topographic survey for the purpose of satisfying himself as to the location of underground obstructions or conditions.

Necessary permission from the competent authority/ police shall be obtained by the ULB prior to digging up trial trenches/ pits. For this purpose, the contractor has to pursue with the relevant authority. The Employer may render necessary assistance for getting permission from the different authorities/ police for such excavation. The Contractor shall proceed with caution in any excavation and shall use all means to determine the exact location of underground utilities / structures like water line, sewer lines, conduits and other utilities etc, in the immediate vicinity thereof prior to excavation. The Contractor shall be solely responsible for the cost of protections or repair or replacement of any structure, water line, sewer line, conduit etc, above or below ground which may be broken or otherwise damaged by these operations.

Trial trench/ pits once excavated shall not be left unattended. Once the underground utilities are identified, the trench and pit shall be filled up and compacted to its original level. Any subsequent depression at this location due to vehicular movement shall have to be made good by the Contractor by filling additional borrowed earth. In any case, no inconvenience is to be caused to the vehicular and pedestrian traffic due to such trial trench excavation.

The depth of the trial pit/ trench shall be determined by the invert level of the pipeline as given in the data sheet issued by the Engineer in line with the Tender Drawings or as further instructed by the Engineer. A detailed sketch showing plan and sectional elevation view of the existing underground services, depth of sub-surface water level, type of soil based on visual inspection etc. shall be prepared for each pit/ trench and the same shall be submitted to the Engineer within 7 days. This information will form an input for the selection of alignment of proposed pipeline and production of Construction Drawing by the Contractor for approval by the Engineer-in-charge.

The lighting, barricading, guarding of the trenches and the provision of watchman shall be done by

the Contractor. Some of the roads may be too narrow to provide barricade along the trenches. In such case the location of the barricades etc. shall be finalized by the Contractor in consultation with the Engineer-in-charge.

Necessary arrangements such as cranes, tripods, chain pulley block for lowering pipes into trench shall be made by the Contractor at his own cost. In no case pipes shall be dropped from a height. All posts and sight rails shall in no case be removed until the trench is excavated, the pipelines are laid and the Engineer gives permission to proceed with the backfilling.

The bedding for pipeline shall be provided as specified in the drawings, standard specifications and or as per direction of the engineer-in-charge.

The placement of bought out items and other construction materials during transit and during placement near the alignment shall be done with utmost care so that they are not damaged. Any damage due to these reasons shall be the Contractor's liability.

All the water lines are to be laid perfectly true to alignment and gradient specified. In case of spigot and socket pipes, the socket end of the pipe line shall face upstream. Properly fitted temporary wooden stoppers shall be provided to close the ends of incomplete water lines. The stoppers shall be removed when pipes are being laid and jointed. Open end of water line at the end of day's work shall be capped and sealed.

Water pipe laying and jointing shall be started and completed only section-wise as per instruction of the Engineer. Hydro-testing / Pressure testing of pipeline shall be done section-wise and as directed by Engineer. The water lines shall be secured in place with approved backfill material tamped under it and proper care shall be taken during tamping at the socket end of the pipe to ensure that it is not damaged.

Backfilling of the trenches and temporary road restoration shall be taken-up immediately after laying of pipes for which payment shall be made as per contract provision. In case work needs to be suspended after excavation of trenches for any reason, the trench shall be backfilled immediately and re-excavated prior to re-commencing the work. No payment shall be made for backfilling/ excavation under such situation. If any portion of the trench needs to be kept open as per instruction of the Engineer-in-charge, same shall be suitably barricaded.

Installation of valves and pipeline appurtenances shall be taken-up simultaneously with the progress of pipe laying work.

The restoration of road/ footpath shall be done as specified and as per the requirements of the local authorities.

The excess excavated material shall be carried away from the site of works as specified, failing which, in view of public safety and traffic convenience, the Engineer-in-charge may carry out the work by any other agency at the Contractor's risk and cost.

The inspection and testing of all the bought-out items (Pipes, Valves, Flow-meters etc), both at factory and site shall be carried out in presence of the Employer/ Engineer-in-charge or his representative unless otherwise directed by the Engineer-in-charge.

In the case of tanks whose external faces are submerged and are not accessible for inspection, such

as underground tanks, the tanks shall be filled with water and after the expiry of seven days after the filling; the level of the surface of the water shall be recorded. The level of the water shall be recorded again at subsequent intervals of 24 hours over a period of seven days. The total drop in surface level over a period of seven days shall be taken as an indication of the water tightness of the tank. The Engineer-in-charge shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the tanks are open or closed and the corresponding effect it has on evaporation losses. For many purposes, however, underground tanks whose top is covered may be deemed to be water-tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

If the structure does not satisfy the conditions of test, and the daily drop in water level is decreasing, the period of test may be extended for a further seven days and if specified limit is then reached, the structure may be considered as satisfactory.

In the rare event that the water retaining structure fails to pass the water tightness test satisfactorily, the Contractor will have to provide a comprehensive plan to identify the leakage areas and plug it by grouting the area with approved water proofing compound and shall demonstrate the water tightness test successfully. The entire operation shall be got done by the Contractor at no extra cost.

The Contractor shall provide for the hydraulic test by making his own arrangements for water filling and disposal of water after the test and shall repeat this test, if necessary, until the requisite test results are obtained without any claim for extra cost or compensation. The tendered rates for hydraulic structures shall include all costs incurred by the Contractor for water tightness test.

Soil investigation

The Contractor shall carry out Soil Investigation work. The investigation results shall be used to establish the soil and parameters are to be adopted for the design of various structures as per relevant IS codes:

- Soil investigation work shall be carried out for all major structure of Water Treatment Plant and OHSRs etc.
- The soil investigation is necessary for finalization of the type of foundation of the structure and hence all necessary parameters like SBC, N-Value etc. are required to be determined for design purpose.
- All the Soil Test Reports are to be submitted in a separate booklet containing details of soil characteristics, testing details and results, foundation design and recommendations.

Applicable Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the materials and other supplies to be furnished, and work performed or tested, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to the date of bid submission shall apply, unless otherwise expressly stated in the Contract.

Where such standards and codes are national, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be accepted subject to the Engineer-in-charge prior review and written approval.

Differences between the standards specified (In the contract / codes) and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineers approval. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the contract documents (or relevant codes as mentioned in the contract documents and or as decided by the Engineer-in-charge).

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.

Quality Control and Tests

The Engineer-in-charge or his representatives shall inspect the work from time to time during and after construction and ascertain the quality of the work tested (by himself, or by his Testing and Quality Control Units or by any other agency deemed fit by him) generally as per the requirements (outlined in the QA / QC manual). Additional tests may also be conducted where, in the opinion of the Engineer-in-charge, need for such test exists. In the absence of clear indications and frequency of tests for any item in the above-mentioned publication, procedures and tests as directed by the Engineer-in-charge shall be followed.

The Contractor shall provide necessary cooperation and assistance in 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.

Quality Assurance Plan

The Contractor shall provide Quality Assurance Plan adhered by the manufacturing units for production of Electro-mechanical components (like Pipes, Specials, Valves, Flow-meters, EOT Cranes, pumps, motors, drivesetc) as required prior to the procurement. If required Engineer-in-charge may inspect through self (or designated representative or Third-Party Inspector) all manufactured items at the vendor's workshop / factory. After delivery of materials, the same should be visually inspected at site. The Contractor shall supply samples of the material / units, for testing as per the frequency and number of tests specified in the Quality Control Manual and get it tested by independent agency.

All equipments required shall be duly inspected as mentioned in the tender document.

Unacceptable Works

All defective / deficient Works are liable to be demolished, rebuilt, and defective materials replaced by the Contractor at his own cost. In the event of such Works being accepted by carrying out repairs etc. as specified by the Engineer-in-charge, the cost of repairs will be borne by the Contractor. Defective / deficient works shall also imply non-confirmation to quality standards and mandatory tests that shall guarantee successful completion.

No payment shall be made for rectification / repairs done on account of deficient in quality of

materials or service.

1.17. Rates of Work items

In the absence of any directions to the contrary, the rates are to be considered as full inclusive rate for finished works covering all labour, materials, wastage, transportation, temporary work, plant, equipment, testing, overhead charges and profit as well as the general liabilities, obligations, insurance and risks. The rates quoted by the contractor shall, unless otherwise specified, also include compliance the activities stated below:

- 1 General works such as survey and setting out, clearance of site before setting out and clearance of works after completion; carrying out soil investigation works, condition assessment reports etc.
- 2 Preparation and submission of detailed Work Program for the construction and completion of the works (using CPM/PERT techniques) giving, in addition to construction activities, detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/equipment and their installation and testing, and for all activities of the Employer that are likely to affect the progress of work, etc., including updating of all such activities on the basis of the decisions taken at the periodic site review meetings or as directed by the Engineer-in-charge.
- 3 Tests to ensure that the material for construction are as per the relevant provisions contained in the Specifications including carrying out necessary test at Works on samples of various materials as proposed to be used on the Work and conducting tests thereon as required as per the provisions of the Contract and or as per codal provisions.
- 4 Design of mixes as per the relevant Clauses of the Specifications giving proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant clauses of the Specification to be submitted to the Engineer-in-charge for his approval before use on the Works.
- 5 Testing of various finished items and materials including cement, concrete, bearings as required under these Specifications and furnishing test reports/certificates;
- 6 Cost of in-built provisions for Quality Control and Quality Assurance activities including of safeguarding/protection of the environment, as required from time to time.
- 7 Cost of Designs, Documents, drawings including necessary as-built drawings and other submittals as required under the specifications. Cost for procurement for necessary software (like Auto-CAD) required for preparation / updating the water supply network drawings, including finalisation of as-built drawings shall be considered to be included within quoted rates.
- 8 Cost incurred on Traffic management plan, including diversion works, accommodation of traffic, including erecting barricading, caution signs, project sign boards, and safety tapes to ensure protection at site.
- 9 Cost of all taxes, duties and royalties, site commissioning and all incidental costs.
- 10 Cost of all operations like storing, erection, moving into final position, etc. necessary to complete and protect the work till handing over to the Employer; and
- 11 Cost for storage of tools, plants and equipment's including office operations, as required from time to time.
- 12 Any other data which may be required as per these Specifications or the conditions of Contract or any other annexes/schedules forming part of the contract;
- 13 Any other items of works which is not specifically provided in the Schedule of Quantities/payment Schedules but which is necessary for complying with the provisions of the Contract.

- 14 **Interconnections Of Rising Mains/Distribution Networks/OHSRS:-**The Contractor is expected to visit the site of work and make his own assessment of quantum of work required to be carried out. Further before actual implementation of work the drawing of interconnections will have to be got approved from the Engineer-in-Charge. The interconnections of rising mains of all OHSRS (existing and proposed) with the distribution mains (old & new distribution) is included in the scope of work of this Contract. Bidder's Lump sum offer shall be all inclusive and no extra payment shall be made.
- 15 As it is lump sum Contract and there may be any detail of construction or materials which have not been referred to in the specifications/payment Schedules and tender drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be executed by the contractor at his own cost, nothing extra shall be paid by the department.
- 1.18. **General Requirements for building works:** -The following requirements/works deemed to be included in the Lump Sum offer of contractor.

Unless otherwise specified, all the building works shall generally comply with the following Employer's Requirements:

- (i) All buildings shall have reinforced concrete framework.
- (ii) 75 mm thick RCC Damp Proofing Course in M15 shall be provided to all building walls.
- (iii) Anti-termite treatment as per IS: 6313 part-III – 1971 with injection of chloropyriousemulsifiable concrete (1%) timber care ground treatment chemically emulsion 1:3 and creating a chemical barrier under and around the column pits, wall trenches, basement excavation, top surface of plinth filling, junction of wall and floor along the external perimeter of building, expansion joints, surrounding of pipes and conduits etc.
- (iv) All external walls shall be in 230 mm thick brick masonry built in cement mortar in (1:4). Transoms and mullions shall be of 115 mm x 230 mm size of cement concrete in M15 with four numbers 6 mm bars and 6 mm links at 150 mm c/c shall be provided to form panels not exceeding 3500 mm x 3500 mm in size.
- (v) All internal partition walls except for toilets shall be in 230 mm thick brick masonry built in cement mortar 1:4 with transoms and mullions as stated above. Toilet partition walls shall be in 115 mm thick brick masonry built in cement mortar 1:4 and shall have transoms and mullions as stated above to form panels not exceeding 1200 mm x 1200 mm size.
- (vi) All internal masonry surfaces shall be finished with 12 mm thick smooth faced cement plaster in cement mortar (1:4).
- (vii) All external masonry surfaces shall be plastered in two coats with sand faced cement plaster in cement mortar (1:4) and shall have total thickness of 20 mm. Waterproofing compound of approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.
- (viii) Bathroom/ W.C. floor slab shall be sunk and filled with brickbat coba (broken bricks set in lime) and provided with waterproofing as per the specifications of an approved specialist waterproofing company. The finished floor level in Bathroom / W.C. areas shall be normally 12 mm below the finished floor level on the outer side.
- (ix) The toilet facilities shall include at least:
 - 1 No. Water closet with white wall hung seat minimum 580 mm long with PVC flushing cistern of 10 liters capacity.

- 1 No. Urinal of sizes 600 mm x 400 mm x 300 mm flat back type in white porcelain separated by a granite stone partition of size 680 mm x 300 mm shall be provided outside toilet.
 - 1 No. Wash basin of size 510 mm x 400 mm in white Porcelain with inlet, outlet with bottle trap.
 - 1 No. Mirror of size 400 mm x 600 mm PVC moulding wall mounted type fitted over washbasins.
 - 1 No. soap dispenser
 - 1 No. Chromium plated brass towel rails minimum 750 mm long.
 - All stopcocks, valves and pillar cocks shall be of chromium-plated brass, heavy duty.
 - All fittings such as 'P' or 'S' traps, floor traps, pipes, down-take pipes etc.
 - The sewage from toilet blocks shall be led to a septic tank with soak pit. The Contractor, at a suitable location, shall provide a septic tank having appropriate capacity, as per specifications.
- (x) Wherever specified, staircases shall be finished with granite Stone skirting or equivalent as approved by Engineer. The rise of stairs shall not exceed 150 mm and minimum width of the tread shall not be less than 275mm. All steps shall have 20mm nosing. R.C.C. stairways shall be provided to permit access between different levels within buildings. All roof tops and tops of overhead tanks shall be made accessible with ladder provision. Vertical ladders fitted with landing point extensions will be permitted where considered appropriate by the Engineer or Engineer's authorized Representative to access areas not frequently visited.
- (xi) All floor cutouts and cable ducts, etc. shall be covered with pre-cast concrete covers in outdoor areas and G.I. chequered plates of adequate thickness in indoor areas. All uncovered openings shall be protected with Stainless Steel hand railing fixed with two rails. Decorative SS 304 Pipe railings should be provided with vertical post of 50 mm dia, 1.2 m height at 1.5 m centre to centre, horizontal post of three rows in which top row is of 50 mm & lower rows of 32 mm dia, all of SS 304 including insert plate for post/column support as per relevant IS code.
- (xii) All staircases shall be provided with Stainless steel railing. The reinforced concrete roofs shall be made waterproof by application of approved cement/ lime based waterproofing treatment, guaranteed for 10 years. The finished roof surface shall have adequate slope to drain quickly the rainwater to R.W down-take points.
- (xiii) For roofing drainage, cast iron rainwater down-takes with khurra and door bend with C.I. grating at top shall be provided. For roof areas up to 40 sqm minimum two nos. 100 mm diameter down-take pipes shall be provided. For every additional area of 40 sqm or part thereof, at least one no. 100 mm dia. down take pipe shall be provided. The RW pipes shall be concealed.
- (xiv) Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rainwater.
- (xv) Building plinth shall be minimum 600 mm above average finished ground level around building and shall not be less than plinth level of existing buildings.
- (xvi) All buildings shall have a minimum 1.0 m wide, 100 mm thick plinth protection paving in M15 grade concrete finished with stone slabs/ tiles. All plinth protection shall be supported on well-compacted stratum.

- (xvii) All concrete channels and ducts used for conveying liquid shall have smooth finish from inside. The width of concrete channels shall not be less than 500 mm. All open channels shall be provided with Stainless Steel (SS 304) hand railings.
- (xviii) Kerbs to be provided below the hand railing on the catwalks/pathways should be as per relevant sections of the Factory Act.
- (xix) All rooms in the treatment plant buildings shall be provided with appropriate signboards indicating the function of the rooms involved.
- (xx) Wherever equipment and machinery is required to be moved for inspection, servicing, replacement etc., suitable movable gantry of required capacity shall be provided.
- (xxi) The design of buildings shall reflect the climatic conditions existing on site. Process buildings shall as far as possibly permit the entry of natural light.
- (xxii) Emergency exit doorways shall be provided from all buildings in order to comply with local and international regulations. Stairways and paved areas shall be provided at the exit points.
- (xxiii) Toilet blocks in process building shall be provided with two drinking water taps of 12 mm size and sink with appropriate drainage.
- (xxiv) All chequered Plates shall be hot dip galvanized.
- (xxv) Glass shall be minimum 5 mm thick, pin headed or opaque.

Excavation

The depth of excavation will be guided by requirement of stability of foundation, and the hydraulic levels of the various units. The contractor should himself verify this for design of foundation of structure and other hydraulic designs. The foundation shall be filled with bed concrete (leveling course) in 1:3:6 (M 100) with 40 mm gauge graded metal or by the prescribed mix as proposed by the contractor in his design. But it should not be weaker than 1:3:6. The average plinth level shall be at least 1.0 m above general G.L. The difference of level between the floor of pump house and invert of sump well shall not be more than 2.50m in any case.

Foundation for Structures

The minimum depth of foundations for all structures, equipments, buildings and frame foundations and load bearing walls shall be as per IS: 1904.

Care shall be taken to avoid the interference of the foundations or any other component of the new building with the foundations of adjacent buildings or structure. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. The Engineer or Engineer's authorized Representative shall accept no extra claims for such adjustments. Special attention is drawn to danger of uplift being caused by the ground water table. Base raft for underground structure shall be designed for uplift forces that are likely to be developed.

Where there is level difference between the natural/ existing ground level and the foundations of structure or floor slabs, this difference shall be filled up in the following ways:

- (i) In case of non-liquid retaining structures, the natural top soil shall be removed till a firm stratum is reached (minimum depth of soil removed shall be 500 mm.) and the level difference shall be made up by compacted backfill as per specifications. However, the thickness of each layer of the backfill shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction. The safe

bearing capacity of this well compacted backfilled soil for design calculations shall not exceed 100 KN/sqm.

- (ii) In case of liquid retaining structures, the natural top soil shall be removed as described above and the level difference shall be made up with Plain Cement Concrete (1:5:10)

All materials used on civil works should be of quality approved by the Engineer-in-charge. Rejected material shall be removed from the site immediately.

Plinth level of Buildings

The average plinth level of all major buildings within the treatment plant area shall be 0.6m above the natural ground level.

The average plinth level of chemical house, filter house and the pump house shall be at least 1.0 m above general ground level. The entry in pump house shall with suitable approach ramp to enable machineries to be transported inside the building by trucks.

Brick Masonry

Brick work shall be done in C.M. 1:4 richer mix in masonry shall be done only if the structural design requires so and with prior approval of the Engineer-in-charge. The width of all walls done with brick-masonry shall be minimum 230mm for all buildings.

Flooring

The flooring of chemical house (Ground floor) and first floor shall be done with 30 mm thick kota stone.

Floor around chemical tanks should have acid proof treatment. The floor of pump house portion shall be in M-30 mix with 150 mm thickness having specifications for Industrial use.

The flooring of Administrative Building, Staff quarters, sanitary block and all other places shall be of vitrified tiles. (600 mm x 600 mm)

Plastering

The brick masonry walls of building should be plastered with 1:3 cement mortar. The thickness of plaster from outer face of wall should be 20 mm and on inner face the thickness of plaster should be 13 mm. In chlorine room, sump well and wash water tank, due consideration shall be given to provide protective measures in R.C.C. work plastering etc. to prevent the corrosive effect of chlorine.

Doors and Windows

The opening area (for doors/windows/ventilators) for chemical stores and chlorine tonner storage room shall be 20% of the floor area. For rest of the units this area shall be 30%.

Painting and Colour Washing

Doors and windows except shall be painted inside and outside in two coats after priming coat as per the directions of the Engineer-in-charge. The wall shall be provided with two coats of approved quality emulsion paint with 5 years warranty on the inside and outside as per the direction of the Engineer-in-charge.

Roofing

The roof shall be casted in R.C.C. M-20 mix with 20 mm gauge graded metal as per thickness and reinforcement, details to be shown in the drawings and designs. All roofs and civil structures

would be guaranteed for leakages as per relevant I.S.S. suitable treatment for water proofing shall be provided for roof slab.

Fire Extinguishers

Fire extinguishers for each building at every floor shall be provided, and fixed as per the relevant IS Specification.

Horticulture and landscaping

Horticulture and Landscaping shall be done according to the topography of the area and should be planned so as to make the treatment plan area a focal point. The open areas leaving expansion requirements must either be covered by tree plantation or must be suitably grassed. Shadow trees must be planted at a maximum distance of 15 m c/c along the periphery of the campus area and along the roads. The campus must be provided with gardens, with seasonal flowerbeds and decorative plants.

Horticulture operations shall be started on ground previously levelled and dressed to require formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or replaced or it shall be covered over to a thickness decided by Engineer-in-charge or Engineer's authorized Representative with good earth.

Tree guard

The concrete tree guard of 5' height shall be provided as specified by the Engineer-in-charge or Engineer's authorized Representative.

The planted trees, garden etc. so developed shall be maintained in good condition during the execution and maintenance period of the Contract without any additional costs. The Contractor shall ensure the safety of plants and shall take all the activities such as re-plantation, manuring, use of pesticides, mulching, cutting etc. for growth of trees / plants and maintenance of plants.

Grassing

The area from where the grass roots are to be obtained shall be specified by the Engineer-in-charge or Engineer's authorized Representative at the time of execution of the work. The soil shall be suitable moistened and then the operation of planting grass shall be commenced. Generally planting in either direction at 15 cm, 10 cm spacing is done in the case of large open spaces, at 7.5 cm spacing in residential lawns.

2. Miscellaneous requirements

Roads and Pathways

Contractor shall construct new concrete Service Road of 4.0 m wide carriage way and 7.5m total width within the WTP connecting all important buildings, units and connecting the same to the main roads connecting to the premise with all associated CD and other necessary works like drain etc.

The concrete roads shall be of M-30. The wearing coat will be 300 mm thick cement concrete in M30 grade of concrete over 100 mm thick PCC in M15 grade.

Nameplates and Signboards

Each item of the plant shall have permanently attached to it in a conspicuous position a nameplate,

on which shall be engraved or stamped the manufacturer's name, type and serial number, year of manufacture, details of the design capacity etc. Such labels shall be of non-hygroscopic material to be approved by the Engineer or Engineer's authorized Representative. Near by or on each item of the plant, shall be fixed a plate with the name and nomenclature (code) of the item according to the project nomenclature. It shall be visible from a distance of several meters.

The Contractor shall also provide bilingual signboards and instruction tables of durable material, throughout the plant, for the purposes of operation, maintenance and security:

- Danger and caution signs (English and local language)
- Preventive maintenance schedules (local language)
- Operating instructions (local language)
- Unit names (English and local language)
- Nameplates at the doors to the units (English and local language)

Signboards and plates shall be appropriately sized in relation to the relevant item and its surroundings. Details of the proposed inscription, size, material and colours shall be submitted to the Engineer or Engineer's authorized Representative for approval before any signboards or plates are manufactured. They shall be compatible with the instructions in the operation manual.

All cables shall be provided with clip-on identification numbers on both ends and at all terminations in between, for identification. The nomenclature shall correspond to the electrical as-built drawings.

The nomenclature and labelling of the plant shall be decided in close co-operation with the Engineer-in-charge or Engineer's authorized Representative.

First Aid kits

The first aid kit shall consist of all materials, medicines necessary for treatment of cuts, wounds, burns bad effects of inhalation of chlorine, bad effects on skin due to contact of chemicals acids etc. Following materials in general in sufficient quantities shall be provided.

- (i) Medical cotton, sterile cotton pads
- (ii) Cotton Bandages, elastic bandages
- (iii) Pair of scissors, packet of new shaving blades
- (iv) Sticking plaster for medical use.
- (v) Band aid stripes

Following chemicals/medicines shall be provided in sufficient quantities:

- (i) Tinctures iodine and mercury chrome
- (ii) Burnol ointment
- (iii) Bottles of spirit and of Dettol
- (iv) Toilet soaps

To be procured under medical advice

- (i) Tablets for bad-effects of chlorine inhalation
- (ii) Skin lotions and ointments for burns, acid effects
- (iii) Eye drops for soothing effects

Separate First Aid Kits shall be provided in Raw Water Pump House, Workshop, and Clear Water Pump House. Fire extinguisher and first aid kits shall be provided for the end of the commissioning period only. They shall not be used before and shall be complete.

Waste-water drainage

The foul drainage system shall accept discharge from toilets, washrooms, offices and the laboratory. The foul drainage system shall discharge to a septic tank of appropriate capacity and the supernatant shall discharge into a soak pit.

Training of Employers Staff

Prior to and during the Trial Run and Pre-commissioning periods the Contractor shall provide classroom and on-the-job training sessions to the Employer's staff. Training shall cover the process functions and the practical aspects of operation and maintenance. The course material shall be finalized and agreed upon by the Employer and the Contractor prior to the start of training and the Contractor shall provide the necessary trainers course material for all attendees. The Contractor shall budget at least 6 hours of classroom training for each unit process except the filters, chemical dosing and chlorination which shall be allocated a minimum of 12 classroom hours each. On-the-job training shall include process operation, equipment maintenance, instrumentation and control systems (training on each ICP shall be given) and the electrical systems. Training time shall be commensurate with the complexity of each system, as approved by the Employer's Representative. The contractor shall provide a work training officer whose sole duties shall be to advise the O&M personnel on the operation and maintenance of the treatment process and to instruct, on a full-time basis regarding the O&M. The aforesaid personnel for imparting training for the operation and maintenance work, i.e., the mechanical, the electrical and chemical and the instruments and systems personnel at the cost of the agency. Training Employer's Staff during O & M Period: The Contractor shall be responsible for holding one training course each year during the O&M Period for duration of 5 days each year to approximately 10 trainees assigned by the Employer. The course material shall be finalized and agreed upon by the Employer and the Contractor shall provide the necessary faculty and material for all attendees. Each course shall include both class room lectures and on-site training. The training shall be designed to enable the trainees to understand the practical aspects of satisfactory operation and preventive maintenance. Attention shall be given to any problems or quality issues that have arisen in the system over the last year of operation. The Contractor shall also provide full on-the-job operational training to employees assigned by the Employer to be associated with the facilities on a permanent basis. The number of such employees shall be established by the Employer, but will not be expected to exceed 5 per session. The training also includes Field testing and commissioning of meters, training of line department personnel on operation of the meter. The Contractor shall provide on the job training on all aspects of the operation, maintenance and repair of the Plant, equipment and facilities to all personnel selected by the Employer who will ultimately be responsible for the operation, maintenance and repair of the Plant and its facilities, in accordance with the Employer's personnel schedule provided, all costs for the bidder's personnel and the training facilities required for the training, and any incidental training expenses, shall be included in the Bid Price and nothing shall be paid by the department

ANNEXURE - “E-8”

OPERATION AND MAINTENANCE OF THE SCHEME

Scope of Services

Operation & Maintenance including replacement and warranty of complete water supply scheme at Nagar Panchayat Bhakhara. The rate quoted by Contractor for followings works deemed to be included in its lump sum offer

The Contractor shall operate and completely maintain the following components for 09 Months including replacement and warranty.

- a. Raw water Sump well cum pump house including all civil structures, Raw water pumps, panels valves, flowmeters and all others Electro-mechanical equipments including PLC –SCADA Automation system etc complete.
 - b. Water Treatment Plants including all civil structures, Clear water pumps, panels, valves, flowmeters etc and all others Electro-mechanical equipments including PLC –SCADA Automation system etc complete.
 - c. OHSR (existing and proposed) and allied works
 - d. Electrical Substations and allied works/equipments/accessories
 - e. Pipelines (existing and proposed) and allied works
 - f. HSCs
 - g. Rain water harvesting Structures
 - h. All Valves, interconnections actuators etc and allied works
 - i. Complete GIS Mapping, SCADA and automation system (existing & proposed).
 - j. The complete system/scheme including all civil, structural, electrical, mechanical, SCADA, automation, Instrumentation and GIS Mapping etc which has been executed by the contractor or as directed by Engineer in Charge.
2. All O&M Works Shall be carried out as per –
- a. Government (State & Central) laws & rules such as Indian Electricity Act 1948, Factory Act 1948, Contract & Labor (Regulation & Abolition) Act 1972, Compensation Act, Provident Fund Act etc and rules framed under the said acts by the Competent Authority with all up-to-date amendments.
 - b. Laws and rules prevailing during contract and pertaining to the scope of contract.
 - c. Time to time directions, Instructions & Entire Satisfaction of Engineer in Charge Department.
3. The contractor shall have to carry out all works as per its obligation under the contract to maintain the complete water supply system. The contractor will carry out the complete operation and maintenance of the all the above-mentioned installations for 09 Months including supply, replacement of electro-mechanical parts/equipment, repairs to all civil structures, leakages to pipes/valves/interconnections etc, distemping and painting of all structures at no extra cost to the Department

4. The cost of electrical energy, Chlorine Gas, and pay to departmental staff will be paid by the Department and cost of all other chemicals, consumables and Contractor's staff etc shall be borne by the contractor including replacement and warranty of all item component/spares during the period of O&M. Diesel, petrol, Kerosene etc. required for any dewatering operation during O&M will also have to be arranged by contractor at his own cost only.
5. All materials required for smooth running of mechanical part and leak Proofness of valves as well as Electrical Maintenance etc. Gland packing, rubber & metallic washers. All electrical items etc shall be arranged by contractor at his cost only.
6. Cleaning of all units of Sump well, WTP, OHSRS for all sorts of depositions viz-Silt, algae, floating materials etc. shall be done by the Contractor.
7. All routine/Periodic maintenance & Operational works as instructed by EIC shall have to be carried out by Contractors Staff only.
8. All break down or essential repairs must be carried out immediately so that water supply does not get affected. In case contractor fail to take repair rectification work in time, the Engineer In charge can deploy other agency for such job and expenditure incurred on such job shall be recovered from contractor's bill and penalty be imposed.
9. Maintenance work and if any loss occurs department, then same will be recovered from contractors payment due and if there is any loss of pumping hour then penalty shall be imposed.
10. Painting/White washing/distempering of all civil structures (in 3 years) as per the direction of Engineer in Charge
11. All Machinery & Equipment at Sumpwell/Sump well & WTPs, OHSRs must be in working Conditions all the time. In case any equipment requires repair or replacement then it must be done maximum within 72 hours in case of failure penalty may be imposed as deem fit by the Engineer in Charge/ CMO of concerned division.
12. It will be contractor's responsibility to keep record of daily consumption to electricity and maintain average power factor above 0.95. Contractor will receive, scrutinize CSEB energy bill and submit the same to Engineer-in-charges well in advance i.e., at least 7 days in advance. If energy bill is not received from CSEB within course of time and delayed payment charges and or penalty for Low Power Factor (P.F.) is charged and if the cause of the same is not brought to the notice of Engineer-in-charges well in advance, the same will be recovered from contractors monthly bill in short, and contractor will be reduced the energy consumption to 20% by using apparatus on own cost, contractor will be responsible for collecting, submitting energy bills maintaining average power factor as per norms.
13. All equipments, machineries, flow meters, flow controlling device, LOH, ROF, meters, chlorinators shall be in perfectly working condition. The leakage in should not be observed. There should be no leakage in pipe gallery.
14. Each and every filter bed should be chemically treated and back wash thoroughly with solution of sodium hydroxide (NaOH) of 1% strength, to maintain the media in good condition. This chemical treatment should be given as and when required or once in 6 months
15. Keeping the down time of any equipment as low as possible but at least below the desired level including operating the plants at the design capacity.
16. Operation and Maintenance cost also includes cost for Paper, Cartridge, Office Stationery, Office Overheads, Water, Electricity, Manpower for field work, Operator, IT Engineers, Maintenance of IT Infrastructure, Recurring services purchased, Sundries, Transportation, LoRa Server Software Support, Application software support, Android App 1 support, Recurring cloud services costs etc

17. Communication and co-ordination with the adjacent related facilities and concerned agencies, as required.

The complete operation and maintenance, services shall be performed according to the following principles/ specifications:

Minimum down time	<p>The WTP shall never be operated at less than 50% of its design capacity due to maintenance and repair works. Period of such operation shall not exceed more than two consecutive days and not more than three days in a week. The maximum downtime of the whole plant shall not exceed more than 6 continuous hours. In case the downtime continuously in a day exceeds 06 hours, contractor will be penalised Rs.5000 /hour (Rupees five thousand per hour only). Exceeding 06 hour. Further if this downtime exceeding 06 hours takes place more than on 3 no. Occasion in a month a penalty of Rs 10000/- (Rupees ten thousand per event only) event will be imposed. The period for repairs and maintenance has to be communicated to the Engineer-in-Charge (EIC) at least one month in advance.</p> <p>The down time due to non-availability of power or of raw water at Contractor's point of receipt for any reason shall not be included in the above period.</p>
Operation of the plant as per O&M Manual	The WTP shall be operated according to the rules and procedures laid down in the O&M Manual provided by the manufacturers and CPHEEO. The working hours of the plant and the output quality shall be as per IS 10500 given here.
Awareness & Cleanliness	The Contractor and his staff shall maintain a high degree of awareness in operation and maintenance of the complete scheme. At all times the Complete scheme, its equipment and surroundings shall be kept clean and in order including building floors, walls, roof, windows, road, drains etc.
Frequency of Preventive Maintenance	<p>The preventive maintenance will be done according to the recommended preventive maintenance schedule of the manufacturers of the WTP/components of the WTP with prior intimation to the Engineer-in-charge well in advance. The regular staff may be reinforced by short term specialists by the Contractor for special maintenance tasks at the contractor's own expenses.</p> <p>All required equipment, materials, manpower and other resources for the operation, maintenance, and repairs shall be arranged by the contractor.</p>
Repairs	Repairs shall be made as and when needed very promptly on the spot or at the Contractor's workshop; the need of repair on the spot or at the Contractor's workshop has to be defined in co-ordination with the EIC. No extra payment shall be made for any repairs (including E & M, Civil) & replacement.
Equipment, Spare parts, Consumables etc.	<p>The contractor shall arrange all spare parts, equipment, other consumables etc., and their fitment as and when necessary for smooth and efficient operation and maintenance at contractor's own expenses throughout the contract period. The contractor shall always have the spares available in his store as per the list approved by engineer for carrying out repairs properly.</p> <p>Old / worn out part after replacement shall have to be returned to the</p>

	Employer as per direction of the EIC.
Civil Structures and Civil Works	All existing and proposed civil structures and works shall be maintained by the contractor including all minor and major repairs/works at the contractor's own expenses. The contractor before initiating any major works shall obtain approval of the EIC.
Transportation	All necessary transportation required for operation, and maintenance activities to be carried out shall be arranged and made by the Contractor at his own costs.
Consumables	The Contractor has to ensure that there is always sufficient stock of 30 days of the consumables (like alum, grease, lubricant, oil etc) required.

18. General Obligations

The Contractor shall operate and maintain the WTP including PLC-SCADA Automation system, Raw water Sump well cum pump house, and all the proposed facilities, including roads, plantations, illumination etc., within the premises under this contract for the period specified in the scope of services. Contractor shall submit a detailed Operation and Maintenance plan for approval of Employer one month before taking over. All Operation and Maintenance activities by Contractor shall be carried out strictly in accordance with the approved plan. The General Obligations of the Contractor shall include but not limited to:

- The Contractor shall comply with all safety rules and regulations as per the CPHEEO manual and relevant BIS codes.
- Provide necessary skilled/ unskilled labour/ supervisors/ technicians for maintaining all utility services, sweeping, cleaning of Office room, laboratory, privies, toilets, washroom etc., including cost of all materials and equipment for maintaining the utility services. Personnel employed by the contractor for the services will in no case be absorbed by the Employer.
- Providing necessary labour for cutting of grass, removal of debris, shrubs, development of grassed areas etc as maybe required from time to time. Personnel employed by the contractor for the services will in no case be absorbed by the Employer
- Maintaining strict vigil so as to secure the areas and not allow any trespassers into the area.
- Liaison with concerned Power Supply Agency in case of any voltage trouble (high or low) or breakdown in Power Supply or Low power factor or any other troubles, is the responsibility of the Contractor and the same to be recorded in the Log Book accordingly.
- The contractor shall submit to EIC for approval the calculated power requirement for operating all the facilities, machineries and equipment for the entire services prior to the finalization of the contract including O & M services. The Contractor shall ensure that minimum power requirements are consumed for Operation of the complete water supply scheme. The calculated power demand will be compared with the actual power consumption and if the actual consumption is more than 15% higher than the calculated (expected) consumption, the costs for the same will be deducted from the Contractors monthly bills.
- All maintenance activities shall be recorded in the maintenance register and to be checked and countersigned by the EIC.
- The Contractor shall insure the entire premises against burglary/ theft/ malicious damage/ rust and fire during the tenure of the operation and maintenance activities. The insurance

policy shall be endorsed in favour of the Employer. The Contractor shall insure his workmen/ supervisors against all statutory rules and regulation viz. workmen's compensation, third party liability, accidents etc. The Employer shall not bear any responsibility or cost for any such untoward incident, accident, death, injury, medical treatment etc. The premium shall be borne by the Contractor and shall be considered while quoting the price of operation and maintenance services in the Bill of Quantities.

- The contractor shall be liable to compensate the Employer for any loss of property within the WTP (s) and all other facilities due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong operation, etc. on the part of personnel engaged by the contractor for operation and maintenance of the complete water supply scheme and all other existing and proposed facilities. The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the EIC.
- All prevalent labour laws are to be maintained by the Contractor as per norms.
- Fighting fire with the fire extinguishers in the event of such contingency shall be the responsibility of the contractor. The contractor shall ensure that refilling of fire extinguishers is done as per norms.
- The Contractor must adhere to the regulation of E.S.I., E.P.F., Service tax, labour license etc. The Contractor shall be responsible for depositing the subscription of the E.S.I., E.P.F, Service tax etc. to respective government agencies. The Contractor shall submit their documents regarding payment of E.S.I., E.P.F., Service tax etc, to the EIC as per norms. The monthly claim of the contractor shall enclose proof of month before the previous month's deposition of E.S.I., E.P.F. and related tax.
- At the end of maintenance period, an assessment of the condition of the complete water supply scheme and all other facilities will be carried out by the Employer. Based on the above assessment the Contractor shall, at no extra cost to the Employer, repair and re-condition all the electro-mechanical equipment in the concluding year of the maintenance contract to a condition so that they are in satisfactory running condition with regular preventive and recommended maintenance as per manufacturers' recommendations and/or as per CPHEEO manual/ standard Engineering practice.
- Hand over the complete water supply scheme including all associated facilities and also the entire premises, immediately after completion of O&M period, in good, running, and acceptable condition.
- The contractor shall furnish atleast 03 reports.
 - a. At different times of the day daily indicating the raw water & treated water reports highlighting physic-chemical & biological characteristics to engineer-in-charge.
 - b. Further he will furnish atleast 02 reports at different times of the day daily indicating the incoming and outgoing water characteristics of each treatment units of WTP to the Engineer-in-charge. These reports will indicate the efficiency of each treatment unit.

19. Operational Requirements for Complete water supply scheme including PLC-SCADA Automation System,

- i. The operation of the WTP and Intake, OHSRs will include running all electro-mechanical equipment uninterrupted for all days (24x7) including all holidays. Operation shall be done in proper coordination and in consultation/direction of the Employer to avoid any malfunctioning of the machineries. During operation, the contractor shall adhere to the following points for smooth operation of the plant:

- ii. Operation of all pumps, valves, instrumentation controls at the Intake, WTP, OHSRs and allied structures / facilities like Wash water tanks, including all allied electro-mechanical components of the WTP including Clearwater Pump House & Electrical Sub Station as per requirement. Any sorts of defects, faults in electro-mechanical equipment/components are to be intimated immediately to the EIC and contractor will take corrective action for repairs & replacement without any extra cost.
- iii. Operating the valves as necessary on a diurnal basis, considering the inflows or that maybe required from time to time.

20. Staffing Requirements for Operation and Maintenance of Complete water supply scheme: -

The Contractor shall provide experienced technical, administrative, and non-technical personnel, and labour necessary to operate and maintain the complete water supply scheme and also to maintain other works under scope of work as stipulated in the contract, properly, safely, and efficiently on a continuous 24 hours basis for the full term of the O&M Period including holidays.

The qualifications and capability of the Contractor's personnel shall be appropriate for the task they are assigned to perform. The staff provided shall be fully trained in the operation and maintenance of the works before being given responsibility for operation of the services. If, in the opinion of the EIC, a member of the Contractors staff is considered to be insufficiently skilled or otherwise inappropriate for the task he is required to perform, he shall be replaced by the Contractor with a person with the appropriate skills and experience for the task, with the approval of the EIC.

The bidder shall propose in its tender a staff management structure for the Operation and Maintenance of all the services under O&M Scope in the Contract. This structure for O&M work shall be expected to include at least but not necessarily be limited to the following personnel:

Position	Minimum Qualification	Nos .	Minimum Experience in similar nature of work (yrs.)	Requirement
Plant Incharge	Graduate in Engineering (Civil/Electrical/Mechanical/Chemical)	1 No	3	-
Supervisor cum Shift in-charge	Diploma holder in Mechanical/ Electrical / Instrumentation/Telecommunication with knowledge of computer	1 No.	2	In each shift
Instrument and control Specialist	Graduate in Engineering (Instrumentation/equivalent)	1 No.	3	
Chemist	Bsc/Msc in chemistry/Biology/ Microbiology	1 No.	2	In each shift
Laboratory (Water quality) Analyst	12th Science with chemistry/Biology/ Microbiology		2	
Operators Intake,WTP,Clear Water,Raw water	ITI qualification	4 Nos .	2	In each shift

Position	Minimum Qualification	Nos	Minimum Experience in similar nature of work (yrs.)	Requirement
Pumping Station, All chemical & Chlorine system				
Electrician	12 th / ITI	1 No.	2	In each shift
Mechanic	12 th / ITI	1 No.	2	In each shift
Fitter	12 th / ITI	6 No	2	
Helper	-	9 No.	-	In each shift
House Keeping including Jungle cutting, reservoir cleaning	-		-	Each day
Security	-		-	Each Shift

The above Positions suggested are the minimum requirement and can be modified by as per the actual requirements for operation and maintenance of complete water supply scheme and as directed by Engineer in Charge. It is expected that the contractor will provide the above personnel for operation and maintenance of all works under the scope of work taking together all three shifts in a day. Necessary stand by provisions shall have to be made to take care of absences / leave.

The Plant incharge shall be responsible for total management of the operation and maintenance. He shall have authorization to receive instructions from the EIC time to time and acts accordingly. The Contractor shall provide all secretarial support, printing and publishing services, office furniture and office supplies as necessary for entire O&M period. Procurement of office furniture and other utilities will be made under provisional sums before the commencement of O&M services and these shall be the property of the Employer. The list of office furniture to be procured shall be approved by the EIC before procurement.

The Curriculum Vitae of the Contractor's personnel shall be submitted to the EIC for acceptance at least two months (60 days) before the anticipated commencement of O&M, the pre-commissioning. Normal time duty hours for the Contractor's Operation & Maintenance personnel may be modified as necessary and agreed by the EIC. A rotating shift schedule shall be established by the Contractor and approved by the EIC which will ensure that an adequate number of the Contractor's staff will be available for on duty at WTP for 24 hours each day, 7 days per week, including all holidays.

The O&M personnel shall dedicate 100% of their time for the specified duties and responsibilities and shall not be diverted to perform Contractor's administrative duties, construction arrangement, office management, or other non-project activities. Adequate support staff shall be provided by the Contractor in order to avoid any such diversion. No claim for idle hour shall be entertained.

Employer shall direct the contractor to remove any or all staff employed for O&M services if in his opinion continued presence of such staff is detrimental to safety or proper O&M. The contractor

shall comply with such directions & post suitable substitute(s) thereof. Whenever the EIC has to inform the Contractor in writing that any person on the work is in his opinion unsatisfactory or/incompetent or unfaithful or dishonest, untruthful or disorderly or to be otherwise unsuitable/such person shall be discharged by the Contractor from the work and shall not be reemployed.

No labour below the age of 18 years shall be employed on the work. List of staff is to be given by the agency to the Contractor and advance intimation to be given before deputing/removing any staff from site during the O&M period. Not more than one of the Contractor's key staff shall be absent from the Project site at any given time. In case it is necessary for more than one of the key personnel to be absent at a given time, the Contractor shall provide replacement of equivalent or better qualifications. The CVs of such key staff replacements shall be got approved from Employer in advance.

Recording and Reporting Requirements:----

Contractor shall record quantity and quality of raw water inflows and out flows on a daily basis along filter bed-operation through SCADA. Staff attendance shall also be recorded along with register for cleanliness.

Overall reporting formats will be finalized and approved by EIC and may have to be modified from time to time as required and approved by EIC. Contractor may have to prepare and submit additional reports on particular matter and incidents as and when required by the EIC.

Besides, submission of reports, the contractor shall have to maintain various charts / books / registers recording daily data on operation and maintenance. The following are the charts/books/registers that are required to be maintained other than specific requirements raised by the EIC:

Sl No.	Name of Register/ Log book	Contents	Frequency of Record keeping
1	Attendance book	Attendance of workmen and supervisors	Daily shift wise
2	Log Book for Operation	Parameters of performance of pumps, motors, panel, power factor etc as per the direction of EIC. These shall include but not limited to <ul style="list-style-type: none"> – Voltage – Current – Power – Power factor – Pressure – Water level – Duration of operation of each filter bed – Flow – Other physical, electro-mechanical and hydraulic characteristics. 	Hourly
3	Cleanliness Register	Record of cleaning of pumping Machineries, various buildings, office room, control room, floors,	Daily to be submitted to EIC

Sl No.	Name of Register/ Log book	Contents	Frequency of Record keeping
		toilets and surrounding areas of Complete water supply scheme	
4	Maintenance book	Record of regular, preventive and breakdown maintenance	Based on requirement
5	Consumption / Consumables book	Record of spares required for equipment	Based on requirement
		Record of fittings, fixtures, etc. required for replacement	Based on requirement
		Record of consumables	Based on requirement supplied by the Department

21. Maintenance Activities

The scope shall include regular maintenance of all the pumps, motors, starters, circuit breakers, switches, control panel, cranes, valves/gates, and flow measuring devices etc. for smooth and efficient operation/performance of the complete water supply scheme. Regular maintenance of the Treatment plant area and other components shall be taken up with proper cooperation and coordination with the personnel concerned with the operation & maintenance of the whole scheme and in consultation/ direction of the concerned EIC. During the maintenance activities the Contractor should adhere to the following points:

- The contractor shall prepare and implement an effective plant maintenance programme in consultation with the EIC. It is the Contractor's responsibility to provide all sorts of maintenance - preventive, minor, major, or break-down in nature. Further, the Contractor shall attend to any defects/repair works that may be required during the tenure of the O&M contract.
- The contractor shall plan and arrange all spares and all consumables including grease, lubricating oil, cleaning agents, etc. Further the contractor shall plan about the requirement well in advance (At least 1 month) and procure the material from the market, thereby maintaining a safe stock of the spares and consumables.
- Regular/periodical maintenance such as insertion/replacement of the packing, greasing of bearings, and replacement of gear oil/lubricating oil shall be carried out according to standard engineering practice/manufacture's recommendation. The same shall be intimated to the concerned EIC well in advance.
- The casing / volute cover of the pumps shall be opened twice in a year for thorough inspection of the internal parts/components ensuring smooth operation of the Treatment Units / Plants. However, the above maintenance activities in addition to the mandate above shall be carried out as and when required as per direction of EIC.
- Blown out fuses, indicating lamps, contact points etc. shall be replaced by new ones as and when required.
- The contractor shall cover in his quoted rates cost of replacement of chokes, switches, ballasts, igniters, son lamps, etc. as and when required. No payment shall be made to the contractor for such replacements.

- (g) Cleaning and maintaining of treatment unit and all other electro-mechanical equipment shall be taken up as per standard engineering practice, operation & maintenance manual and as per the instructions of the manufacturer of the equipment.
- (h) The tightness of fasteners, bolts and nuts & terminals shall be checked at periodic intervals and necessary tightening done as per necessity.
- (i) The Contractor shall supply consumables like soaps and detergents, jute, cotton waste and cotton flame, napkins, disinfectants, sweeping accessories, polishes, rain-coats, safety shoes, gumboots, site order books with pages in triplicate, candles, torches with battery and matches, forms, log books, quarterly cleanliness log book, attendance register, pen, scale and stationeries as required for day-to-day O&M activities. The Contractor shall also supply tube lights, incandescent lamps, starters for tube light, indicating lamps, insulating tapes, nut and bolts, screws, cable sockets, grease, oils packing and arrange to replace or fit as per necessity.
- (j) The contractor shall maintain sufficient tools and plants at Treatment plant which shall be required for operation and maintenance. These consists of items like screw drivers, spanners, slide wrench, hammers, chisels, pliers, cutting pliers, hack saw with blade, hand drill, spirit level, measuring tape, scales, etc.
- (k) Repairing works of pumps, motors, panels, switches, circuit breakers, gates, valves, pipelines, OHSRs and other electro-mechanical machineries of the project shall be carried out as per direction of Engineer-in-Charge and as per standard engineering practice.
- (l) Preventive and running maintenance of pipes, valves etc.
- (m) Preventive and running maintenance of control panel, PCC, MCC, relay, etc. for smooth operation of the complete water supply scheme.
- (n) Preventive and running maintenance of pumps, motors, valves, cranes etc.

Periodic maintenance of the machineries is to be ensured by deploying qualified and trained personnel

22. Building and Site Maintenance

The Contractor shall be responsible for:

- a) Full maintenance of building electrical, ventilation, plumbing, and drainage installations.
- b) Building and housekeeping maintenance.
- c) Full maintenance of the site, water and wastewater services, cabling and earthing system, together with the site road lighting system, boundary fencing.
- d) Site maintenance including the upkeep of landscaped areas, gardening, plantations
- e) The telephone installations in all buildings.

The building services and housekeeping maintenance shall be undertaken in all buildings and services installations created under this contract and existing. Routine housekeeping maintenance shall be carried out in accordance with the procedures specified in the Operation and Maintenance Manual.

23. Preventive Maintenance

The Contractor shall prepare a planning of the day-to-day maintenance and the preventive maintenance. This planning must include all equipment and the estimated necessary hours in preventive maintenance and curative maintenance. The Contractor must mention the qualification

of the foreseen maintenance personnel required for each case.

The Contractor shall provide the yearly requirement of consumables needed for the operation and maintenance of all equipment. These correspond only to the day-to-day maintenance, preventive maintenance and fore-seen curative maintenance if any. The Contractor shall get the plan approved from the Engineer-in-Charge.

Maintenance of Assets Created

During maintenance period, all electro-mechanical assets (Like pumps, motors etc) that have been installed / rehabilitated shall follow routine maintenance activities.

Illumination of the WTP/OHSRs/Sump welletc

The Contractor shall have to keep the illumination system of the WTP/OHSRs/Sump well etc area in full working condition. The Contractor shall maintain the proper illumination level in the office room, security room, pumping stations including outdoor roads. In doing so, he must replace the defective spares like lamps, condensers, igniters, ballasts etc. in proper time for all outdoor luminaries of standard quality.

24.Safety Requirements at Site

The Contractor shall be responsible for safety of his staff on Site during the Construction as well as O&M services. In case of accidental death/injury, causing danger to health/ loss of any kind of property and life due to negligence/lapse or any other reason, the sole responsibility and liability will be fixed against the contractor. He will be liable to any kind of proceeding investigation damage claim etc.

The Contractor's duties with respect to Safety shall include the following:

1. Utilize safety awareness procedures in every element of Operation and Maintenance.
2. Give emphasis to site safety including:
 - a) Safe working procedures.
 - b) Cleanliness and care of complete water supply scheme as a whole.
 - c) Accident and hazardous conditions reporting.
 - d) Organise Safety discussion meeting with all the personnel weekly.

Formal discussions on safety shall be held with all concerned agencies at least once a month.

The Contractor shall provide Notice Boards/ Display Boards at appropriate location detailing precautions to be taken by Operation and Maintenance personnel in work in conformity to regulation and procedures.

The Contractor shall notify the EIC immediately, if any accident occurs, whether on-site or off-site in which the Contractor is directly involved which results in any injury to any person, whether directly concerned with the Site or a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

The contractor shall have to provide and maintain a suitable First Aid Box at the office. The first aid box shall be equipped but not limited to, with following medicine and first aid materials:

- (a) Different sizes of sterilized dressings
- (b) Sterilized dressing for burns
- (c) 30ml bottle containing 2% alcoholic solution of iodine

- (d) 30gm bottle of potassium permanganate crystal
- (e) Scissors
- (f) Boric cotton
- (g) Ointment of burns
- (h) A bottle of suitable surgical antiseptic solution

25. Services and Facilities to be provided by Employer

The Employer shall be liable to the Contractor for the following:

- a) Provide free office accommodation space with attached toilet space for O&M personnel of the Contractor including security room within the WTP Premises.
- b) The charges for power during the O&M period shall be paid by Employer.

26. Special Conditions

The following special conditions shall be binding on the contractor:

- (a) **Agreement with the Contractor:** Rates for the O&M services shall be governed by the rates quoted by the bidder in Annexure-F- Price Bid for due consideration of the Employer. The contractor shall sign a agreement with the Employer along with the contract for the main works.
- (b) **Performance Security:** The Contractor shall provide a Performance Security for O&M Services in the form of a bank guarantee for an amount of Ten percent (10%) of the contract value of the O&M services issued by a reputable bank including scheduled bank or nationalized bank located in India, acceptable to the Employer in the format enclosed. The Performance Security for O & M services contract shall have to be furnished two months prior to the commencement of the O&M services.
- (c) **Insurance Policies:** The Contractor shall undertake insurance during the complete operation and maintenance period:
 - (i.) For all Equipment related to the complete water supply scheme. The value of the insured equipment shall be considered as 70% of the composite value of the equipment agreed in the Contract for the case of new equipment.
 - (ii.) Against Injury to Persons and Damage to Property
 - (iii.) Contractor's Personnel and Professional Liability insurance
 - (iv.) Third party vehicle liability insurance as required under India's Motor Vehicles Act, 1988 by the contractor for its Personnel or for Sub Contractor and their personnel for the period of contract.
 - (v.) Employer's liability & Workers compensation insurance in respect of the Personnel of the contractor in accordance with the relevant provisions of the Applicable Laws of India, as well as with respect to such personnel and such life, health, accident, travel or other insurance as may be appropriate.
 - (vi.) Any other laws/rule applicable in India.

The Contractor shall submit evidence of Insurance as per the provisions within 10 days from the date of commencement of the O& M services with the Employer and submit the relevant insurance policies within 30 days from the date of commencement of the O& M services with the Employer. The cost of the all the insurance premium shall be borne/paid

by the Contractor.

- (d) **Advance Payment:** No advance payment shall be paid for operation and maintenance services.

27. Other Terms and Conditions

- i. The personnel engaged by the Contractor shall not be absorbed by the in the Employer in any circumstances.
- ii. Contractor should extend full co-operation to Electrical Inspection, Dy Director Factories and any other Statutory Authority visiting the plant as per rules. Contractor shall have to follow the suggestions and direction covered under the respective Act and Rule. Contractor will have to arrange necessary to and fro conveyance to them for their inspection of plants. He will responsible to get necessary clearances from Electrical safety dept. and Deputy Director, Factories to run the plant.
- iii. The Contractor shall have to ensure timely payment to their personnel and comply with the provisions of all labour legislation and rules.
- iv. In case of any difficulties faced by the Contractor in performing the operation & maintenance activities, the same shall be reported immediately to the concerned EIC for taking necessary action.
- v. The Employer shall not be responsible for any untoward incident of accidental death, injury, and medical treatment etc. during on-duty hours. The payment of compensation if required under Workmen Compensation Act, 1923 and any other act, rules shall be borne by the Contractor. This will be statutory obligation on the part of the Contractor.
- vi. The Contractor has to ensure the payment of minimum wages to the deployed personnel as declared by the Labour Department, Govt. of CG from time to time. Any enhancement of minimum wages during the contractual period shall be paid by the Contractor, such additional charges shall however not be payable to the Contractor by the Employer.
- vii. The working hours of the operation & maintenance, number of shifts and timings of shift shall be approved by the EIC. The personnel engaged by the Contractor should follow /abide by the instructions of the EIC.
- viii. The Contractor shall deploy minimum number of operation & maintenance personnel having requisite qualification on each shift of the day as specified approved by the EIC. The same shall be done in such a manner that at no point of time, the pumping station remains inoperative. The Contractor shall ensure that none of the operation and maintenance personnel leaves his duty place unless and until he is relieved by another person deployed by the Contractor for the next shift.
- ix. The O&M personnel deployed by the Contractor shall record their time of attendance and departure on every day/shift in attendance register which is to be maintained at the place of deployment. Such attendance register shall be produced before the concerned EIC for regular checking.
- x. The Contractor shall not deploy any person as Operation & Maintenance personnel who may be found unsuitable for duty on medical ground because of illness (mental/physical), old age and or infirmity, duly certified by a registered medical practitioner.
- xi. The Contractor shall keep himself informed of the relevant and related laws & ordinances and shall conduct the work in compliance with such laws. Fees for

necessary permits, licenses, & taxes required by law shall be paid by the Contractor as per GCC.

- xii. For filling the vacant position on the event of death or otherwise, the Contractor must inform and seek consent from the EIC for the appointment of new worker.
- xiii. The Employer reserve the right to terminate the operation and maintenance contract of the plant (s) in case of non-performance of the Contractor based on report of the EIC. The termination shall however be governed by the GCC of the contract.
- xiv. All other terms and conditions shall be governed by the standard practices prevalent with the Employer.
- xv. Spares parts: The contractor shall give a list of spare parts/items which are essential for 9 Months maintenance with their rates. The Engineer in Charge would approve the list of spares which is to be submitted by the contractor.

➤ **List of minimum spares to be maintained during O&M period**

The contractor shall operate and maintain the complete water supply scheme including all the civil structures, electro-mechanical equipment, pipes, pipe specials, instrumentation etc in water supply scheme. He will maintain spares with stores for the proper upkeep of the WTP. List of minimum spares is given below.

LIST OF SPARES:

- i. Flash Mixer
 - (a) Motor----1 no of each capacity of motor
 - (b) Bearing----1 set for each type of pump and motor
 - (c) Shaft----1 set for each type of pump of specified MOC
- ii. Clariflocculators
 - (a) Motor Shaft--1 set for each type of motor
 - (b) Bearing---1 set for each type of pump and motor of specified MOC
- iii. 2 No. Tonners of approved MAKE Chlorine Cylinder

For repairs and proper upkeep of the complete water supply scheme in case any repair to any equipment is required, no extra payment will be paid to the contractor.

For non compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied. Residual chlorine at outlet of clear water pump house ≤ 2 ppm

➤ **Testing of raw and treated water during 9 months O&M by the contractor:**

“Daily the contractor has to get the raw water and treated water tested atleast three times at 8-hour interval for the parameters viz., turbidity, colour, taste, pH, TDS, Total hardness, residual chlorine conductivity, Alkalinity, Chlorides and coliform for Water Treatment Plants.

For non-compliance of the water quality parameter a penalty of Rs. 5000/- for one event in a day shall be levied incase the residual chlorine at outlet of WTP is found less than 2 ppm or any of the above physico-chemical and biological parameters is found in the beyond acceptable range as specified in IS: 10500

(i)Residual chlorine at outlet of clear water pump house < 2 ppm

Every day at least 3 times daily raw water and treated water test reports of all the parameters as indicated shall be made available to Engineer in Charge.”

➤ PERFORMANCE CAPABILITY:

For rapid gravity filters, the performance standards should be in accordance with para 6.6.8.2 of manual on water supply and treatment published by CPHEEO.

➤ Testing and Inspection:

All pipes and other castings subjected to pressures, shall be hydraulically tested to 2 times the designed pressures as directed by the CMO.

The entire work during manufacturing and erection, shall be subjected to inspections by the departmental staff (i.e. CMO or his nominees) for which adequate facilities, shall be extended by the tenderers at his cost. The WTP process will have arrangement for recycling of used back wash water for its complete treatment so that it becomes Zero Liquid Discharge facility

28. Payment

Payment shall be made to the contractor as per payment schedule mentioned Annexure F. The Contractor shall submit the bill for each month within the fifth working day of the next month to the concerned Engineer-in-charge.

The Monthly Progress Report along with Staff attendance sheet, duly signed by each Staff and countersigned by the Contractor shall be submitted with the monthly bill for operation of the complete water supply scheme

29. Non-Compliance

The EIC / representative designated by the Employer will make random visits to the complete water supply scheme to review the operation and maintenance practices including:

- (1). Compliance to operating of the complete water supply scheme as per agreement
- (2). Compliance for safety
- (3). Review of staff, attendances
- (4). Cleanliness of the Site etc

All field visits must be recorded and outcome of the visit/minutes of the meeting should be signed by Contractor and Employer for compliances.

a. Non-compliance to Reporting Requirements

All records shall be compiled for the monthly progress report to be submitted to the Employer. The monthly reports shall be submitted on the fifth day of the next month. The monthly report shall generally contain information in prescribed formats that shall be finalized in consultation with Employer.

The Reports shall include:

- Staff attendance for the Month
- Log Book showing Operation of Filter wash / pumps
- Cleanliness Register
- Maintenance book
- Consumption / Consumables book

Non-compliance to submission of the Monthly reports or in maintaining the records shall result in a deduction of 5% of the monthly charges.

b. Non-Compliance in the event of non-maintenance / repairs

The WTP shall not be operated at less than 50% of its design capacity due to maintenance and repair works. The period of such operation shall not exceed more than two consecutive days and not more than three days in a week. The maximum downtime of the WTP shall not exceed more than 8 continuous hours. The period for repairs and maintenance has to be communicated to the Engineer-in-charge (EIC) at least one month in advance.

Non maintenance/repairs/ to other civil structures, Electrical, Mechanical, SCADA, automation, instrumentation etc.

In the event of failure to comply with the above operational and maintenance requirement, the penalty shall result in deduction of 20% of the monthly charges.

c. Non-compliance to Staffing Requirements

At no point the staff / manpower within the pumping stations shall be less than 75% of the strength required. In no case, the absence of the Shift In-charge and Operator shall be admissible. The applicable rates for reduction on the Monthly Fees for staff / manpower on any day are as presented below:

Sl. No	Staff / Manpower attending to Staff /Manpower Required / Proposed (Whichever is higher)	Reduction in Rate
1	100%	Nil
2	90%	10% of the rates for non-compliance for each day
3	80%	25% of the rates for non-compliance for each day
4	75%	50% of the rates for non-compliance for each day
5	Less than 75%	100% of the rates for non-compliance for each day

d. Penalty for Damage, theft, Pilferage

The contractor shall be liable to compensate the Employer for any loss of property of the Water supply scheme during the construction as well as O&M period, due to theft, pilferage, damage, etc. caused as a result of negligence, mishandling, wrong operation, etc. on the part of personnel engaged by the contractor for operation and maintenance. The penalty amount shall be fixed by the Employer or the same shall have to be restored in original condition to the satisfaction of the Employer.

List of Laboratory Equipments/Glassware/Chemicals required for Water Treatment Plant –

The followings items deemed to be included in the Lump sum offer of Contractor. Nothing extra shall be paid by the department.

S.N.	Name of Equipments	Quantity
01.	Digital Electronic Precision Weighing balance	01
02.	Magnetic Stirrer with Hot plate- capacity 5 liters	01
03.	Water Proof Multiparameter Portable Meter P ^H / mV/Ion/ Conductivity / TDS/ Resistivity/ Salinity/ Dissolved Oxygen/ Temp. without ION ELECTRODES	01
04.	Fluoride Ion Electrode	01
05.	Vertical Autoclave	01
06.	Turbidity Meter Water Proof-IR Source	01
07.	Water Distillation Unit-4 liter/ hour (Wall Type)	01
08.	Micro- Processor Based Photo Colorimeter	01
09.	Bacteriological Incubator-	01
10.	Hot air oven (Medium size)	01
11.	Refrigerator (290 Ltr)	01
12.	Digital Colony Counter	01
13.	Centrifuge	01
14.	Jar test apparatus	01
Other Accessories		
15.	Steel Vessel (S.S. for Autoclave) Capacity-5lts	02
16.	Test Tube Stand (15 Hole) 18X150mm ss	05
17.	Test Tube Stand (15 Hole) 18X150mm pvc	05
18.	Nessler Tube Stand (100 mm dia)	02
19.	Cruable Tongs ss 18"	02
20.	Cruable Tongs ss 24"	02
21.	Beaker Tongs ss 12"	02
22.	Flask Tongs ss 18"	02
23.	Tissue Paper	05 pkt

LABORATORY GLASSWARE TO BE SUPPLIED BY THE CONTRACTOR

S.N.	Particulars	Capacity	Qty.
01.	Beaker	50ml	12
		100ml	24
		250ml	24
		500ml	12
02.	Burette	10ml	06
		25ml	06
		50ml	06
03.	Pipette	01ml	12
		05ml	12
		10ml	12
04.	Conical Flask	100ml	18
		250ml	24

		500ml	12
		01 lts	6
05.	Measuring Cylinder	25ml	2
		50ml	2
		100ml	2
		250ml	2
		500ml	2
06.	Volumetric Flask	100ml	06
		250ml	06
		500ml	12
		01Lts.	12
07.	Wash Bottle (Polythene)	01 Lts.	2
08.	Sample Bottle	250ml	18
		500ml	18
10	Reagent Bottle	1Lts.	12
		2 Lts.	6
11.	Dishes Crystallizing	100x 50mm	4
12.	Petridish (withcover)	80mm	8
13.	Durham Tube	1"x 3/8"x6/16",3" 1/16"	300
14.	Nessler Tube	100ml	24
15.	Test Tube (Rimless)	(Size 6"x3/4")	300
16.	Glass Rod		12
17.	Funnel	50mm	6
		100mm	6
18.	Distilled Water Bottle	2.5 lts.	6
19	Burette Stand		2
20.	Pipette Stand Horizontal		4
21.	WhattmanFiter		01
	(1) NO. 40 ,15 cm	100 nos	01pkt
	(2) NO. 1, 15 cm	100 nos	01pkt
	(3) No. 540, 12.5 cm	100 nos	01pkt

LABORATORY CHEMICALS TO BE SUPPLIED BY THE CONTRACTOR

S.N.	Particulars	Capacity	Quantity
01	O – Toludine	500 gm	06 nos.
02	Phenolphthalein Indicator Solution	125 ml	06 nos.
03	Phenol Red	125 ml	06nos.
04	Potassium Dichromate	500 gms	02 nos.
05	Potassium Chromate	500 gms	02nos.
06	Potassium Hydroxide (P)	500 gms	02 nos.
07	Potassium Chloride	500 gms.	02 nos.
08	Potassium Thicyanate	500 gms.	02 nos.
09	Potassium Iodide	250 gms.	02 nos.

10	1-10 Phenanthroline	25 gms	02 nos.
11	Buffer Tab P ^H 4.0	20 tablets	01 no.
	Buffer Tab P ^H 7.0	20 tablets	01 no.
	Buffer Tab P ^H 9.2	20 tablets	01 no.
12	Phenol Di-sulphonic acid	500 ml	02 nos.
13	Potassium Metaperiodate	100 gms	01 nos.
14	Ammonia Solution 0.91-25%	2.5 liters	02 nos.
15	Ammonia Buffer Solution	500 ml	02.nos
16	Acetic Acid glacial	500 ml	02 nos.
17	Ammonium Acetate	500 gms.	01 no.
18	Ammonium per sulphete	500 gms	02 nos.
19	Aluminum Hydroxide	500 gms.	02 nos.
20	Hydrochloric Acid	2.5 liters	01 no.
21.	Sulphuric Acid	2.5 liters	01no.
22.	O-Phosphoric Acid 85%	500 ml	01 no
23	Nitric Acid	2.5 liters	01 no.
24.	Murexide	5gm	02 nos.
25.	Eriochrome Black T	25 gm	04 nos.
26.	Sodium Hydroxide	500 gms.	02 nos.
27	Sodium Chloride	500 gms	02 nos.
28.	Silver Nitrate	25 gms.	04 nos.
29	SPANDA AR	5 gm	02 nos.
30.	Sodium Carbonate	500gms.	02 nos.
31.	Starch Soluble	500 gms.	02.nos
32	Silver Suphate	25 gms	02 nos.
33	Sodium Fluoride	500 gms.	01 no.
34	Sodium Acetate Anhydrous.	500 gms.	01 no.
35	Chloroform	500 gms.	01 no.
36.	Methyl Orange	125 ml	03 nos.
37	Glycerol 98%	500 ml	01 no.
38	Barium Chloride	500 gms.	01 no.
39	Ethanol Absolute	500 ml	01 no.
40	Hydrazine sulphate	100 gms.	05 no.
41	Mac Conkey Broth	500 gms.	02 nos.
42	Glass Wool	250 gms.	02 nos.
41	Mac Conkey Broth	500 gms.	02 nos.
42	Glass Wool	250 gms.	02 nos.
41	Ferrous Ammonium Sulphate	500 gms.	01 no.
42	Sodium Thio Sulphate	500 gms	01 no.
43	Magnesium Suplhate	500 gms.	01 no.
44	Hydrogen peroxide 30%	500 ml	01 no.
45	Ammonium Chloride	500 gms.	01 no.
46	Copper Sulfate	500 gms.	01 no.
47	Sodium Azide	500 gmas.	01 no.

48	Calcium Carbonate	500 gms.	01 no.
49	Hexamine GR	500 gms	01 no.
50	Sulphanilamide AR	500 gms.	01 no.
51	Potassium Nitrate	500 gms.	01 no.
52	Hydroxylamine	500 gms.	01 no.
53	EDTA	500 gms	02 nos.
54	Zirconiumoxy chloride	500 gms.	02 nos.
55	Potassium per magnet	100 gms.	02 nos.
56	Sodium Sulphate	100 gms.	02 nos.
57	Sodium Arsinat	100 gms.	02 nos.
58	Sodium oxalate	100 gms.	02 nos.
59	MercuricSulphate	500 gms.	01 nos.

Above mentioned requirements are minimum and indicative only, anyothers components/items/works required for successful operation and maintenance of complete water supply scheme for 12 Months, deemed to be included in the Contarctor's Lump Sum offer. Nothing extra shall be paid by the department.

Annexure E-09: Approved make list: -

S.no	Item/Component	Recommended Marks
MECHANICAL		
1	VT and Centrifugal Pumps	Kirloskar/Jyoti/Mather+Platt/WPIL/Becon Weir, Worthington/Flowmore limited/KSB
2	Flocculator driving arms motors	Alstom/Kriloskar/Jyoti/Crompton/ABB
3	DI pipes	ISI marked conforming to IS: 8329 Centrifugally Cast (Spun) DI Pressure Pipe of Water, Gas and Sewage duly inspected by [IR CLASS/RITES] as per approved QAP
4	MS Pipes/Plates	As per IS 3589.
5	Sluice Valves/Scour Valves (ISI marked)	Kirloskar/IVC/VAG/IVI/Fourcss/Durga/Dauli/LP (Manufacture: Perfect Valves)/Mahadevi/R&D (Manufacture: R&D Multiples)/Sachdeva Metal works/Shiva Industries/Aira Euro Automation Pvt. Ltd.
6	Butterfly Valve (ISI marked)	Kirloskar/IVC/VAG/IVI/Fourcss/Durga/Dauli/ Sigma Flow /LP (Manufacture: Perfect Valves)/Mahadevi/R&D (Manufacture: R&D Multiples)/R.G. Industries/Shiva Industries/Aira Euro Automation Pvt. Ltd.
7	Non-Return Valves (ISI marked)	Kirloskar/IVC/VAG/IVI/Fourcss/ Sigma Flow /Durga/Dauli/LP (Manufacture: Perfect Valves)/Mahadevi/R&D (Manufacture: R&D Multiples) /R.G. Industries
8	Kinetic Air Valve (ISI marked)	Kirloskar/IVC/VAG/IVI/Fourcss/Durga/Dauli/ Sigma Flow /LP (Manufacture: Perfect Valves)/Mahadevi/R&D (Manufacture: R&D Multiples)
9	Valve Actuators	Auma/Rotork/Limitork
10	Hydraulically operated Flow-cum-Pressure control valves	VACI/Daling-Muesco/ Sigma Flow / Bermad /Singer/Dorot/
11	Single faced Sluice Gates	JASH/VACI/ Sigma Flow /Kirloskar/IVC/Adroit AssociatesPrivate Limited
12	Water Hammer Control Devices	Sureseal/Saisanket/Durga
13	Electro-Magnetic Flow Meters	Emerson/KrhonMarshall/SBEM/Yokogawa/E&H/ Nivvo Control/Siemens/Adept
14	WTP Equipment: Flash-mixers, Clariflocculator, Rotating-Bridge, Blowers etc.	Triveni, Shivpad/Dorr-Oliver/ Voltas/ Reliable/ KAY/ AIRVAC/Adroit AssociatesPrivate Limited
15	Chlorination Equipment's, Chlorinator, Chlorine leak detector, Residual Chlorine analyser, Scrubber etc.	Pennwalt/ W&T/ Alldos/ CHLOROTECH/ Siemens/ Emerson Process/E&H/Forbes Marshall
16	DI Fitting & Specials	As per IS 9523:2000
17	Dismantling/ Expansion Joints	Reputed Makes
18	Compression fitting, Tapping Saddles, Electro-fusion Couplets	Kimplas/ Georgeficher/ Glynwed/ Frialeii/ Trustlene/ GPS/ Durafuse/Aiva.

S.no	Item/Component	Recommended Marks
ELECTRICAL		
1	Moulded Case Circuit Breaker (MCCB)	Siemens/ Schneider M.G./ Jyoti/ L&T/ C&S
2	MCB, RCCB	Siemens, Schneder, Hager, ABB, MDS
3	ACB (Air Circuit Braker)	Siemens/ Jyoti/ ABB/ L&T/ Schneider / C&S/ BCH
4	VCB (Vacuum Circuit Breaker)	Crompton Greaves/ABB/ Siemens/ Schneider (M.G.)/
5	Relay and Contractors	Siemens/ Alstom/ Jyoti/ ABB/ L&T/ Snider/ C&S/ BCH
6	Cables	Tropodue/ Finolex/ Asian/ Gloster/ Incab/ Universal/ Polycab/ Unidoor/ Havells/ Nicco/ RR Kabel
7	Panel Enclosures and Consoles, PDB, LDB	Rittal/ President/ Cutler Hammer/Schineder/L&T/ABB.
8	Switches & Sockets	Legarnd, Schnieder, Panasonic, Cona, ROMA
9	Crimping Lugs, Gland of Double Compress Type	Dowells, Jainson, Lotus, Braco
10	Cable Glands & Lugs	Dowell, Lotus, A.G. Electricals, Siemens.
11	CAT-6 LAN Cable	Luncent, LAPP, AMP
12	Motor Protection Relay	Universal, Thresold, L & T, Minilac, Siemens, C&S, ABB, Telemechanique, Indo-Asian
13	Copper Cable (FRLS Grade)	Finolex, RR cable, LAPP, Polycab, Sundeep
14	Motors	Kirloskar/Jyoti/Marathon/Crompton/Greaves/ABB/Alsto m/BHEL/Siemens/BharatBijlee/ Marathon
15	Switch Fuse Disconnecter	L&T/FN Type/Siemens 3KL Type/GEPS/ Havells/ C&S/ Schneider
16	Multi-Function Energy Meters	Enercon/ L&T/Socomec/AE/Mecco/Schnieder
17	Capacitor Bank	Cromton Greaves/Khatau Junker/ Malde/L&T/Asian/ Mohmaya/ Universal/ C&S
18	Cable Termination Kit	Raychem Denson/ M-Seal
19	Battery	HBI/ NIFE/Exide/Amco
20	Battery Charger	Chaabi Electrical/Masstech
21	Soft Stater	Siemens/ ABB/ BCH/ GE/ L&T/ C&S/Schneider
22	EOT Cranes	Venus Engineers/ Unicon/ Hercules

S.no	Item/Component	Recommended Marks
23	Transformer	Kiloskar/ Crompton/ MP Transformer/ Voltamp/ Patson/ Datson/ Danke/ Danish/Approved makes of CSPDCL
24	LED batten Light, LED Street light, luminaries, Ceiling fan, Exhaust fans, Inspection boxes, light fixtures	Philips, /Crompton/GEC/Khaitan/Bajaj/ Wipro
25	Air Conditioners (AC)	Voltas/LG/Samsung/Panasonic/Daikin/Hitachi
26	Fan	Crompton, Bajaj, Almonard, Khaitan, Orient, Usha, Havells.
27	Ferrules	Akar/Saksham/Grrf
28	Alarm Annunciator	Miniles/Peacon/Ica/Aplab
28	Uninterruptible Power Supply	HI-Real/Pulse/Tata Libert/Apc/ Aplab
30	Lightening Protection Unit	MH Inst/ Crompton Greaves/ Mlt/Pepper & Fuchs/ Rittmeyer/Cirprotec/ Alstom/ Elpro
PCC-SCADA AUTOMATION		
1	PLC/RTU	Rockwell (Allen Bradley)/ Siemens/ Honeywell/ /Schneider/ABB
2	HMI Software	SIEMENS/ Rockwell Automation (<i>Allen Bradley</i>) / Schneider/ABB
3	HMI	Rockwell Automation (<i>Allen Bradley</i>) / Siemens / Honeywell/Schneider/ABB
4	TB With Fuse & Fuse failure Indication for PLC input/Output	PHONIEX, Wago
5	Interposing Relay	OMRON, PHONIEX
6	ETHERNET SWITCH	PHONIEX, WAGO, DLINK
7	LED SCREEN/MONITOR	SONY/SAMSUNG/LG
8	Computer [Servers & Workstation]	HP-Compaq/ IBM/ Dell
9	Laptop	HP/ Dell/ Sony/ Toshiba
10	Engineering cum Operator workstation/Desktop Top PC	IBM/HP/Dell
11	Printer	Samsung /HP/CANNON
12	CCTV	Sony/LG/Panasonic
13	Ultrasonic/Radarflow&Level transmitter	Endress+Hauser/ KrohneMarshall/ Hycontrol/emerson/Krohne Marshall
14	Pressure Switch	Indfoss/Switzer/Tag Process Instruments
15	Pressure Gauge	Waree/Wika/An Instrumentals/Guru/Hitek
16	Flow Switch	Switzer/General Instrument/ Forbes Marshall

S.no	Item/Component	Recommended Marks
17	Pressure Transmitter	Ememerson/Foxbro/Druck/Endress-Hauser/ABB/Honeywell Automation/Krohne Marshall
18	Instruments & Control Cables	Delton/Asian/Several/ Tcl/Thermopad
19	Receiver Indicator/ Digital Panel Meter	Masibus/ Yokogawawa/ Lectrotek/Nishko/ Saitech/ Mtl INSTS
20	Conductivity Level Switch	Pune techtrol/Krohne Marshall/SBEM/E+H/ NIVO
21	Mechanical Water Meters confirming to IS 779:1994 and ISO 4064:1003	RLT (Manufacture: RL Technologies)
22	Full bore Electromagnetic flow meters and ultrasonic flow meter confirming to ISO-9001:2008	RLT (Manufacture: RL Technologies)/Krohne Marshall
23	Water meters - AMR compatible and AMR Type	Itron/Xylem/Rahul/Elster/Xylem/Baylan/Dasmesh Engineering Works.
24	Pressure Reducing Valves	VAG/Bermad/Darling Muesco/Singer/Shiva Industries
25	Flow Control Valves (FCV)	Dorot/Singer/ Darling Muesco/Aira Euro Automation Pvt. Ltd.
26	Online PH Analyzer	E&H/Emerson/Krohne Marshall/GE/Hach/ABB/Yokogawa
27	Online Turbidity Analyzer	E&H/Emerson/Krohne Marshall/GE/Hach/ABB/ Yokogawa
CIVIL		
1	Cement	ACC/Ambuja/Century/JK Laxmi/Ultratech/Birla/Lafarge
2	Paint	Weather-shield Apex/ Asian Paints
3	Wall Putty	Birla wall care/Alltek superfine W/R of (NCL)/ Asian/ICI, Nerolac, /J. K wall/Nuvoco
4	Structural Steel	SAIL/Tata Steel Ltd/RashtriyaIspat Nigam Ltd [RINL] or Equivalent ISI marked
5	Steel reinforcement	SAIL/ Tata Steel Ltd /RashtriyaIspat Nigam Ltd [RINL]/Jindal/Goel TMT or Equivalent ISI marked
6	Tiles	Kajaria/RAK/Somany/Nitco

Note; - All makes approved/sanctioned by CGUADD/CGPHED, upto the last date of submission of online bids, will also be considered if they meet the desired specifications mentioned in the tender document.

In situations where approved vendors are unable to supply the required equipment or materials due to certain reasons, the contractor has the option to select alternative reputed suppliers who meet the desired specifications outlined in the tender document. However, this selection must be made with the approval of the competent authority.

Annexure - "F"(Main) : Price/Payment Schedule

S. No.	Component of Water Supply Scheme	Percentage Payment to the Contractor
	Engineering, Procurement, Construction, testing, commissioning of Existing Water Supply Scheme at Nagar Panchayat Bhakharaincluding Trial run, (inclusive of replacement and warranty) of all followings Project Components (as per scope of work, technicalspecficiations and as per the direction of Engineer in Charge.	
S.no	Component-A	Percentage Payment to the Contractorwrt Quoted cost against Construction cost (Lumpsum)
1	Sump well-cum Pump House Sump well cum Pump House- 11.3m (internal dia), including all allied works	1.49%
2	Raw water pumping main-DI K-9 Class pipe (Dia 250mm) of total length = 11674Rmt including all allied works	44.75%
3	Raw water Pumps, Clear water Pumps, Substations: - 3nos.(2W+1S) vertical turbine pump sets, each having discharge of 16 LPS and 15m head and including all allied works. 3 nos.(2W+1S) Centrifugal pumps, each having discharge of 22.35LPS and40 m head) including all allied works Substations for Intake&WTP 100 KVA(1W+1S) at Intake wellincluding all allied works	4.61%
4	Rehabilitation of Conventional Water treatment plant of capacity2.00 MLDand including all allied works	9.42%
5	Clear water Rising main–DI, K-9 class pipe (Dia 150 to 250 mm) total length - 5899RMT including all allied works	18.16%
6	OHSRs: - 1 no. OHT (160 KL/20 m staging) including all allied works	3.08%
8	Distribution network –DI, K-7 class pipe (Dia 100 to 150 mm)total length - 3540 RMT) including all allied works	9.91%
9	FHTCs: -Functional House service Connections -115 nos.	0.35%
11	Panel room &Other Allied works	0.90%

12	PLC & SCADA automation, monitoring and control system for complete water supply Scheme (existing &proposed) including all allied works	7.21%
13	Dismantalling of Unservicable OHT	0.12%
	TOTAL	100.00 %

Component-A- Price breakup**Annexure - "F-1**

(RCC Raw Water Sump well-cum-Pump House)” : Price Schedule

Percentage break-up of payment for the Construction of RCC Sump well-cum-Pump House(For 1.49% of Lumpsum offer) (CGPHE SOR 2020 amendment 07/2022-23)

Sl. No	Description	Percentage payment on completion
	Design, Supply, Erection, Construction, geotechnical investigation (determination of SBC) Testing, Commissioning of RCC Sump well cum-pump House complete as per scope of work, specifications and as per the direction of Engineer in Charge. The payment break up is as follows: -	
1.	After approval of Physical survey, geotechnical investigations including trial bores (for determination of SBC, for preparation of cross section, fixing of HFL etc & other necessary parameters), Structural design & drawings including and other necessary surveys etc	5 %
2.	Excavation, dewatering, PCC 1:2:4 etc	8 %
3.	Foundation and Construction upto GL	10 %
4.	Upto discharge floor including RCC slab of DFL	17 %
5	Completion of pump house including top RCC slab	8 %
6	Approach Bridge/Road etc and allied work	15 %
7	Supply of Mechanical & Electrical items including all required and allied items.	12%
8	Installation, testing and commissioning of all components.	15 %
9	Inside and Outside painting, other finishing works, demolition of Cofferdam etc and all other requirements as per scope of work, technical specifications and as per the direction of Engineer in Charge	5 %
10	Internal and External Electrification (Inside and outside illumination)	5 %
	TOTAL	100 %

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure - "F-2**(Raw water Pumps,Clear water Pumps,Electric Substations)" : Price Schedule**

Percentage Break-up of payment for Raw water Pumps, Clear water Pumps and Electric Sub-Stations (Intake and WTP) (For 4.61% of Lumpsum offer) (CG_PWD_SOR_2020 & NON SOR)

The percentage cost of work for intermediate payment at different stages of work shall be as follows: -

PART- A**SCHEDULE FOR ITEMS FOR RAW WATER VT PUMP SET (PROPOSED)**

<u>S.no</u>	<u>Particulars</u>	<u>% Payment of work</u>
	Design, Supply, installation/Erection, testing, commissioning of followings items as per scope of work, technical specifications and as per the direction of Engineer in Charge	
1	V.T pumps(2w+1S) for 16 LPS each at 15mtr. Head each as per detail specification along with column pipe, column assembly Foundation bolts for above pump set along with suitable HP VHS Electric Motor 3 phase, 415 volts, as per technical specifications. Pump efficiency minimum 80% at duty point.	5%
2	Vertical Hollow Shaft motors, SPDP, 1450 RPM suitable to operate on 415V + 10%, 3P, 50Hz, AC supply having 'F' class insulation temp. rise limited to 'B' class with continuous duty, conforming to IS-12615 as per technical specifications.	5%
3	Motor control panels: Motor control panels shall be as per detail specification along with soft starters as per technical specification.	4%
4	EOT Cranes of approved make complete as per technical specification.	2%
5	Sluice/Butterfly Valves, Common Manifolds, Dismantling Joints, NRVs, Cables, Mud pumps, Tools & accessories and all others items as per scope of work, technical specifications and as per the direction of Engineer In Charge	2%
6	Installation, testing and commissioning of all above items including Earthing, painting and all others items as per scope of work, technical specifications and as per the direction of Engineer In Charge	4%
		22%

PART - B**SCHEDULE FOR ITEMS FOR CLEAR WATER PUMPSET. (PROPOSED)**

<u>S.no</u>	<u>Particulars</u>	<u>% Payment of work</u>
	Design, Supply, installation/Erection, testing, commissioning of followings items as per scope of work, technicalspecifications and as per the direction of Engineer in Charge	
1	Centrifugal pumps (2w+1S) for 22.35 LPS each at 40 M total head with positive as per detail specification along with Coupling, Coupling guard, Base Plate & Foundation bolts for above pump along with suitable HP Electric Motor as per technical specifications. Pump efficiency minimum 80% at duty point.	17%
2	Suitable HP Electirc motors 3 phase, 415V, foot mounted type TEFC, 1450 RPM as per technical specifications.	8%
3	Motor control panel: Motor control panel shall be as per detail specification alongwith soft starters as per technical specification.	8%
4	EOT Crane of approved make complete as per technical specification.	3%
5	Sluice/Butterfly Valves, CommonManifolds, DismantlingJoints, NRVs, Cables, others tools & accessories and all others items as per scope of work, technicalspecifications and as per the direction of Engineer In Charge	3%
6	Installation, testing and commissioning of all above items including Earthing, painting and all others items as per scope of work, technicalspecifications and as per the direction of Engineer In Charge	5%
		44%

PART – C - 1**SCHEDULE OF ITEMS FORELECTRIC SUB STATION(INTAKE).**

<u>S.no</u>	<u>Particulars</u>	<u>% Payment of work</u>
	Design, Supply, installation/Erection, testing, commissioning of followings items as per scope of work, technicalspecifications and as per the direction of Engineer in Charge	
1	11/0.415 kV 100 KVA Transformer (1w+1S) having as per detail specification.	5%
2	HT circuit Breaker with CT arrangement	3%
3	LA's, ABswitch, cables, Busbars, Fuseunits, Insulators, ACBs, Realyunits, others tools & accessories and all others items as per scope of work, technicalspecifications and as per the direction of Engineer In Charge	3%
4	Installation, testing and commissioning of all above items including Earthing, painting, fencing and all others items as per scope of work, technicalspecifications and as per the	3%

	direction of Engineer In Charge	
		14%

SCHEDULE OF ITEMS FORELECTRIC SUB STATION (WTP).

- A. On supply of equipment at site - 60% [Duly approved by Third Party Inspection (IR CLASS/RITES/IRCLASS)]
- B. On erection of equipment at site - 20%
- C. On testing, commissioning, trial run 20%
-

Total: - 100%

Note: -

- Three Phase electric connections, Extension of HT line up to metering equipments shall be done through concered department. The contractor's scope starts after metering unit.
- The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure - "F-3

(Raw Water , Clear Water Rising Mains and Distribution Network, Push through for road/Canal crossing, House Service Connections & Bulk flow meters)" :
Price Schedule(CGPHE SOR 2020 amendment 07/2022-23)

Raw water Rising/Pumping mains- Percentage breakup of payment of 44.75% of Lump Sum offer

S No	Particulars	Quantity	Amount (In Rs)
1	Excavation: Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. For Lift 0 to 1.5 m Total Quantity 13892.06 x 0.6 (UOSR Amendment 7-2022-23 18.15/ 51) (UOSR Amendment 7-2022-23 18.19.6/ 52)	8335.236	
2	Earth work in excavation for pipe trench in Hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. (UOSR Amendment 7-2022-23, I.N.18.16/ 51) For Lift 0 to 1.5 m Total Quantity 13892.06 x 0.4	5556.824	
3	Demolishing cement concrete manually / by mechanical means including disposal of material within 50 m lead as per direction of engineer-in-charge. Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix) (UOSR Amendment 7-2022-23, I.N.18.29.1/ 52) Considering 10% length through paved area 1167.4 0.85 0.2 198.458 198.458	198.458	
4	Pumping out water caused by springs, tides or river seepage, broken water mains or drains or well or the like. (UOSR Amendment 7-2022-23 I.No. 18.21/ 52)	1000	
5	Providing, laying and jointing including testing following socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (class K-9) conforming to IS 8329 /2000 with suitable Rubber Gasket (Push on) joints as per IS:5382/2018 250 mm dia DI K-9	11674	

	TOTAL	11674	
	(UOSR Amendment 7-2022-23 4.3/ 3)		
6	Providing and Laying including testing Ductile Iron Double Socket 90° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.13/ 7) 250 mm dia	6	
7	Providing and Laying including testing Ductile Iron Double Socket 45° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.15/ 7-8) 250 mm dia	10	
8	Providing and Laying including testing Ductile Iron Double Socket 22.5° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.17/ 8) 250 mm dia	5	
9	Providing and Laying including testing Ductile Iron Double Socket 11.25° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (CG PHE SOR_2020 4.19/62) 250 mm dia	4	
10	Providing and Laying including testing Ductile iron Mechanical joint collar with follower glands conforming to IS: 9523/2000 having dimension as per table 24 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.11/ 6) 250 mm dia	4	

11	Providing & fixing following ductile iron single chamber triple function temper proof air valves, small orifice with screwed end as per IS : 14845-2000 including jointing & testing with cost of jointing material and rubber insertion all complete as per IS :13095-1991 (UOSR Amendment 7-2022-23 4.50/ 21) 50 mm diameter (PN 1.6)		23
12	Providing & fixing of following Ductile iron double flanged sluice valves as per I.S.:14846-2000 fitted with cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete. (UOSR Amendment 7-2022-23 4.41/ 18) Sluice Valve & Scour Valve 100 mm diameter		

17	<p>Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications. (For Village roads)</p> <p>For Remaking of road crossing & paved surface 5 % road area for paving P.C.C. M-10 (UOSR Amendment 7-2022-23 18.40.1.4/ 53) 583.7 0.85 0.15 74.42175 74.42175 74.42175</p> <p>With Cement concrete grade M-30 and minimum cement content @ 375 kg/cum. P.C.C. M-20 (UOSR Amendment 7-2022-23 18.41.1.3/ 54) 583.7 0.85 0.2 99.229 99.229</p>		
18	<p>Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage.</p> <p>(UOSR Amendment 7-2022-23, I.N.18.44 / 54) (for Thrust block)</p>	1170.6	
19	<p>Providing & fixing form work i/c centering and shuttering including strutting, propping etc. and removal of form work for:</p> <p>Foundation , footing, bases of columns ,etc for mass concrete (UOSR Amendment 7-2022-23 18.64.1/ 56)</p>	139.1473	
20	<p>Chamfering of CI/DI pipes of all types and classes to make suitable for tyton joints.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 i.n. 19.6/61) 250 mm dia.</p>	34	
21	<p>Labour only for cutting following Ductile Iron pipes of any type and class.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 19.4/60) 250 mm dia.</p>	34	
22	<p>Supply & Filling moorum/river sand for pipe bedding or over the pipe (including supply)</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 18.24/52)</p>	148.8435	
23	<p>Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5m in all kinds of soils</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 18.22/52) Available excavated earth Deduct Volume of pipe Thrust block Road Reinstating</p>	13892.06 -573.266 -39.02 -173.651	

	Sand Filling	-148.844	
		-934.781	
	Total Refilling	12957.28	
	This item also include refilling for bedding below pipe 15 cm thick		
24	Construction of RCC Valve chamber with RCC precast Cover		
	250 mm Dia Sluice Valve	4	
	For scour Valve 100 dia	28	
25	Carriage of Material by Mechanical transport including loading unloading & stacking etc.		
	Earth & Moorum 5 KM	934.7806	
	CGPHE SOR 2020 Ammedment7 , item 19.10.2.5 p-62		

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

- Clear water Rising Mains-Percentage Breakup of payment of 18.16% of Lump Sum offer

S.N.	PARTICULARS	QUANTITY	UNIT	AMOUNT
1	Excavation: Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. For Lift 0 to 1.5 m Total Quantity 6141.205 x 0.6 (UOSR Amendment 7-2022-23 18.15/ 51)	3684.72	Cum	
2	Earth work in excavation for pipe trench in Hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. (UOSR Amendment 7-2022-23, I.N.18.16/ 51) For Lift 0 to 1.5 m Total Quantity 6141.205 x 0.4	2456.48	Cum	

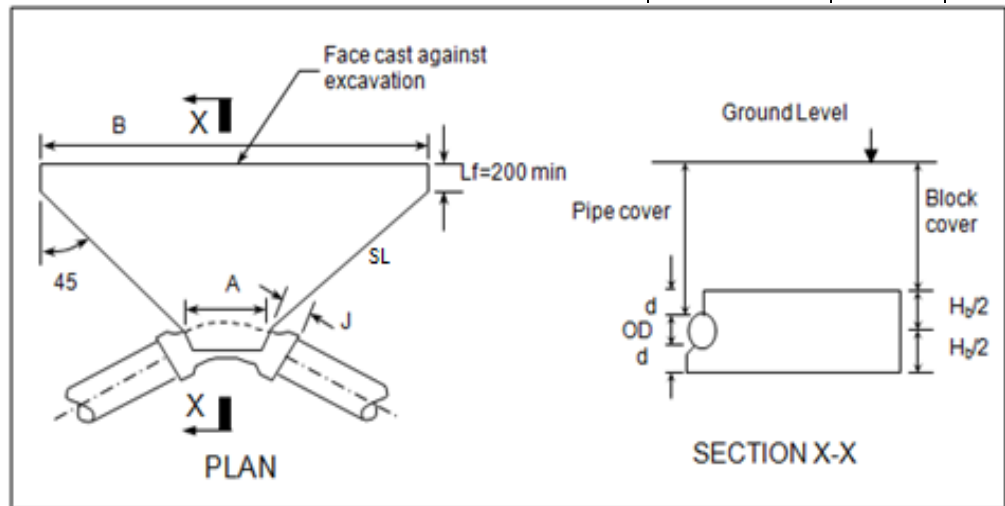
3	<p>Demolishing cement concrete manually / by mechanical means including disposal of material within 50 m lead as per direction of engineer-in-charge.</p> <p>Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)</p> <p>(UOSR Amendment 7-2022-23, I.N.18.29.1/ 52)</p> <p>Considering 10% line passing through paved area</p> <table><tr><td>170.6</td><td>0.85</td><td>0.2</td><td>29.00</td></tr><tr><td>21.8</td><td>0.80</td><td>0.2</td><td>3.49</td></tr><tr><td>397.5</td><td>0.75</td><td>0.2</td><td>59.63</td></tr><tr><td></td><td></td><td></td><td>92.12</td></tr></table>	170.6	0.85	0.2	29.00	21.8	0.80	0.2	3.49	397.5	0.75	0.2	59.63				92.12	92.12	Cum													
170.6	0.85	0.2	29.00																													
21.8	0.80	0.2	3.49																													
397.5	0.75	0.2	59.63																													
			92.12																													
4	<p>Pumping out water caused by springs, tides or river seepage, broken water mains or drains or well or the like.</p> <p>(UOSR Amendment 7-2022-23 I.No. 18.21/ 52)</p>	1000	KL																													
5	<p>Providing, laying and jointing including testing following socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (class K-9) onforming to IS 8329 /2000 with suitable Rubber Gasket (Push on) joints as per IS:5382/2018</p> <table><tr><td>250 mm dia</td><td>DI</td><td>1706.00</td><td>Mtr</td></tr><tr><td></td><td>K-9</td><td></td><td></td></tr><tr><td>200 mm dia</td><td>DI</td><td>218.00</td><td>Mtr</td></tr><tr><td></td><td>K-9</td><td></td><td></td></tr><tr><td>150 mm dia</td><td>DI</td><td>3975.00</td><td>Mtr</td></tr><tr><td></td><td>K-9</td><td></td><td></td></tr><tr><td colspan="2">TOTAL</td><td>5899.00</td><td></td></tr></table> <p>(UOSR Amendment 7-2022-23 4.3/ 3)</p>	250 mm dia	DI	1706.00	Mtr		K-9			200 mm dia	DI	218.00	Mtr		K-9			150 mm dia	DI	3975.00	Mtr		K-9			TOTAL		5899.00				
250 mm dia	DI	1706.00	Mtr																													
	K-9																															
200 mm dia	DI	218.00	Mtr																													
	K-9																															
150 mm dia	DI	3975.00	Mtr																													
	K-9																															
TOTAL		5899.00																														
6	<p>Providing and Laying including testing Ductile Iron Double Socket 90° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining.</p> <p>(UOSR Amendment 7-2022-23 4.13/ 7)</p>																															

	250 mm dia	2	Each	
	200 mm dia	1	Each	
	150 mm dia	4	Each	
7	Providing and Laying including testing Ductile Iron Double Socket 45° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.15/ 7-8)			
	250 mm dia	1	Each	
	200 mm dia	1	Each	
	150 mm dia	4	Each	
8	Providing and Laying including testing Ductile Iron Double Socket 22.5° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.17/ 8)			
	250 mm dia	1	Each	
	200 mm dia	1	Each	
	150 mm dia	3	Each	
9	Providing and Laying including testing Ductile Iron Double Socket 11.25° Bends conforming to IS: 9523/2000 having dimension as per table 15 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining. (CG PHE SOR_2020 4.19/62)			
	250 mm dia	1	Each	
	200 mm dia	1	Each	
	150 mm dia	2	Each	
10	Providing and Laying including testing Ductile iron Mechanical joint collar with follower glands conforming to IS: 9523/2000 having dimension as per table 24 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen and internal cement mortar lining. (UOSR Amendment 7-2022-23 4.11/ 6)			
	250 mm dia	4	Each	
	200 mm dia	1	Each	

	150 mm dia	8	Each																	
11	<p>Providing & fixing following ductile iron single chamber triple function temper proof air valves, small orifice with screwed end as per IS : 14845-2000 including jointing & testing with cost of jointing material and rubber insertion all complete as per IS :13095-1991</p> <p>(UOSR Amendment 7-2022-23 4.50/ 21)</p> <p>50 mm diameter (PN 1.6)</p>	12	No.																	
12	<p>Providing & fixing of following Ductile iron double flanged sluice valves as per I.S.:14846-2000 fitted with cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete.</p> <p>(UOSR Amendment 7-2022-23 4.41/ 18)</p> <p>Sluice Valve & Scour Valve</p> <table><tr><td>250 mm dia</td><td>PN-16</td><td>1</td><td>No.</td></tr><tr><td>200 mm dia</td><td>PN-16</td><td>1</td><td>No.</td></tr><tr><td>150 mm dia</td><td>PN-16</td><td>7</td><td>No.</td></tr><tr><td>100 mm dia</td><td>PN-16</td><td>8</td><td>No.</td></tr></table>	250 mm dia	PN-16	1	No.	200 mm dia	PN-16	1	No.	150 mm dia	PN-16	7	No.	100 mm dia	PN-16	8	No.			
250 mm dia	PN-16	1	No.																	
200 mm dia	PN-16	1	No.																	
150 mm dia	PN-16	7	No.																	
100 mm dia	PN-16	8	No.																	
13	<p>Providing and Laying including testing Ductile Iron Double Socket branch flange Tee conforming to IS:9523/2000 having dimension as per table 21 of IS:9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining with finishing as per clause 13 of IS:9523/2000.</p> <p>(UOSR Amendment 7-2022-23 4.23/ 11)</p> <p>For Scour Valve</p> <table><tr><td>250 mm x 100 mm</td><td>1</td><td>No.</td></tr><tr><td>200 mm x 100 mm</td><td>0</td><td>No.</td></tr><tr><td>150 mm x 100 mm</td><td>7</td><td>No.</td></tr></table>	250 mm x 100 mm	1	No.	200 mm x 100 mm	0	No.	150 mm x 100 mm	7	No.										
250 mm x 100 mm	1	No.																		
200 mm x 100 mm	0	No.																		
150 mm x 100 mm	7	No.																		

14	<p>Providing and Laying including testing ductile iron PN 16 type flanged sockets conforming to IS: 9523/2000 having dimension as per table 23 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining with finishing as per clause 13 of IS:9523/2000.</p> <p>(UOSR Amendment 7-2022-23 4.7/ 4)</p> <p>Flange Socket Tail piece</p> <p>250</p> <p>200</p> <p>150</p>	2	No.	
		2	No.	
		14	No.	

16	<p>Providing & laying mechanically mixed R.C.C. excluding centering& shuttering and reinforcement in foundation/plinth (20mm graded metal)</p> <p>THRUST BLOCK</p>			
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Nominal Diameter mm	Bend Angle deg	Test Pressure bar	Pipe Cover mm	Design Case	OD mm	Thrust kN	Hb mm	A mm	B mm	Volume m3	SL
250	22.5	33	1000	1	274	75.8	674	350	2650	1.545	1626
250	45	33	1000	2	274	148.6	674	500	4700	4.345	2970
250	90	33	1000	3	274	274.6	674	800	7600	10.684	4808
200	22.5	28	1000	4	222	42.3	622	300	1700	0.665	990
200	45	28	1000	5	222	83.0	622	450	3100	1.873	1874
200	90	28	1000	6	222	153.4	622	650	5200	4.812	3217
150	22.5	29	1000	7	170	25.8	570	250	1200	0.345	672
150	45	29	1000	8	170	50.6	570	350	2200	0.938	1308
150	90	29	1000	9	170	93.6	570	550	3750	2.407	2263

	<p>Size: A= 0.350, B=2.22, Hb=0.57 d=0.20 &Lf=0.20 SL=1.308</p> <p>45 deg. Bend No. 4 0.938 3.752</p> <p>Size: A= 0.250, B=1.20, Hb=0.57 d=0.20 &Lf=0.20 SL=0.672</p> <p>22.5 deg. Bend No. 5 0.345 1.725</p> <p>Deduct Volume of bends</p> <p>Volume for bends FOR DEDUCTION</p> <p>90 deg. Bend 4*0.785*0.17 0^2*1.32 -0.119785</p> <p>45 deg. Bend 4*0.785*0.17 0^2*0.57 -0.051725</p> <p>22.5 deg. Bend 5*0.785*0.17 0^2*0.30 -0.03403</p> <p>Total M20 RCC quantity 51.396586 Cum</p>																																																											
17	<p>Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications. (ForVillage roads)</p> <p>For road crossing and remaking of paved surface P.C.C. M-10 (UOSR Amendment 7-2022-23 18.40.1.4/ 53)</p> <table><tr><td>0.00</td><td>170.60</td><td>0.85</td><td>0.15</td><td>21.75</td><td></td><td></td></tr><tr><td></td><td>21.80</td><td>0.80</td><td>0.15</td><td>2.616</td><td></td><td></td></tr><tr><td></td><td>397.50</td><td>0.75</td><td>0.15</td><td>44.72</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td>69.09</td><td>69.09</td><td>Cum</td></tr></table> <p>With Cement concrete grade M-20 and minimum cement content @ 375 kg/cum.</p> <p>P.C.C. M-20 (UOSR Amendment 7-2022-23 18.41.1.3/ 54)</p> <table><tr><td></td><td>170.60</td><td>0.85</td><td>0.20</td><td>29.00</td><td>29.00</td><td>Cum</td></tr><tr><td></td><td>21.80</td><td>0.80</td><td>0.20</td><td>3.49</td><td></td><td></td></tr><tr><td></td><td>397.50</td><td>0.75</td><td>0.20</td><td>59.63</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td>161.2</td><td></td><td></td></tr></table>	0.00	170.60	0.85	0.15	21.75				21.80	0.80	0.15	2.616				397.50	0.75	0.15	44.72							69.09	69.09	Cum		170.60	0.85	0.20	29.00	29.00	Cum		21.80	0.80	0.20	3.49				397.50	0.75	0.20	59.63							161.2					
0.00	170.60	0.85	0.15	21.75																																																								
	21.80	0.80	0.15	2.616																																																								
	397.50	0.75	0.15	44.72																																																								
				69.09	69.09	Cum																																																						
	170.60	0.85	0.20	29.00	29.00	Cum																																																						
	21.80	0.80	0.20	3.49																																																								
	397.50	0.75	0.20	59.63																																																								
				161.2																																																								
18	<p>Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage.</p> <p>(UOSR Amendmen t 7-2022-23,</p>	1541.90	Kg																																																									

	I.N.18.44 / 54) (for Thrust block 30 kg per cum)			
19	Providing & fixing form work i/c centering and shuttering including strutting, propping etc. and removal of form work for: Foundation , footing, bases of columns ,etc for mass concrete			
	Area of formwork required for Thrust Block on 250 mm dia lines 90 deg. Bend No. $(B+Lf+SL+A+SL+Lf) \times Hb$ 12.4 123 84 2 Bend x 12.41 = 24.8 sqm 247 68 45 deg. Bend No. $(B+Lf+SL+A+SL+Lf) \times Hb$ 7.78 1 Bend x 7.78 = 7.78 sqm 22.5 deg. Bend No. $(B+Lf+SL+A+SL+Lf) \times Hb$ 4.48 2 Bend x 4.48 = 8.97 sqm Area of formwork required for Thrust Block on 200 mm dia lines 90 deg. Bend No.	Size: A= 0.800, B=7.6, Hb=.674 d=0.20 &Lf=0.20 SL=4.808 24.82 Size: A= 0.500, B=4.7, Hb=0.674 d=0.20 &Lf=0.20 SL=2.97 7.78 Size: A= 0.350, B=2.65, Hb=0.674 d=0.20 &Lf=0.20 SL=1.626 8.97 Size: A= 0.650, B=5.2,		

			Hb=0.622 d=0.20 &Lf=0.20 SL=3.217		
(B+Lf+SL+A+SL+Lf)xHb	7.89				
1 Bend x 7.89 =	7.89	sqm	7.89		
45 deg. Bend No.			Size: A= 0.450, B=3.10, Hb=0.622 d=0.20 &Lf=0.20 SL=1.874		
(B+Lf+SL+A+SL+Lf)xHb	4.79				
1 Bend x 4.79 =	9.58	sqm	9.58		
22.5 deg. Bend No.			Size: A= 0.300, B=1.70, Hb=0.622 d=0.20 &Lf=0.20 SL=0.990		
(B+Lf+SL+A+SL+Lf)xHb	2.72				
2 Bend x 2.72 =	5.45	sqm	5.45		
Area of formwork required for Thrust Block on 150 mm dia lines					
90 deg. Bend No.			Size: A= 0.550, B=3.75, Hb=0.57 d=0.20 &Lf=0.20 SL=2.263		
(B+Lf+SL+A+SL+Lf)xHb	5.26				
4 Bend x 5.26 =	21.0	sqm	21.04		
45 deg. Bend No.			Size: A= 0.350, B=2.22, Hb=0.57 d=0.20 &Lf=0.20 SL=1.308		
(B+Lf+SL+A+SL+Lf)xHb	3.18				
4 Bend x 3.18 =	12.7	sqm	12.74		

	<p>22.5 deg. Bend No.</p> <p>(B+Lf+SL+A+SL+Lf)xHb</p> <p>5 Bend x 1.82 =</p> <p>(UOSR Amendment 7-2022-23 18.64.1/ 56)</p>	<p>Size: A= 0.250, B=1.20, Hb=0.57 d=0.20 &Lf=0.20 SL=0.672</p> <p>1.82 058 9.10 sqm 29 21.42 98.26</p>	<p>Sqm</p>	
20	<p>Chamfering of CI/DI pipes of all types and classes to make suitable for tyton joints.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 i.n. 19.6/61)</p> <p>250 mm dia.</p> <p>200 mm dia.</p> <p>150 mm dia.</p>	<p>7 5 27</p>	<p>Each End Each End Each End</p>	
21	<p>Labour only for cutting following Ductile Iron pipes of any type and class.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 19.4/60)</p> <p>250 mm dia.</p> <p>200 mm dia.</p> <p>150 mm dia.</p>	<p>7 5 27</p>	<p>Per Cut Per Cut Per Cut</p>	
22	<p>Supply & Filling moorum/river sand for pipe bedding or over the pipe (including supply)</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 18.24/52)</p>	<p>1228.241</p>	<p>Cum</p>	
23	<p>Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5m in all kinds of soils</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 18.22/52)</p>			

	Available excavated earth	6141.21		
	Available excavated earth 1.5 to 3m	0.00		
	Deduct			
	Volume of pipe	-160.90		
	Thrust block	98.26		
	Road Reinstating	-98.09		
	Sand Filling	-1228.24		
		-1388.97		
	Total Refilling	4752.23	Cum	
	This item also include refilling for bedding below pipe 15 cm thick			
24	Construction of RCC Valve chamber with RCC precast Cover For sluice valve & scour Valve 100 dia As per Rate Analysis	17		
	Total	17	each	
25	Carriage of Material by Mechanical transport including loading unloading & stacking etc. Earth & Moorum 5 KM CGPHE SOR 2020 Amendment 7, item 19.10.2.5 p-62	1388.97	Cum	

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

DISTRIBUTION NETWORK: - Percentage Breakup of payment of 9.91% of Lump Sum offer

S.N.	PARTICULARS	QUANTIT Y	RATE	PER	AMOUNT
1	Excavation: Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. Lift 0.0 to 1.5 m (CGPHE SOR 2020 Amendment 07/2022-23, 18.15/51)	1104.80		cum	
2	Earth work in excavation for pipe trench in Hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed. Lift 0.0 to 1.5 m (CGPHE SOR 2020, amendment 07/2022-23 I.N.18.16/P-51)	828.60		cum	
3.1	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unserviceable material up to lead up to 50m and lift up to 1.5m. Soft rock with or without blasting or bituminous pavement / cement concrete road. Lift 0.0 to 1.5 m (CGPHE SOR 2020, amendment 07/2022-23 I.N.18.19.1/P-51)	414.30		cum	
3.2	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unserviceable material up to lead up to 50m and lift up to 1.5m.				

	Hard rock requiring chiseling / where blasting is prohibited. Lift 0.0 to 1.5 m (CGPHE SOR 2020, amendment 07/2022-23 I.N.18.19.2/P-52)	414.30		cum	
4	Demolishing cement concrete manually / by mechanical means including disposal of material within 50 m lead as per direction of engineer-in-charge. Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix) (CG PHE SOR 2020, amendment 07/2022-23, I.N.18.29.1/P-52) 3540 0.80 0.30 849.60	849.60		cum	
5	Pumping out water caused by springs, tides or river seepage, broken water mains or drains or well or the like. (CGPHE SOR 2020 amendment 07/2022-23, I.N-18.21/52)	3000		KL	
6	Providing, laying and jointing including testing following socket & spigot centrifugally cast (Spun) Ductile Iron pressure pipes with inside cement mortar lining (class K-7) conforming to IS 8329 /2000 with suitable Rubber Gasket (Push on) joints as per IS:5382/2018 Diameter mm Type 100 mm DI K-7 150 mm DI K-7 dia dia (CGPHE SOR 2020 amendment 07/2022-23, I.N-4.1/2)	3140 400		Mtr Mtr	
7	Providing and Laying including testing Ductile Iron Double Socket ,Bends ,Tees, Reducers, with external bitumen coating and internal cement mortar lining. 10% of Item No 6	0.00			

8	<p>Providing and Laying including testing Ductile iron Mechanical joint collar with follower glands conforming to IS: 9523/2000 having dimension as per table 24 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen and internal cement mortar lining.</p> <p>(CGPHE SOR 2020, amendment 07/2022-23, I.N-4.11/10)</p> <p>100 mm Diameter</p> <p>150 mm Diameter</p>	10		No.	
		5		No.	
9	<p>Providing & fixing following ductile iron single chamber triple function temper proof air valves, small orifice with screwed end as per IS : 14845-2000 including jointing & testing with cost of jointing material and rubber insertion all complete as per IS :13095-1991</p> <p>(CGPHE SOR 2020, amendment 07/2022-23 4.50/21)</p> <p>80 mm diameter (PN 1.0) for 3000 m Interval</p>	0.00		No.	
10	<p>Providing & fixing of following Ductile iron double flanged sluice valves as per I.S.:14846-2000 fitted with cap including jointing & testing with cost of jointing material such as bolts, nuts, rubber insertions etc. all complete.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 4.41/18)</p> <p>Sluice Valve (5000 m Interval) which will include controlling valve near OHTs</p> <p>100mm PN-10 diameter</p> <p>150mm PN-10 diameter</p>	5		No.	
		2		No.	
11	<p>Providing and Laying including testing ductile iron PN 16 type flanged sockets conforming to IS: 9523/2000 having</p>				

	<p>dimension as per table 23 of IS: 9523/2000 in the following nominal diameter/sizes with external bitumen coating and internal cement mortar lining with finishing as per clause 13 of IS:9523/2000.</p> <p>100mm diameter</p> <p>150mm diameter</p> <p>(CG PHE SOR Ammendment P.4&5 It.No.4.7,4.8)</p>	5.00		Each	
		2.00		Each	
12	<p>Labour only for cutting following Ductile Iron pipes of any type and class.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 19.4/60)</p> <p>100mm Dia</p> <p>150mm Dia</p>	10.00		Per Cut	
		6.00		Per Cut	
13	<p>Chamfering of CI/DI pipes of all types and classes to make suitable for tyton joints.</p> <p>(CGPHE SOR 2020 amendment 07/2022-23 19.6/61)</p> <p>Upto 150 mm dia.</p>	26		Per End	
14	<p>Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5m in all kinds of soils</p> <p>(CGPHE SOR 2020, amendment 07/2022-23 18.22/52)</p> <p>Available excavated earth</p> <p>Deduct</p> <p>Volume of pipe</p> <p>Sand filling from outside</p> <p>Thrust block</p>	<p>2762.00</p> <p>-31.74</p> <p>-42.48</p> <p>0.00</p>			

	Road Demolition Total Refilling	-849.60 1838.18		cum	
15	Supply & Filling moorum/river sand for pipe bedding or over the pipe (including supply) 354 x 0.8 x 0.15 (CGPHE SOR 2020, amendment 07/2022-23 18.24/52)	42.48		Cum	
17	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications. (For Village roads) P.C.C. M-10 (CG PWD Road SOR 2021/6.6) 3540 708.00 0.80 0.15 84.96 84.96 With Cement concrete grade M-30 and minimum cement content @ 375 kg/cum. P.C.C. M-30 (CG PWD Road SOR 2021/6.2) 2832 1.20 0.2 679.68			Cum Cum	
16	Construction of RCC Valve chamber with RCC precast Cover. As Per Rate Analysis based on CG PHE SOR 100 mm to 150 mm	7		each	

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Unit Estimate breakup for construction of Valve chambers

150 to 250 mm Valve chamber:-Providing and constructing Precast R.C.C valve chamber Internal size 900 mm x 900 mm x 1200 mm ht, including 0.15 m thick 1:2:4 proportion PCC bedding, 150 mm thick RCC wall , 200 thick base slab ,top cover of precast R.C.C slab 150 mm thick (with key hole in two parts each with handles and M.S. Bars etc complete as given size) as directed by Engineer-in-Charge upto the depth from G.L. to pipe invert level including complete civil work and including the cost of excavation, refilling and C.I.rungs. etc. complete as directed.

Sr. No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1	Earth work in excavation for pipe trench in ordinary/hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed.				
	Up To 1.50 mt. Depth				
	Soft Soil	5.18	cum		
	Hard Soil	3.60	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no-18.15,18.16 Page No-51				
2	Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5 in all kinds of soils.				
		6.00	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no.- 18.22, Page No-52				
3	Providing and laying mechanically mixed cement concrete with crushed stone aggregate excluding centring and shuttering (with 40mm nominal size graded stone aggregate)				
	Without Formwork.				
		0.49	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no.- 18.40 & Page No-53				
4	Providing & laying mechanically mixed R.C.C. excluding centering & shuttering and reinforcement in superstructure up to 4 mtr. Height above plinth level (20mm graded metal) RCC Grade M:30 (1:0.75:1.5)				
	RCC Grade M:30 Quantity	1.39	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, item no.- 18.43.3, Page No-54				
5	Providing and placing in position reinforcement for R.C.C. work including straightening, cutting, bending, binding etc. complete as per drawings including cost of binding wire in foundation and plinth all complete				
	Do-Thermo mechanically treated (TMT) bars Fe-415 grade for all diameters.				
	Say Total Steel Quantity =	176.00	kg		

	SOR_Chhattishgarh_PWD_2015, Ch-3, item no.-3.12.1 , Page No-24				
6	Extra for precast PCC/ RCC work of any mix including form work, hoisting and fixing in Cement Mortar. 1:2 (1 Cement : 2 coarse sand) and finishing with cement plaster in Cement Mortar 1:3 (1 Cement : 3 coarse sand) but excluding reinforcement.				
	precast slab				
	Say Total RCC Quantity =	1.00	cum		
	SOR_Chhattishgarh_PWD_2015, Ch-3, item no.-3.9 , Page No-24				
7	Providing and making 18mm thick cement plaster in two coats with under layer of 12mm thick plaster 1:5 (1 cement : 5 fine sand) and top layer of 6mm thick with cement plaster 1:3 (1 cement : 3 fine sand) finished rough with sponge.				
	Inside 18 mm thick				
		5.00	sqm		
	SOR_Chhattishgarh_PWD_2015, Ch-11, item no.-11.8 Page No-104				
8	Providing and fixing in position C.I./M.S.steps or 22mm dia M.S. bar step with proper anchorage etc. and providing and applying 3 coats of anti-corrosive paint etc. complete as directed by Engineer-in-charge.				
		4.00	Nos		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no.-20.12, Page No-73				

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

300 and above valve chamber- Providing and constructing Precast R.C.C valve chamber Internal size 1200 mm x 1200 mm x 1200 mm ht, including 150 mm thick 1:2:4 proportion PCC bedding, 150 mm thick RCC wall , 200 thick base slab ,top cover of precast R.C.C slab 150 mm thick (with key hole in two parts each with handles and M.S. Bars etc complete as given size) as directed by Engineer-in-Charge upto the depth from G.L. to pipe invert level including complete civil work and including the cost of excavation, refilling and C.I.rungs. etc. complete as directed.

Sr. No	Description	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1	Earth work in excavation for pipe trench in ordinary/hard soil areas including dressing, watering, ramming and disposal of excavated earth lead up to 50m and lift up to 1.5m, disposal earth to be levelled, neatly dressed.				
	Up To 1.50 mt. Depth				
	Ordinary soil 60% (Item 18.16)	5.40	cum		
	Hard Soil 40% Item -18.16)	3.60	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no-18.15,18.16 Page No- 51				
2	Filling available excavated earth in trenches, plinth sides of foundation in layers not exceeding 20cm. In depth including consolidation of each layer by ramming watering, lead up to 50m and lift up to 1.5 in all kinds of soils.	3.00	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no.- 18.22, Page No-52				
3	Providing and laying mechanically mixed cement concrete with crushed stone aggregate excluding centering and shuttering (with 40mm nominal size graded stone aggregate)				
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, Item no.- 18.40.1.4 page No-53	0.49	cum		
4	Providing & laying mechanically mixed R.C.C. excluding centering& shuttering and reinforcement in foundation/plinth (20mm graded metal)	1.72	cum		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, item no.- 18.42.3, Page No-54				
5	Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/ccost of binding wire and wastage.				
	Say Total Steel Quantity =	218.00	kg		
	SOR_Chhattishgarh_PHE_2020, Amendment No. 07/2022-23, item no.- 18.44, Page No-54				
6	Providing & fixing form work i/c centering and shuttering including strutting, propping etc. and removal of form work for:				
a	Foundation, footing, bases of columns, etc for mass concrete				
	PCC				
b	Wall (any thickness) including attached pilasters, buttresses, plinth and string courses etc				
	wall				
c	Suspended floors, roofs, landings, balconies and access platform				

	Base slab sides				
	Top slab				
	sides				
		4.14	sqm		
7	15mm thick cement plaster in single coat i/c finished even, smooth and curing complete -in CM 1:6				
	Inside of Chamber				
		6.00	sqm		
	SOR Chhattishgarh PHE 2020, Amendment No. 07/2022-23, item no.- 18.61, Page No-54				
8	Providing and fixing in position C.I./M.S.steps or 22mm dia M.S. bar step with proper anchorage etc.and providing and applying 3coats of anti-corrosive paint etc. complete as directed by Engineer-in-charge.				
		4.00	Nos		
	(CG PHE SOR 2020 Amendment No. 07/2022-2023 item no.-20.12, Page No-73				

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Unit Estimate for Constrcution of RCC Thrust Blocks

S. No.	Item	Unit	Qty	Rate	Amount
1	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unservicveable material up to lead up to 50m and lift up to 1.5m.				
	Soft rock with or without blasting or bituminous pavement / cement concrete road.	cum.	1.96		
	(CG PHE, SOR Amendment No.-07/2022-23, ITEM NO. 18.19.1 P/51)				
2	Providing and laying mechanically mixed cement concrete with crushed stone aggregate excluding centering and shuttering (with 40mm nominal size graded stone aggregate)				
	PCC 1:3:6 (M-10)	cum.	0.144		
	(CG PHE, SOR Amendment No.-07/2022-23, ITEM NO. 18.40.1.3 P/53)				
3	Providing & laying mechanically mixed R.C.C. excluding centering& shuttering and reinforcement in foundation/plinth (20mm graded metal)				
	RCC 1:1.5:3 (M 20)	cum.	1.296		

	(CG PHE, SOR Amendment No.-07/2022-23, ITEM NO. 18.42.1 P/54)				
4	Providing & fixing form work i/c centering and shuttering including strutting, propping etc. and removal of form work for:				
	Foundation , footing, bases of columns, etc for mass concrete				
	Shuttering for outer side	sqm	4.32		
	(CG PHE, SOR Amendment No.-07/2022-23, ITEM NO. 18.64.1 P/56)				
5	Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage.				
	Providing Steel (for RCC)	Kg	50.00		
	(CG PHE, SOR Amendment No.-07/2022-23, ITEM NO. 18.44 P/54)				

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

House Service connections - Breakup of payment of 0.35% of Lump Sum offer

Sr No	Particulars	No.	L	B	H	Quantity	Rate (₹)	Unit	Amount (₹)
1	Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering and ramming and disposal of excavated earth lead up to 50 meters and lift up to 1.5m, disposal earth to be levelled, neatly dressed.								
	CGPHE SOR, 2020, Amendment No.7, Itm- 18.15, Pg - 51								
		100							
	Connection Pipe Trench for without Road Crossing	100	6.0	0.20	0.3	36.00			
		10	6.0	0.25	0.3	4.50			
		5	6.0	0.32	0.3	2.88			
						43.38		Cum	
2	Dismantling of Cement Concrete Pavement by mechanical means using pneumatic tools, cutter breaking to pieces not exceeding 0.02 cum in volume and stock piling at designated locations and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately								
	Connection Pipe Trench for Road Crossing	20							
		20	4.0	0.20	0.35	5.60			
		2	4.0	0.25	0.35	0.70			
		1	4.0	0.32	0.35	0.45			
	CGPHE SOR, 2020, Amendment No.7, Item- 18.29.3, Pg- 52					6.75		Cum	
3									
	Cutting of Bituminous road and making good the same including supply of extra quantities of materials i.e. aggregate, moorum screening and labour required including compaction inlayer by appropriate methods.								

	Connection Pipe Trench for Road Crossing	30						
		30	4.0	0.20	0.35	8.40		
		2	4.0	0.25	0.35	0.70		
		1	4.0	0.32	0.35	0.45		
	CGPHE SOR, 2020, Amendment No.7, Itm- 18.39, Pg - 53					9.55		Cum
3	Earth work in excavation for pipe trench in ordinary soil areas including dressing, watering and ramming and disposal of excavated earth lead up to 50 meters and lift up to 1.5m, disposal earth to be levelled, neatly dressed.							
	Tapping Pit	60	1.00	1.00	0.65	39.00		
	CGPHE SOR, 2020, Amendment No.7, Itm- 18.15, Pg - 51					39.00		Cum
4	Earth work in excavation for pipe trench in all kinds of rocks in areas including dressing, stacking of useful material and disposal of unserviceable one up to 50 m lead and lift up to 1.5 m.							
	Soft rock with or without blasting or bituminous pavement / cement concrete road.							
	Tapping Pit	55	1.00	1.00	0.65	35.75		
	CGPHE SOR, 2020, Amendment No.7, Itm- 18.19.1, Pg - 51					35.75		Cum

5	Providing & Supplying of Clamp Saddle (DI Strap Saddle) for House Service connections from metal pipe water distribution mains shall be of fastened strap type with threaded outlet for service connection. Clamp Saddle shall be suitable for nominal size of distribution mains pipe line. The strap shall be elastomer coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the unidentical metals. The saddle shall be single strap type up to pipe sizes of NB 600 and service outlet 15mm, 20mm & 25mm. Fasteners shall be of threaded nut bolt washer type. The sealing between the saddle and mains shall be obtained by using a profiled elastomer seal matching to the curvature of the pipe. The seal shall be of elastomer type, suitable for all potable water application. The material of construction of the body, straps, fasteners etc. shall be of non-corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both. and shall be inclusive of all cost such as testing, inspection charges, transportation up to site, transit insurance, loading, unloading, stacking etc. complete.					
	100 NB x 15 mm, 20 mm, 25 mm					
	100 NB x 15 mm	80	1.00	80.00		
	CGPHE SOR, 2020, Amendment No.7, It- 9.13.2, Pg-132			80.00		Each
	150 NB x 15 mm, 20 mm, 25 mm					
	150 NB x 15 mm	35	1.00	35.00		
	CGPHE SOR, 2020, Amendment No.7, It- 9.13.3, Pg-132			35.00		Each
6	Providing and fixing following GM or brass ferrules confirming to IS: 2692/1989 (Reaffirmed 2005), tested to 21.09 kg/sq.cm. i/c boring and tapping the main.					
	Brass Ferrule					
	15 mm	100	1.00	100.00		Each
	20 mm	10	1.00	10.00		Each

	25 mm	5	1.00	5.00		Each	
	CGPHE SOR, 2020, It- 6.9, Pg-92						
7	Providing & Supply of Compression fitting, PN 16 rated in conformation to ISO: 14236-2000 and shall be tested as per ISO: 3459, ISO: 3501 & ISO:3503, suitable for drinking water & approved by WRAS, UKI KIWA etc., in food grade polypropylene and shall be inclusive of all cost such as testing, inspection charges, transportation up to site, transit insurance, loading, unloading, stacking etc. complete.						
	Compression Fittings Metal inserted Compression Female Threaded Adaptor with SS 304 Material						
	20 x 15 mm	100	2.00	200.00		Each	
	25x20mm	10	2.00	20.00		Each	
	32x25mm	5	2.00	10.00		Each	
	CGPHE SOR, 2020, Amendment No.7, It- 9.11.1.1, Pg-35						
8	Providing and fixing Polyethylene - Aluminum - Polyethylene (PE-AL-PE) Composite Pressure pipes Conforming to IS: 15450-2004 U.V. Stablshed with carbon black having thermal stability for hot & cold-water supply, capable to with stand temperature up to 80°C including all specials and fittings of composite material (engineering plastic. gland and brass insert wherever required) e.g. elbows, tees. reducers, couplers and connectors wiith clamp at 1m spacing. This includes testing of joints complete as per the directions of engineer - in - charge (External work).						
	1620 (20 mm Ø OD) pipe.			500.00		m	
	CGPHE SOR, 2020, It-19.38.2, Pg-255						
	2025 (25mm Ø OD) Pipe			50.00		m	
	CGPHE SOR, 2020, It-19.38.3, Pg-255						
	2532 (32 mm OD) Pipe			50.00		m	
	CGPHE SOR, 2020, It-19.38.4, Pg-255						

9	Providing laying and jointing of following Galvanized Iron (MS) Pipes with specials (such as bends, elbows, tees etc) class light, medium & heavy including testing of joints, cost of pipes, specials and jointing materials all complete. Pipes and sockets conforming to IS:1239/2011 Part- II. (Note - Stand Pipe should be properly clamped on wall and fixed in CC Base.)								
	40 mm Ø (Medium Class)								
	Sleeve Pipe for crossing drain etc.	5	3.50		17.50				
	CGPHE SOR, 2020, It-6.1, Pg- 89					17.50		Rmt	
10	Filling available excavated earth in trenches, lead up to 50m and lift up to 1.5m in all kind of soil including 100 % Compaction of Backfilled stuff in trenches.								
	Connection Pipe Trench Backfilling					43.38			
	Tapping Pit Backfilling					74.75			
	Deductions								
	16 mm Outer Diameter	=	100.0	10.00	110.00	0.02			
	20 mm Outer Diameter	=	10.0	10.00	20.00	0.01			
	32 mm Outer Diameter	=	5.0	10.00	15.00	0.01			
	Providing & Laying RCC					5.78			
	CGPHE SOR, 2020, Amendment No.7, Itm- 18.23, Pg - 52					112.28		Cum	
11	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications. (For Village roads)								
	With Cement concrete grade M-30 and minimum cement content @ 375 kg/cum. Restoration of Pavement- PCC- M30								
	Road Crossing restoration	20	4.00	0.20	0.30	4.80			
		2	4.00	0.25	0.30	0.60			

	1	4.00	0.32	0.30	0.38			
	P.C.C. M-30 (CG PWD Road SOR 2021/6.2)				5.78		Cum	

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure –“F-4

(Water Treatment Plant-)”: Price Schedule:- for 9.42 % of LUMP SUM offer for WTP (NON SOR)

Design, Supply, Installation, testing, commissioning, trialrun, Defect Liability period for Water treatment plant of capacity 2.0 MLD existing and 1.0 MLD Expansion as per scope of work, technical specifications and as per the direction of Engineer in Charge: -
The further sub break up is as follows: -

S.no	Description of work	Percentage payment wrt % fixed for WTP
1	Civil Works/other allied works including internal & external finishing (WTP Units)	40%
2	Civil Works/other allied works including internal & external finishing	15%
3	Electro-Mechanical Works and its allied works (duly approved by Third Party Inspection based on approved QAP)	30%
4	Supply of Laboratory Equipments, Installation, testing, commissioning and trial run of WTP	15%
	Total	100%

1. Civil Works/other allied works including internal & external finishing (WTP Units) – 40%

S.no	Description of works	Percentage payment on completion
1	After completion of Rehabilitation works in all respect for Inlet Pipe, Cascade Aerator/Aerator Fountain, Inlet chamber, Inlet Channel with Parshall flume, Chemical house, Flash mixer, Clariflocculator etc	30%
2	After completion of Rehabilitation works in all respect for Filter House, Wash water tank, Chlorine unit, Clear water sump and pump house etc	30%
3	After completion of Rehabilitation works in all respect for administrative block, Laboratory block, Store house, Sanitary block, Guard room etc	20%

4	After completion of Rehabilitation works in all respect for Thickener feed pump house, Sludge holding tank and sludge thickener, Sludge drying beds etc.	15%
5	After testing & commissioning	5%
Total		100%

2. **Rehabilitation /Other allied Works including internal & external finishing (Other infrastructure for site development like roads, roadside drains, footpaths, internal & external electrification, internal and external plumbing, Parking etc.) – 15%**

S.no	Description of works	Percentage payment on completion
1	After completion of all works in all respect	80%
2	After successful commissioning	20%
Total		100%

3. **Electro-Mechanical Works and its allied works (duly approved by Third Party Inspection based on approved QAP) – 30%**

S.no	Description of works	Percentage payment on completion
1	After approval of detailed designs/drawings/QAPs etc. in all respect	5%
2	After supply of all equipments in all respect	60%
3	After Installation, testing & commissioning	35%
Total		100%

Note: The payment of R.A/Final. Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure - "F-5
(OHSR)" : Price Schedule(CGPHE SOR 2020 amendment 07/2022-23)

TABLE-A

PERCENTAGE Break-up of payment of 3.08%- of LUMP SUM OFFER

Sl. No	Description	Percentage amount for the OHSR on completion (WRT to percentage fixed for OHTs components)
1	Design, Construction, geotechnical investigation (determination of SBC) Testing, Commissioning of followings Overhead Service reservoir including allied works complete in every respect as per scope of work, technical specifications and as per the direction of Engineer in Charge at:	

Sl. No	Description	Percentage amount for the OHSR on completion (WRT to percentage fixed for OHTs components)
(i)	Proposed 160 KL 20m Staging	100%
Total		100%

TABLE-B**Break up of Payment Schedule for Proposed OHSR**

Sl. No	Description	Percentage Payment admissible	Cumulative Percentage Payment
1	Approval of Design and Drawings and construction of levelling course of PCC (1:4:8) for foundation of OHSR complete	5%	5 %
2	After casting of foundation including columns upto GL	10%	15 %
3	After casting of 50% of RCC complete staging	12%	27%
4	After completion of casting of complete RCC staging	13%	40%
5	After completion of casting of Ring Beam & Bottom Slab	15%	55%
6	After completion of casting of vertical walls of reservoir/container complete	15%	70%
7	After completion of casting of staircase, top dome /slab	10%	80%
8	On supply [including approval by the Third-Party Inspection] and fixing of pipes & specials, valves, complete at site	10%	90%
9	[a] Supply [including approval by the Third-Party Inspection], fixing of water level indicator, Railing, Ladder, washout overflow, By-pass arrangement, Valves, Man hole frame covers, plinth protection of minimum 5 m wide over external wall, CC flooring at FGL below OHSR, backfilling of foundation upto FGL, Gate, ventilating shafts, lightning arrestor, Earthing [as per Is-3043], anti termite treatment etc complete at site. [b] After finishing, distempering and painting [as directed by Engineer-in-charge] & successful water tightness testing, as per clause 12 of IS-3370 Part-1[2009] of work, installation and commissioning. [c] Artistic painting of the complete OHSR Structure as directed by Engineer-in-Charge.	10%	100 %

Note: The payment of R.A/Final Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure - "F-6

PLC – SCADA Automation, Monitoring and Control System” : Price Schedule (NON SOR)

Break up of Payment Schedule for PLC & SCADA 7.21% of LUMP SUM OFFER

Sr no	Item Name & Description	%Payment on completion of work (Wrt Percentage for PLC SCADA component)
	Design, Supply, Installation, testing, commissioning, trial run, DLP for PLC –SCADA and automation of complete water supply scheme as per scope of work, technical specifications and as per the direction of Engineer in Charge: -	
1	Approval of Design, Drawings, QAPs, Detailed Engineering, P&ID etc for entire scheme	5%
2	Supply, Installation and calibration of all instruments, automation, at Raw water pump house/Raw water Sump well	10%
3	Supply, Installation and calibration of all instruments, automation, at WTP units and clear water Pump house	35%
4	Supply, Installation and calibration of all instruments, automation, at OHTs (existing & proposed)	10%
5	Engineering logics development, Screen development of SCADA and HMI, I/O lists tagging and integration of all instruments with SCADA and after setup of remote monitoring over static IP in addition to the automation and SCADA for access and integration of data.	30%
6	Testing and commissioning, trial run and Defect Liability Period for complete scheme	10%
	Total	100%

Note: The payment of R.A/Final Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Annexure - "F-7

(Dismantling of Unserviceable OHT)” : Price Schedule (MJP SOR)

Break up of Payment for the 0.10 % of Lump sum offer for “Dismantling of OHT”

Design, Supply, Construction, Installation testing and commissioning of followings Allied works as per scope of work technical specifications and as per the direction of Engineer in Charge

S.No.	Particulars	Unit	Break up for Percentage payment on completion
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			of work (wrt percentage fixed for Allied works)
1	Site handover, barricading, deployment of machinery & safety arrangements	Job	10.00%
2	Tank emptying, cleaning, disconnection of pipelines & electrical systems	Job	10.00%
3	Demolition of RCC container (dome/slab/walls)	Job	20.00%
4	Removal of columns, braces up to mid-height	Job	20.00%
5	Full dismantling of staging up to ground level	Job	20.00%
6	Loading, transportation, and disposal of debris	Job	10.00%
7	Site clearance, leveling, final inspection & approval	Job	10.00%
	Total		100 %

- I. Further payment break up for Panel rooms (including all civil, electrical, mechanical, works etc) as per scope of work, technical specifications and tender drawings etc

S.no	Description of works	Percentage payment on completion (wrt percentage payment fix for Guard rooms as mentioned above)
1	After approval of detailed designs/drawings/QAPs etc. in all respect	10%
2	After completion of all civil, electrical, mechanical, finishing works etc at 3nos OHSR location	40%
3	After completion of all civil, electrical, mechanical, finishing works etc at another 2nos OHSR location	25%
4	After completion of all civil, electrical, mechanical, finishing works etc at remaining OHSRs location	25%
Total		100%

Note: The payment of R.A/Final Bills shall be made as per actual work done at site and as certified by Engineer-in Charge.

Any items/components which may not be mentioned in the scope of work, technical specifications/payment schedule, tender drawings etc, but are necessarily required for successful commissioning of the complete water supply scheme with desired outputs and complete functions in all respects will be deemed to inclusive in quoted cost by the bidder/contractor and nothing extra shall be paid by Department.

IMPORTANT NOTE

Payment Terms

Payment shall be made to the Contractor on a monthly billing as per the measurement. Payment for items other than pipelines shall be made as per breakup schedule given for that particular work.

For pipeline works detailed measurements shall be made and evaluation will be as per Schedule of Rates (SOR), and payment shall be made as per tender rates (above or below the PAC, as applicable).

1. For works PHE SOR effective from **01.06.2020**, amended up to the date of issue of NIT, will be applicable.
2. For non-SOR items, rates will be decided by the Competent Authority, and will be binding on the Contractor.
3. For SOR items, but not included in the BOQ, payment will be made as per SOR rates with applicable above or below percentage.
4. This USOR contains the rates of all items without GST. No claims against GST shall be entertained at any Level. GST shall be paid by the Agency/contractor directly to the concerned department.
5. All running payments shall be made in accordance with Clause 1.15. **90% of the work done** will be paid, which will also be sufficient for testing of pipelines and structures.

Penalty for Theft / Pilferage

The Contractor shall be liable to compensate the Employer for any loss of WTP property due to theft, pilferage, damage, etc., caused due to negligence, mishandling, or improper operation by the Contractor's personnel engaged in operation and maintenance of the WTP(s).

The penalty amount shall be determined by the Employer, or the damaged property shall be restored to its original condition to the satisfaction of the Employer.

Secured Advance

Advances to contractor are as a rule prohibited, and every endeavour should be made to maintain a system, under which no payments are made for unmeasured work except for work actually done. Exceptions are, however permitted in the following cases. Cases in which a contractor whose contract is for finished work, requires an advance on the security of materials brought to site, Chief Municipal Officer may in such cases sanction advances up to an amount not exceeding 75% of the value of material and 90% in the case of steel (as assessed by the C.M.O.) provided that the rate(s) of allowed in no case is/are more than the rate payable for the finished item as stipulated in the contract of such materials, provided that they are of imperishable nature and that a formal agreement is drawn up with the contractor under which Nagar Panchayat a lien on the materials and is safeguarded against losses due to the contractor postponing the execution of the work or to the shortage or misuse of the materials, and against the expense entitled for their proper watch and safe custody. Payment of such advances should be made only on the certificate of an officer not below the rank of C.M.O., that the quantities of materials upon which the advances are made have actually been brought to site, that the contractor has not previously received any advance on that security and that all the materials are required by the contractor for use on items of work for which rates for finished work have been agreed upon. Recoveries of advances so made should not be postponed until the whole of the work entrusted to the contractor is completed. They should be made from his bills for work done as the materials are used the necessary deductions being made whenever the item of work in which they are used, are billed for before granting the above-secured advance the contractor shall sign the prescribed Indenture Bond in the prescribed form.

ANNEXURE- "G"

(Revised form of Bank Guarantee Bond)

GUARANTEE BOND

(In lieu of Security Deposit)

(To be used by approved scheduled Bank)

1. In consideration of Chief Municipal Officer, Nagar Panchayat_____, Chhattisgarh (here in after called the Government) having agreed to exempt.....
 (herein after ailed the said contractors) from the demand under the terms and conditions of an agreement datedmade between for the swork (Name of work) (Herein after called the said Agreement) of security deposit for' the due fulfillment by the said contractors) of the Terms and conditions in the said agreement on production of a Bank Guarantee for RsRupees.....only.
 (*)
(herein after referred to as "The Bank" (at the request of the said contractors) do here by undertakes to pay to Chief Municipal Officer, Nagar Panchayat_____, Chhattisgarh and amount not exceeding Rsagainst any loss or damage caused to or suffered or would be caused to or suffered byChief Municipal Officer, Nagar Panchayat_____, Chhattisgarh, by reason of any breach by the said contractor (s) of the terms or conditions contained in the said agreement in cache said contractor and the Government for the work of
 (indicate name of work) notified vide N.I.T. No..... Dated issued by the Chief Municipal Officer, Nagar Panchayat_____, Chhattisgarh (herein after called the said Agreement) of earnest money for the due fulfillment by the said contractor (s) of the germs and condition.
2. We (*)do hereby undertake to pay the amounts due and payable under this guarantee without any demur merely on a demand from Chief Municipal Officer, Nagar Panchayat_____, Chhattisgarh stating that the amount claimed is due by way of loss or damage caused to or suffered by The Nagar Panchayat by reason of any breach by said contractor(s) of any of the terms or conditions contained in is said agreement or by reason or The contractor(s) failure to perform the said agreement. Any such remand made on the Bank shall be conclusive as regards the amount due and payable by the bank under is guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs.....

3. We undertake to pay the Chief Municipal Officer, Nagar Panchayat_____ Chhattisgarh any money so demanded not withstanding any dispute or disputes raised by the contractor(s) in any suit or proceedings pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.
4. We (.) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of said agreement and that it shall continue to be enforce able till all the dues o the Government

under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till the Chief Municipal Officer, Nagar Panchayat_____, certified that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor (s) and accordingly discharged this guarantee, unless a demand to claim under this Guarantee is made on us in writing on or before the (here indicate a date which falls 9 months beyond the due date of completion of the work) we shall be discharged from all liability under the guarantee.

5. We (.)

..... further agree with the government that the Govt, shall have the fullest liberty without our consent and with out affecting in any manner our obligation here under to vary any of the terms and conditions of the said agreement or to extend time of performance by the said contractor (s) from time to time or to postpone for any time or for time to time any of the powers excerciseable by the Governmemtagainst the said contractor (s) and to for bear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reasons of any such variations. or extension being granted to the said contractor (s) or for barnacle, act or commission on the part of the Goverenment or any indulgence by the Govt. to the said contractor (s) or by any such matter or thing what so ever which under the lay relating to surities would but for this provision have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor (s).

7. We (.) lastly under take not to revoke this gurarantee during its currency except with the previous consent of the Government in writing:-

Dated the Day of

For(*)

(*) Indicate the Name of the

Bank.....
.....
.....

ANNEXURE H- SPECIAL CONDITIONS

(Amendment & Supplement to Clauses in the General Conditions of Contract, Scope of Work, Technical Specifications and Payment Schedules etc of the tender document)

1. The addresses are: “Employer”: Nagar Panchayat/Nagar PanchayatBHAKHARA
2. Tax will be deducted at source as per prevailing Income Tax Rules
3. **Insurances:** - The risk and insurance coverage shall be as follows:
 - a. Third party vehicle liability insurance as required under India’s Motor Vehicles Act, 1988 by the contractor for its Personnel or for Sub Contractor and their personnel for the period of contract.
 - b. Third Party Liability insurance, with a minimum coverage of equal to amount of contract.
 - c. Professional Liability insurance with a minimum coverage equal to amount of contract.
 - d. Employer’s liability & Workers compensation insurance in respect of the Personnel of the contractor in accordance with the relevant provisions of the Applicable Laws of India, as well as with respect to such personnel and such life, health, accident, travel or other insurance as may be appropriate.
 - e. Any other laws/rule applicable in India.

Note: - The cost of the all the insurance premium shall be borne/paid by the Contractor.

If the Contractor fails to effect and keep in force any of the insurances required as mentioned above or fails to provide the policies or receipts as aforementioned, then, and in any such case, the Employer/ULB may affect and keep in force such insurances and pay premium as may be necessary and recover the amount incurred plus a penalty of 10 % of amount incurred (**i.e premium amount+10% of premium amount**) from the Contractor’s Bill or available Bank Guarantee/Secured advances.

But it does not mitigate the contractors’ obligations, if there is any time lapse in payment of insurance premium, contractor shall be liable for any accident, injury, damages or any loss whatsoever caused during lapse period also.

4. The arbitration proceedings shall take place in C.G.
5. **Performance Security:** - The Contractor shall have to submit performance security of amount equal to **5.00 %** of the accepted cost at the time of signing of the contract in the form of Bank Guarantee issued by any Nationalized/Scheduled banks. The contractor shall have to ensure that such performance security remains valid for the period up to 03 (three) months beyond the **Expiry of defect Liability Period/Extended Defect Liability**.

Contractor may submit the same amount of Bank Guarantee on a yearly basis. However, it is solely the responsibility of the Contractor to ensure that the Bank Guarantee is renewed before 2 months from the date of expiry each year. This renewal process must continue until the Bank Guarantee covers a duration of 3 months beyond the Defect Liability Period/ Extended Defect Liability.

The Contractor must promptly submit the renewed Bank Guarantee to the client within the designated timeframe. Failure to comply with this requirement gives the department the right to encash or forfeit the Bank Guarantee without providing any prior notification to the Contractor.

The performance Security in the form of Bank Guarantee will be in addition to the

normal security deposit to be deducted as per clause 1 of Conditions of contract for the execution of contract.

The performance security deposited for construction shall be released only after the performance security for O&M is submitted by the contractor.

6. **Additional Performance Security:** - Additional performance security (APS) shall be deposited by the successful bidder at the time of signing of agreement when the bid amount is seriously unbalanced i.e., less than the estimated cost by more than 10% in such an event the successful bidder will deposit the Additional performance security (APS) to the extent of difference of 90 % of the PAC and bid amount in the shape of FDR/Bank Guratntee, in favor of the CMO before signing the agreement. The same shall be refunded along with the normal S.D. after completion of the work. If the contractor fails to complete the work or left the work incomplete, & the additional performance security (APS), Shall be forfeited by the department, & the agreement shall be terminated and action shall be taken in accordance with Contract Agreement. In case the tendered/contractor refuses to deposit Additional performance security (APS) then his bid will be rejected by the sanctioning authority and earnest money shall be forfeited.
7. **Security Deposit:** - The Security Deposit to be taken for the due performance of the contract under the terms and conditions printed on the tender form will be the earnest money plus an amount to make it equal to 5% (five percent) of the cost of work put to tender, as per clause 1 of condition of contract of form "F". The security deposit can also be submitted in the shape of FDR from Nationalised/ Scheduled Bank. The Bank guarantee shall not be accepted in this case. One moiety of the Security Deposit shall be refunded on completion of work as certified by the Engineer-in-Charge and the balance 50% amount shall be refunded on expiry of defect liability period or settlement of final bill whichever is later. Security deposit is in addition to Performance Security.
8. **Mobilization Advance:** Mobilization advance up to **5.00 %** (Five percent) of the contract value shall be given if requested by the contractor within one month of the date of order to commence the work. In such a case the contractor shall furnish Bank Guarantee from Nationalised/Scheduled bank in favour of the CMO, equivalent to the advance amount, before sanction and release of the advance.

The Bank Guarantee should have a minimum validity of one year and remain in effect until the complete mobilization advance is recovered and it is the responsibility of the contractor to get the BG renewed before 2 months from the date of expiry and submit to client, if the contractor fails adherence to this, department will be at liberty to encash/forfeit the same without any information to Contractor.

The advance shall be Interest free. The **5.00 %** (Five percent) advance shall be given in two stages

Stage-1:2% (Two percent) of the contract value payable after signing of the agreement.

Stage-2:3% (Three percent) of the contract value payable on receipt of the certificate from the contractor that he has established complete central and field-testing laboratories and has engaged workers/technicians and have brought requisite plants and machineries at work site, and also that the work is physically started and only after construction programme is submitted by the contractor and is duly approved by the CMO.

Recovery of Mobilisation Advance: The recovery of above advances (mobilizations, plants and machineries) shall be recovered in equal monthly instalments on pro- rata basis (after 15% (Fifteen percent) of contract work is executed) from each of the further running bills. However, all these advances shall be fully recovered when 80% (Eighty percent) contract sum is complete or when 75% (Seventy Five percent) of stipulated or validity extended period is over – which ever event is earlier.

9. The Contractor shall give in advance authority letter (s) in favour of the CMO, authorizing him to get all bank's fixed deposit receipts, Bank Guarantees (either normal security deposit and or for performance security) to get these bank receipts and guarantee deeds verified and got confirmed from the concerned bank. It will be only after getting such confirmation that the CMO shall pay any amount accordingly or refund the equal amount for which BG submitted has been duly verified and confirmed.

10. **Secured advances:** -Advances to contractor are as a rule prohibited, and every endeavour should be made to maintain a system, under which no payments are made for unmeasured work except for work actually done. Exceptions are, however permitted in the following cases. Cases in which a contractor whose contract is for finished work, requires an advance on the security of materials brought to site, CMO may in such cases sanction advances up to an amount not exceeding 75% of the value of material in the case of DI Pipes and Electromechanical Equipments only (as assessed by Engineer in Charge) provided that the rate(s) of allowed in no case is/are more than the rate payable for the finished item as stipulated in the contract of such materials, provided that they are of imperishable nature and that a formal agreement is drawn up with the contractor under which ULB secures a lien on the materials and is safeguarded against losses due to the contractor postponing the execution of the work or to the shortage or misuse of the materials, and against the expense entitled for their proper watch and safe custody.

Payment of such advances should be made only on the certificate of an officer not below the rank of CMO, that the quantities of materials upon which the advances are made have actually been brought to site, that the contractor has not previously received any advance on that security and that all the materials are required by the contractor for use on items of work for which rates for finished work have been agreed upon. Recoveries of advances so made should not be postponed until the whole of the work entrusted to the contractor is completed. They should be made from his bills for work done as the materials are used the necessary deductions being made whenever the item of work in which they are used; are billed for. Before granting the above-secured advance the contractor shall sign the prescribed Indenture Bond in the prescribed form.

11. **Project Management Consultants (PMC)** engaged by ULB/UADD C.G.will carry out complete supervision, quality control of activities carried out by contractor including checking measurement, designs, drawings, contractors bill, all deliverables till completion of the contract & rectification of deliverables.

The PMC deployed by the Engineer in Charge shall act as the representative of Engineer in Charge of the Contract. Unless specified otherwise, PMC shall be involved in testing of materials, supervision of works to ensure quality as per required (IS / Technical specifications) standards. Contractor shall provide support and assistance in all field works,

checking of measurements, bills, work done (temporary / permanent) in the field, including all works to be carried out by the Engineer-in-charge. However, written approval of designs of surge control devices, drawings, additions, alterations, omissions, substitutions, approval for non-schedule items / rates as required shall be obtained from competent Authority of ULB.

12. **APPROVAL OF DESIGNS & DRAWINGS:** All design calculations & detailed drawings of all components (Electrical, Mechanical, automation, instrumentation & Structural etc) of the project shall be got approved by Govt. Engg. College in Chhattisgarh / NIT/IIT at the cost of contractor and then submitted to ULB.

- a. The successful bidder shall first submit General Arrangement drawing accommodating all the proposed units & submit the same for approval by ULB.
- b. Contractor shall also prepare & submit hydraulic designs (for Intake, Raw water rising/gravity mains, WTP, Clear water rising mains, Distribution networks, etc) & after its approval shall prepare & submit structural design & architectural drawings, get them approved by Govt. Engg. College in Chhattisgarh/NIT/IIT/Bhilai Institute of Technology, Bhilai and finally submit them for approval of Engineer in Charge/CMO through PMC. All costs shall be borne by the contractor.
- c. For approval of design and drawing, the procedure as per latest Govt. order in this regard to be followed.

13. **THIRD PARTY INSPECTION** of all items beyond procurement shall be carried out by **ITES/ IRC** based on Datasheets, Quality Assurance Plan & complete specifications as submitted by the Contractor to Engineer –in- charge. Third Party Inspection charges will be borne by the Contractor.

Third Party Inspection (TPI) of all pipes, fittings and all kinds of valves, Electro-mechanical equipment shall be carried out based on the Quality Assurance Plan duly prepared and submitted by the contractor. These TPI charges will be borne by the contractor.

Further for witnessing the tests at works of the manufacturer by 2 No. officials of the ULB, the contractor shall arrange the same and bear the entire cost (cost of lodging, to and from etc).

14. **The Successful bidder has to submit the following documents within 30 days from the date of issue of Work order**

- a. Local Address of office or Site office at ULB for regular communications and correspondences along with details of Contact Person.
- b. Details & CVs of Technical persons and key Staffs to be deployed in the Project for approval of CMO
- c. Detailed work programme (Using CPM/PERT Techniques) showing key / sub activities and mobilization schedule for personnel, equipment and procurement of materials for construction for approval of CMO
- d. Detailed list of Equipment as specified in bid document or as any other which is necessary required for construction along with all the necessary information as stipulated in there
- e. Methodology and workplan
- f. Format of Site order Book for Approval
- g. The contractor shall submit in the first week of each month a statement of “target vis-à-vis actual performance” of each item/event with slippage, if any mentioning

reasons of slippage and proposal for revised construction programme to complete the same in targeted date or validly extended date. Failure to submit this monthly statement for 4 (Four) months can be treated as “Fundamental Breach of Contract” and can result in invoking clause 14 of the conditions of contract.

15. The contractor shall have to carry out all necessary “Rectification” of defects noticed, caused due to any reasons at his own cost within such reasonable period mentioned in such communication notice from the CMO to him.

Failure of the contractor to rectify the defects properly in the given period, it shall be open for the CMO/ to get the defect (s) rectified either departmentally or through other agency (without calling any tender/quotation) and recover the actual cost plus 15% (Fifteen Percent) of such cost from the contractor from any sum, in any form, and available with the department or can be recovered as “Arrears of Land Revenue.

16. **Risk and Cost:** -In conjunction with clause-14 of conditions of contract, if the contractor(s) shall become bankrupt or compound with or make any assignment for the benefit of his/their creditors or shall suspend or delay the performance of his/their part of the contract or causes fundamental breach of the Contract as mentioned in clause 14 of the conditions of Contract. The CMO may give to the contractor (s) or his/their assignee or trustee, as the case may be, notice requiring the work to be proceeded with and in case of default on the part of the contractor(s) or his/their assignee or trustee for a period of 7 days, it shall be lawful for the CMO to enter upon and take possession of the works and employ any other person or persons to carry on and complete the same and to authorise his/them to use the plant, materials and property of the contractor(s) upon the works and the costs and the charges incurred in any way in carrying on and completing the said works are to be paid to the CMO by the Contractor(s). The CMO shall be the final authority to determine the amount spent to complete the unfinished work. The certificate of CMO as to the value of the balance work done shall be final and conclusive against the contractor.

Moreover, the contractor shall be debarred from participating in any future tender of Nagar Panchayat/UADD for a period of 2 (two) years from the date of such order, by the authority which had registered him/her.

Such orders & action shall be final binding and conclusive.

17. As it is lump sum contract therefore all Survey, investigation, Engineering Procurement Construction, testing commissioning, trial run, defect Liability period and 9 Months operation & maintenance of all components of the project are in the scope of Contractor only.
18. The design parameters, technical specifications and others details given in the tender document are indicative and minimum only. Bidders are advised to visit the Nagar Palika/ Nagar Panchayat office and site in advance to assess the exact and complete scope of work before quoting the rates.
19. Levels as mentioned in Tender Document, drawings, etc. are indicative only, Contractor has to verify the same from concerned department before taking up detailed designs of all the components of the project.
20. The contractor will extend its full cooperation in getting the necessary permissions from different departments such as PWD, NH, Railways, BSNL, etc. and the amount to be incurred in securing the permissions shall be paid by contractor (after prior approval of EE/CMO/Nodal), which will be reimbursed as per actual after submission of original receipt.

21. Before procuring any type of valves, contractor to submit the feasibility report along with drawing clearly mentioning the location, diameter and type of valve to be used, for approval of department / PMC.
22. All components mentioned in the scope of work are on Lump Sum basis and contractor should quote considering all items/ components required for its successful completion and commissioning of the complete water supply scheme with desired outputs irrespective whether any component /Item is mentioned specifically or not in the tender document, technical specifications/payment schedule, tender drawings etc, but are necessarily required for successful commissioning of the complete water supply scheme, will be deemed to be inclusive in quoted cost by the bidder/contractor and nothing extra shall be paid by Department on Lump sum components.
23. For Pipeline works Payment shall be made as per actual work done, for the items executed, as per PHED SOR 2020 (with latest amendments upto the date of issuance of Tender Document) plus quoted percentage above or below.
24. For Pipeline works in case of variation in length (increase in length or decrease in length), if any, the payment shall be made as per the actual measured length, however in case the laying of pipe length increases (upto 25%) the payment shall be made as per the agreed rates i.e. rate as per relevant item of PHED SOR 2020 plus quoted percentage above or below.
25. During design of Inlet ports, at Sump well, contractor shall ensure that the top of bottom port shall be kept atleast 1 m below LWL
26. The scope of work covers Operation & Maintenance of all components of scheme including Pipeline works, House service connections, etc.
27. During execution and O&M period it is the liability of the contractor to rectify all the damages occurred due to his fault, and if, the damages were due to fault of any other department, it will be the duty of contractor to rectify the same and the amount incurred for rectifying the damages, due to others fault, will be reimbursed based on agreed rates i.e., PHED SOR 2020 rates plus/minus the quoted percentage, for the items executed.
28. The 5-year operation and maintenance will be deemed to be commenced only after successful completion and commissioning (as certified by Engineer in Charge) of all components of the entire water supply scheme. O&M of Partially completed scheme will not be accepted.
29. The scope of work also includes integration of Existing WTP, Intake, RWPH, CWPH, OHSRs/MBRs with central SCADA, which includes replacement of all old valves, Panels etc. (not compatible for integration with SCADA system) with new SCADA compatible valves with actuators, Panels etc. It is the duty of the contractor to visit site in advance to assess the quantum of work required for successful integration, monitoring and controlling of entire system with newly implemented SCADA system. Department will not entertain any extra financial claim in this regard.
30. If after the successful completion and commissioning of major components of project like Intake, RWM,WTP,CWM, OHSRs, all Electro-mechanical works, PLC SCADA & Automation works and at least 80% of the proposed House service connections (80% of proposed houses are getting drinking water) the department is unable to provide feasible sites for providing HSCs even after expiry of six months beyond contract period or extended period of completion, contractor is at liberty to apply for fore closing of contract.
31. Department will not entertain any extra financial claim on account of extension of time provided, if the project is extended beyond original contract period.

32. Before commencement of work at any of the sites, contractor to procure prior approval of Engineer-in-charge in writing. If department has not submitted any objections/ observations, for compliance of contractor before start of work, within 21 days from the date of request in writing, the contractor may deem the permission be given and can start the work at the requisitioned site.
33. It is the responsibility of the contractor to get the BG renewed before 2 months from the date of expiry and submit to client, if the contractor fails adherence to this, department will be at liberty to encash the same.
34. For execution of items related to Pipe line works and providing House service connections, the payment shall be made only for the items executed / used at site, with prior permission of department, any extra item procured or not used at site shall not be reimbursable to the contractor. The secured advance, if paid, on the excess items / items not used at site shall be deducted from upcoming RA bill /Final bill.
35. In conjunction with clause-6 of conditions of contract, it is to elaborate that EE/CMO/Nodal can alter the scope of work as regards providing House service connections. Payment shall be made to the contractor as per the actual work done at site and only for the items executed.
36. The contractor shall not remove minor mineral form borrow areas, quarries without prior payment of Royalty charges.
37. **Force Majeure**:-Should failure in performance of any part of this contract arise from war, insurrection, restraint imposed by Government, act of Legislature or other authority, stoppage of hindrance in the supply of raw materials, or fuel, explosion, accident, strike, riot, lockout, or other disorganization, of labour or transport, breakdown of machine, flood, fire act of God, or any inevitable or unforeseen event beyond human control directly or indirectly interfering with the supply of stores or from any cause which may be a reasonable ground or an extension of time, the competent authority will allow such additional time as he considers to be justified in the circumstances of the case. No compensation will be payable to the contractor for any loss incurred by him due to these reasons.
- Time shall be considered as the essence of the contract. If, however, the failure of the contractor to complete the work as per the stipulated date referred to above arises for "Force Majeure" (as stated above) an appropriate extension of time will be given. The contractor shall request such extension within one month of the cause of such delay and in any case before expiry of the contract period.

Nagar Panchayat_____

Name of Contractor

Date of work order

Due date of completion

Detail work programme – Original/1st Revision/2nd Revision/ Revision)

Work Items

Sr. No.	Items	Unit	Months							
			1	2	3	4	5	6	7	8
1										
2										
3										

4										
5										
6										

Approved

CMO

Signature

MONTHLY TARGET Vs. ACTUAL ACHEVEMENT

Cumulative Achievement of item of work for the month ending of

Agt. No.

Name of Work

Length

Date of W.O.

.....

Date of

.....

Completion.....

Sr. No.	Items	Cumulative Work Programme			Cumulative Achievemtnt actual	Slipage if any (Period)	Reason for slippage (Use add sheet if needed)
		As per Original	1St Revision	Last No. Revision			
1	2	3 (a)	3 (b)	3 C	4	5	6

Comments of CMO if any

Cash Flow for performing the contract (applicable fro works cost)

Name of Division

Name

of

Contractor

.....

Period of Contract

Value

(A)	Investment	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month
(I)	Initial (E.M.) P.G. Insurance (Establish Site Office)						
(II)	Advance for Procurement of Material (if any)						
(III)	Advance for Procurement of labour (if any)						
(IV)	Purchase of New Equipment (if any)						
(V)	Other overheads staff including head office						
(VI)	Other if any (Furnish details)						
Total Investment(x)							
(B)	Receipt						
(I)	Gross Bill Amount						
	Deductions.						
a	S.D.						
b	Advance						
c	TDS						
d	Other recoveries if any						
(y) Total Receipt							
Net cash flow (x-y)							

ANNEXURE-I

Guidelines for bidders on using Integrated eProcurement System Govt. of Chhattisgarh. **<https://eproc.cgstate.gov.in>**

Note: These conditions will over-rule the conditions stated in the tender document(s), wherever relevant and applicable.

1. Vendor / Bidder Registration on the e-Procurement System:

All the Users / Bidders (Manufacturers / Contractors / Suppliers / Vendors / Distributors etc.) registered with and intending to participate in the Tenders of various Govt. Departments / Agencies / Corporations / Boards / Undertakings under Govt. of Chhattisgarh processed using the Integrated e-Procurement System are required to get registered on the centralized portal <https://eproc.cgstate.gov.in> and get approval on specific class (e.g. A, B, C, D, UGE, UDE) from Public Works Department (in case to participate in tenders restricted to vendors / bidders in a particular class).

The non – registered users / bidders who are also eligible to participate in the tenders floated using the e-Procurement system are also required to be registered online on the e-Procurement system. Vendors are advised to complete their online enrolment / registration process on the portal well in advance to avoid last minute hassle, it is suggested to complete enrolment at least four days before the last date of bid submission date, failing which may result in non-submission of bids on time for which vendor/end user shall be solely responsible.

For more details, please get in touch with e-Procurement system integrator, M/s. Mjunction Services Limited, Raipur – 492 001 on Toll free 1800 258 2502 or email helpdesk.eproc@cgswan.gov.in.

2. Digital Certificates:

The bids submitted online must be signed digitally with a valid Class II / Class – III Digital Signature Certificate to establish the identity of the bidders submitting the bids online. The bidders may obtain pair of Encryption & Signing Class – II / Class – III Digital Certificate issued by an approved Certifying Authority (CA) authorized by the Controller of Certifying Authorities (CCA), Government of India.

Note: It may take upto 7 to 10 working days for issuance of Class-II / Class-III Digital Certificate, Therefore the bidders are advised to obtain it at the earliest. It is compulsory to possess a valid Class-II / Class-III Digital Certificate while registering online on the above-mentioned e-Procurement portal. A Digital Certificate once mapped to an account / registration cannot be remapped with any other account / registration however it may be inactivated / deactivated.

Important Note: bid under preparation / creation for a particular tender may only be submitted using the same digital certificate that is used for encryption to encrypt the

bid data during the bid preparation / creation / responding stage. However, bidder may prepare / create and submit a fresh bid using his/her another / reissued / renewed Digital Certificate only within the stipulated date and time as specified in the tender.

In case, during the process of a particular bid preparation / responding for a tender, the bidder loses his/her Digital Certificate because of any reason they may not be able to submit the same bid under preparation online, Hence the bidders are advised to keep their Digital Certificates secure to be used whenever required and comply with IT Act 2000 & its amendments and CVC guidelines.

The digital certificate issued to the authorized user of an individual / partnership firm / private limited company / public limited company / joint venture and used for online bidding will be considered as equivalent to a no-objection certificate / power of attorney to the user.

Unless the certificate is revoked, it will be assumed to represent adequate authority of the specific individual to bid on behalf of the organization / firm for online tenders as per Information Technology Act 2000. This authorized user will be required to obtain a valid Class-II / Class-III Digital Certificate. The Digital Signature executed through the use of Digital Certificate of this authorized user will be binding on the organization / firm. It shall be the responsibility of management / partners of the concerned organization / firm to inform the Certifying Authority, if the authorized user changes, and apply for a fresh digital certificate for the new authorized user.

3. Online Payment: As the bid is to be submitted only online, bidders are required to make online payment(s) of the Registration fee / Transaction or Service fees / EMD using the online payments gateway services integrated into the e-Procurement system using various payment modes like Credit Card / Debit Card / Internet Banking / Cash Card / NEFT / RTGS etc.

For the list of available online modes of electronic payments that are presently accepted on the online payments gateway services, please refer the link '**Payments accepted online**' on the Procurement portal <https://eproc.cgstate.gov.in>.

4. Setup of User's Computer System: In order to operate on the e-Procurement system for a bidder / user, the computer system / desktop / laptop of the bidder is required to have Java ver. 765, Internet explorer 9 / 11, latest Mozilla Firefox with IE Tab V2 (Enhanced IE Tab) or any other latest browser. A detailed step by step document on the same is available on the home page. Also, internet connectivity should be minimum one Mbps.

5. Publishing of N.I.T.: For the tenders processed using the e-Procurement system, only a brief advertisement notice related to the tender shall be published in the newspapers and the detailed notice shall be published only on the e-Procurement system. Bidders can view the detailed notice, tender document and the activity time schedule for all the tenders processed using the e-Procurement system on the portal <https://eproc.cgstate.gov.in>.

6. Tender's Critical Dates & Time/Tender Time Schedule: The bidders are strictly advised to follow the tender time for their side for tasks / activities and responsibilities to participate in the tender, as all the activities / tasks of each tender are locked before the start time & date and after the end time & date for the relevant activity of the tender as set by the concerned department official.

7. Download Tender Document(s): The tender document and supporting document(s) if any can be downloaded only online. The tender document(s) will be available for download to concerned bidders after online publishing of the tender and up to the stipulated date & time as set in the tender.

8. Submit Online Bids: bidders have to submit their bid online after successful filling of forms within the specified date and time as set in the tender.

The encrypted bid data of only those bidders who have submitted their bids within the stipulated date & time will be accepted by the e-Procurement system. It is expected that the bidder completes his bid and submit within timeline, a bidder who has not submitted his bid within the stipulated date & time will not be available during opening.

Bid documents uploading during bid preparation should be less than five MB (for individual document) and overall bid documents should be less than fifty MB.

9. Submission of Earnest Money Deposit: The bidders shall submit their Earnest Money Deposit Either as in usual physically sealed Earnest Money Deposit envelope and the same should reach the concerned office OR online using payment gateway as stated in the Notice Inviting Tender/ Tender document. Bidders also have to upload scanned copy of Earnest Money Deposit instrument OR Online Payment / NEFT/RTGS receipt along with the reference details online.

10. Opening of Tenders: The concerned department official receiving the tenders or his duly authorized officer shall first open the online Earnest Money Deposit envelope of all the bidders and verify the same uploaded by the bidders. He / She shall check for the validity of Earnest Money Deposit as required. He / She shall also verify the scanned documents uploaded by the bidders, if any, as required. In case, the requirements are incomplete, the next i.e., technical and commercial envelopes of the concerned bidders received online shall not be opened.

The concerned official shall then open the other subsequent envelopes submitted online by the bidders in the presence of the bidders or their authorized representatives who choose to be present in the bid opening process or may view opened details online.

11. Briefcase: Bidders are privileged to have an online briefcase to keep their documents online and the same can be attached to multiple tenders while responding, this will facilitate bidders to upload their documents once in the briefcase and attach the same document to multiple bids submitting.

For any further queries / assistance, bidders may contact:

1. The Service Integrator of e-Procurement system, M/s. Mjunction Service Ltd. on Help Desk Toll free No. 1800 258 2502 or email helpdesk.eproc@cgswan.gov.in.
2. Mr. Shailesh Kumar Soni, Sr. Manager, Chhattisgarh Infotech & Biotech Promotion Society (CHiPS) on Tel. No. 0771 - 4014158 or email: pro-chips@nic.in.

Annexure – ‘J’

Pre contract Integrity Pact

1. GENERAL

1.1 This pre-bid contract Agreement (herein after called the Integrity Pact) is made on.....day of the month.....20.....between, theNAGAR PANCHAYAT_____ acting through Shri.....(Designation of the officer , Department) NAGAR PANCHAYAT_____ (hereinafter called the “BUYER” which expression shall mean and include, unless the context otherwise requires, his successors in the office and assigns) and the First Party , proposes to procure (name of the Stores / Equipment /Work/Service) and M/srepresented by ShriChief Executive Officer (hereinafter called the “BIDDER/Seller” which expression shall mean and include , unless the context otherwise requires, his successors an permitted assigns) and the Second Party, Is willing to offer/has offered.

1.2 WHEREAS the BIDDER is a Private Company/Public Company/Government Undertaking/Partnership/Registered Export Agency, constituted in accordance with the relevant law in the matter and the BUYER is a Ministry/Department of the Government, performing its function on behalf of the NAGAR PANCHAYAT_____.

2. OBJECTIVES

NOW , THEREFORE the BUYER and the BIDDER agree to enter into this pre-contract agreement , hereinafter referred to as Integrity Pact, to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to during and subsequent to the Contract to be entered into with a view to :-

2.1 Enabling the BUYER to obtain the desired Stores/Equipment /Work/Service at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

2.2 Enabling BIDDERS to abstain from bribing or indulging in any corrupt practices in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing any corrupt practices and the BUYER will commit to prevent corruption, in any form, by its official by following transparent procedures.

3. COMMITMENTS OF THE BUYER

The BUYER commits itself to the following :-

3.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favors or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

3.2 The BUYER will, during the pre-contract stage, treat BIDDERS alike, and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to the other BIDDERS.

3.3 All the officials of the BUYER will report the appropriate NAGAR PANCHAYAT_____office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to

the BUYER with the full and verifiable facts and the same *prima facie found* to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not be stalled.

4. COMMITMENTS OF BIDDERS

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, un fair means an illegal activities during any stage of its bid or during any pre-contract or post- contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following :-

4.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or the any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

4.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour , any material or immaterial benefit or other advantage, commission, fees, brokerage, or inducement to any official of the BUYER or otherwise in procuring the Contract of forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the NAGAR PANCHAYAT_____for showing or forbearing to show favour or disfavor to any person in relation to the contract or any other contract with the Government.

4.3 The BIDDER further confirms and declares to the BUYER that the BIDDER in the original Manufacture/Integrator/Authorized NAGAR PANCHAYAT_____sponsored export entity of the stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

4.4 The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payment he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

4.5 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

4.6 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

4.7 The BIDDER shall not use improperly, for purpose of competition or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposal and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

4.8 The BIDDER commits to refrain from giving any complaint directly or through any other

manner without supporting it with full and verifiable facts.

4.9 The BIDDER shall not instigate or cause to instigate any third person to commit any of the acts mentioned above.

5. PREVIOUS TRANSGRESSION

5.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any NAGAR PANCHAYAT _____ Department in India that could justify BIDDER's exclusion from the tender process.

5.2 If the BIDDER makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

6. EARNEST MONEY (SECURITY DEPOSIT)

6.1 Every BIDDER while submitting commercial bid, shall deposit an amount as specified in RFP as Earnest Money/Security Deposit, with the BUYER through any of the following instruments:

(i) Bank Draft or a Pay Order in favour of

(ii) A confirmed guarantee by an Indian Nationalised Bank, promising payment of the guaranteed sum to the(BUYER)on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever, The demand for payment by the BUYER shall be treated as conclusive proof of payment.

(iii) Any other mode or through any other instrument (to be specified in the RFP).

6.2 The earnest Money/Security Deposit shall be valid up to a period of five years or the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and BUYER, including warranty period, whichever is later.

6.3 In the case of successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of Sanctions for violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.4 No Interest shall be payable by the BUYER to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

7. SANCTIONS FOR VIOLATIONS

7.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the BUYER to take all or any one of the following actions, wherever required :-

(i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceeding with the other BIDDER (s) would continue.

(ii) To forfeit fully or partially the Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed), as decided by the BUYER and the

BUYER shall not be required to assign any reason therefore.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

(iv) To recover all sums already paid by the BUYER, and in case of the Indian BIDDER with interest thereon at 2% higher than the prevailing Prime lending Rate while in case of a BIDDER from a country other than India with Interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encase the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.

(vi) To cancel all or any other contracts with the BIDDER and the BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation / rescission and the BUYER shall be entitled to deduct the amount so payable from the money (s) due to the BIDDER.

(vii) To debar the BIDDER from participating in future bidding processes of the NAGAR PANCHAYAT_____ for a minimum period of five years, which may be further extended at the discretion of the BUYER.

(viii) To recover all sums paid in violation of this Pact by BIDDER (s) to any middlemen or agent or broken with a view to securing the contract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.

(x) If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or Indirectly, is closely related to any of the officers of the BUYER, or alternatively if any close relative of an officer of the BUYER has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filling of tender Any failure to disclose the interest involved shall entitle the BUYER to rescind the contract without payment of any compensation to the BIDDER.

The term 'close relative for this purpose would mean spouse whether residing with the NAGAR PANCHAYAT_____servant or not, but not include a spouse separated from the NAGAR PANCHAYAT_____servant by a decree or order of a competent court, son or daughter or step son or step daughter and wholly dependent upon NAGAR PANCHAYAT_____servant but does not include a child or step child who is no longer in any way dependent upon the NAGAR PANCHAYAT_____servant, or of whose custody the NAGAR PANCHAYAT_____servant has been deprived of by or under any law, any other person related, whether by blood or marriage, to the NAGAR PANCHAYAT_____servant or to the NAGAR PANCHAYAT_____servant's wife or husband and wholly dependent upon NAGAR PANCHAYAT_____Servant.

(xi) The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly with any employee of the BUYER, and if he does so, the BUYER shall be entitled forth with to rescind the contract and all other contracts with the BIDDER The BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such rescission and the BUYER shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

7.2 The decision of the BUYER to the effect that a breach of the provisions of this pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Monitor (s) appointed for the purpose of this Pact.

8. FALL CLAUSE

8.1 The BIDDER undertakes that if has not supplied /is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Department of the NAGAR PANCHAYAT_____ or PSU and if it is found at any stage that similar product/systems or sub systems was supplied by the BIDDER to any other Department of the NAGAR PANCHAYAT_____ or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the BUYER, if the contract has already been concluded.

9. INDEPENDENT MONITORS

9.1 The BUYER will appoint Independent Monitors (hereinafter referred to as Monitors) for this Pact.

9.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

9.3 The Monitors shall not be subject to instructions by the representatives of the Parties and perform their functions neutrally and independently.

9.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement including minutes of meetings. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

9.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BUYER.

9.6 The Monitor will submit a written report to the designated Authority of BUYER/Secretary in the Department/within 8 to 10 weeks from the date of reference or intimation to him by the BUYER/BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

10. FACILITATION OF INVESTIGATION

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information of the relevant documents and shall extend all possible help for the purpose of such examination.

11. LAW AND PLACE OF JURISDICTION

This Pact is subject to Indian Law, the place of performance and jurisdiction shall be the seat of the BUYER.

12. OTHER LEGAL ACTIONS

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the any other law in force relating to any civil or criminal proceedings.

13. VALIDITY

13.1 The validity of this Integrity Pact shall be from the date of its signing and extend up to 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/Seller whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

13.2 If one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In such case, the parties will strive to come to an agreement to their original intentions.

The parties hereby sign this Integrity Pact aton.....

BUYER

Name of the Officer
Designation
Department /PSU

Witness

1).....
.....
2).....
.....

BIDDER

CMO

Witness

1)
.....
2)
.....

Annexure- K**CENTRALISED PROCEDURES OF THE GOVERNMENT OF CHHATTISGARH
FOR SUSPENSION, DEMOTION, NON-RENEWAL & DE-REGISTRATION OF
CONTRACTORS/FIRMS, 2014**

- To Replace Appendix-1 to 4 of PWD Orders No. F5-8/19/2013/Nivida dated 5.8.2013
- RFP to specifically refer to the aforesaid orders as amended

1. Nomenclature and Coming Into Force

1.1 These Procedures shall be called "Centralised Procedures of the Government of Chhattisgarh for Suspension, Demotion, Non-Renewal and De-Registration of Contractors/Firms, 2014".

1.2 These Procedures shall come into force with effect from the date of consequential changes made to previous orders PWD No. F5-8/19/2013/Nivida dated 5.8.2013 on the subject.

2. Scope of Procedures

2.1 These Procedures lay down substantive and procedural aspects for demotion, non-renewal and de-registration (including suspension) of registered contractors/firms, including the consequences of such demotion, non-renewal, de-registration and suspension, in relation to contracts covered by these procedures.

2.2 These procedures shall apply to all contracts awarded by state agencies participating in the unified registration system, for e-registration through the website of the state public works department, and the said participating agencies shall include their constituent, attached and subordinate offices, whether referred to as a "Department", "Wing", "Organization", "Board" or similar nomenclature in common usage.

2.3 For the purposes of these procedures, "contracts" shall mean contracts or agreements under the works department manual entered into by the state agencies to which these procedures are applicable (hereinafter referred to as "state agencies")

2.4 These procedures shall not apply to debarment and suspension (or blacklisting, banning etc., by whatever name called) by States Public Sector Enterprises, registered societies, autonomous institutes or similar separate legal entities, even if functioning under the administrative control of the Government of Chhattisgarh.

2.5 These procedures shall be incorporated by specific reference in contracts entered into by relevant agencies with from the date of notification of these procedures. All prior contracts (i.e. cases where the last date of filling a proposal, tender, quotation, bid etc., by whatever name called, predates the date of notification of these Procedures, including contracts entered into before the date of notification of these Procedures), shall however continue to be governed by the specific clauses of contract and instructions issued by the Government of Chhattisgarh in force prior to notification of these Procedures. For cases where the last date of filing a proposal, tender, quotation, bid etc., by whatever name called, has already been scheduled and notified, and is subsequent to the date of notification of these Procedures, an addendum to the Request For Proposal (or Notice Inviting Tender, Request For Quotation, Invitation To Bid etc., by whatever name called) shall be issued by procuring officials, to ensure that acceptance of the terms and conditions prescribed under these Procedures is obtained from all participating bidders.

2.6 "Entities" shall include individuals, as well as companies, trusts, societies or other associations of individuals with whom the state agencies have entered into contracts, or intend to enter into contracts, or could enter into contracts.

3. Cross-Debarment
 - 3.1 Any order for demotion, non-renewal, suspension or de-registration issued by the Designated Authority provided for under these Procedures shall have immediate effect as provided herein on contracts awarded and processed by the state agencies.
 - 3.2 Any order for suspension, banning, demotion, blacklisting, de-registration or debarment issued by any authority in the Government of India or other State Governments, or by any other entity not covered under the scope of these Procedures, shall not affect the eligibility of contractors or firms participating in the Unified Registration System, unless the Designated Authority under these Procedures has issued its own order of suspension, non-renewal, demotion or de-registration, pursuant to or consequent or based upon the order issued by such an external agency, after satisfying itself that the order of suspension, non-renewal, demotion or de-registration against such a contractor/firm is appropriate and warranted in order to protect government or public interest in the facts and circumstances of the specific case.
4. Satisfaction of Designated Authority
 - 4.1 Proceedings for suspension, demotion or de-registration shall be in the nature of summary administrative decisions by the Designated Authority, aimed at protecting government or public interest.
 - 4.2 Accordingly, the Designated Authority shall exercise due diligence normally expected of an administrative authority in terms of his/her subjective satisfaction that such administrative action for issue of an order of suspension, non-renewal, demotion or de-registration against a contractor/firm is appropriate and warranted in order to protect government or public interest in the facts and circumstances of the specific case.
5. Designated Authorities
 - 5.1 The authority competent to issue an order of suspension, non-renewal demotion or de-registration, including a notice of proposed demotion or de registration, shall be the authority so specified in the Unified Registration System.
 - 5.2 The orders of the Designated Authority shall have effect across contracts awarded and processed by the state agencies.
 - 5.3 The Designated Authority shall perform his/her functions independently of any superior officers, Board, Council or Committees in the Government. Normally therefore, there should not be any separate or prior requirement of bringing any case for proposed suspension, non-renewal, demotion or de- registration before any committee. However, if any such case is brought before any Boards, Council or Committee by any state agency, the Designated Authority shall recuse himself/herself from the deliberations or decisions of such Board etc. in order to maintain his/her independence in decision-making.
 - 5.4 The Designated Authority shall be free and be empowered to consult any appropriate Department that he/she may deem appropriate (such as legal or finance divisions or Departments) before arriving at a decision for suspension, non-renewal, demotion or de-registration. However, the advice, recommendation or comments of any such Department shall neither be binding upon the Designated Authority and nor shall it form the sole basis of the d decision of the Designated Authority.
 - 5.5 To the extent practicable, the Designated Authority shall decide upon a case within thirty days of the proposal being submitted to it for de-registration, non-renewal, suspension or demotion, provided he/she has received all documents that he/she deems relevant.
6. Appeals
 - 6.1 Appeals against orders of suspension and final orders for demotion, non- renewal

- or de-registration issued by the Designated Authority shall lie only with the Appellate Authority specified in the Unified Registration System. The Appellate Authority shall discharge his/her functions independently of any superior officers, Boards, Councils or Committees in the Government. No appeals shall lie against a notice of proposed demotion, non-renewal or de- registration.
- 6.2 Therefore, normally there should not be any separate or prior requirement of bringing any case for proposed suspension, non-renewal, demotion or de-registration before any Board, Council or Committee. However, if any case is brought before any Board, Council or Committee, any member of the Appellate Authority represented on such boards etc. shall recuse himself/herself from the deliberations or decisions of such Board etc. in order to maintain his/her independence in decision-making.
- 6.3 The Appellate Authority shall be free and be empowered to consult any Department that it deems appropriate (such as legal or finance divisions or Departments) before deciding an appeal. However, the advice, recommendation or comments of any such Department shall neither be binding upon the Appellate Authority and nor shall it form the sole basis of the decision taken in appeal by the Appellate Authority.
- 6.4 The orders of suspension, non-renewal, demotion or de-registration (including notice of proposed demotion or de-registration) of the Designated Authority, or the orders in appeal issued by the Appellate Authority, shall not form part of the scope of issues that can be brought before before arbitrator(s) or arbitral tribunal, notwithstanding anything contained in an arbitration agreement in relation to contracts covered by these Procedures. Similarly, the orders of the Designated Authority or the Appellate Authority shall not form part of the scope of issues that can be referred to the Independent External Monitor under any "Integrity Pact signed by covered entities under these Procedures, notwithstanding anything contained in the Integrity Pact.
- 6.5 To the extent practicable, the Appellate Authority shall decide an appeal within thirty days of the appeal being submitted to it against de-registration, non- renewal, suspension or demotion, provided he/she has received all documents that he/she deems relevant from the appellant and from respondents.
- 6.6 The Appellate Authority shall have the power to pend the processing of a contract for reasons it may deem fit.
7. Grounds for Demotion, Non-Renewal and De-Registration
- 7.1 The Designated Authority may de-register a contractor/firm (referred hereinbelow as "entity") for any sufficient reason, including any one or more of, but not limited to, the grounds listed below;
- (1) Conviction for, or the commencement of an investigation under the Criminal Procedure Code, 1973 or the filing of a chargesheet by an investigative agency in a criminal court of competent jurisdiction, or a civil judgment in respect of commission or alleged commission of fraud or an offence under any law in force in India or elsewhere, either directly or indirectly, by an entity, its proprietor, employee, partner, agent or representative in connection with (a) obtaining, or (b) attempting to obtain, or (c) performing a government contract or agreement Provided that in case of commencement of criminal investigation this clause shall constitute a valid ground for de-registration only if the said fraud or offence is in relation to a contract or agreement entered into with the Government of Chhattisgarh or an entity directly or indirectly under its administrative control,
- (ii) If national security considerations, including question of loyalty to the State, so warrant,
- (iii) If the entity contemptuously refuses to return Government dues without showing adequate cause, and the Designated Authority is satisfied that this is not due to a

- (iv) reasonable dispute which would attract proceedings in arbitration or a court of law;
If the entity employs a government official, dismissed or removed on account of corruption, or employs a non-official convicted for an offence involving corruption or abetment of such an offence, in a position where he/she could corrupt public officials;
 - (v) If the Designated Authority is satisfied that the entity has submitted fake or forged document(s);
 - (vi) If the entity fails to take all measures necessary to prevent corrupt practices, unfair means and illegal activities at any stage of a contract, and
 - (vii) Instigating or causing any third person to commit any of the above.
- 7.2 The Designated Authority may demote a contractor/firm for any sufficient reason, including any one or more of, but not limited to, the grounds listed below
- (i) Non-performance or under-performance under the terms of a covered procurement action that the Designated Authority considers serious enough to justify debarment or suspension:
 - (ii) Without prejudice to the generality of clause (i), any grounds including any one or more of, but not limited to, the following causes:
 - (a) Wilful supply of sub-standard material;
 - (b) Wilful delays or poor performance,
 - (c) Cartel formation;
 - (d) Violation of labour laws;
 - (e) Violation of any other statutory requirement;
 - (f) Obtaining official government information or documentation by questionable means;
 - (g) Submission of false documents;
 - (h) Established litigant nature;
 - (i) Wilful misuse or damage to public property;
 - (j) Failure to disclose names of agents, whether Indian or foreign, and their foreign principals or associates;
 - (k) Failure to fulfil any requirement that may be laid down from time to time under the Unified Registration System, as published in the website for the system, for disclosure of any payments made to any broker, agent, representative or any other intermediary in relation to any contract to which these Procedures apply;
 - (l) Engagement of any individual or entity to intercede, facilitate, or recommend the award of a contract, excluding legal representatives employed directly by the entity;
 - (m) Collusion to impair transparency, fairness or progress of the contracting process;
 - (n) Complaining without full and verifiable facts; or
 - (o) Instigating or causing any third person to commit any of the above.
- 7.3 A Designated Authority may not renew the registration of a contractor/firm for any sufficient reason, including any one or more of, but not limited to, the grounds listed below:
- (i) Failure to meet any volume of work criterion specified from time to time under the Unified Registration System as published on the website for the system, for the particular class of registration for the last three financial years ending with the financial year immediately prior to the date of submission of proposal for non-renewal to the Designated Authority; and
 - (ii) Any of the grounds specified in paragraphs 7.1 or 7.2 above.
8. Grounds for Suspension
- 8.1 Suspension of an entity can be ordered by the Designated Authority, where it determines that continuation of dealings is not considered desirable in government

- or public interest, pending completion of proceedings into allegations or facts related to any of the grounds enumerated in paragraphs 7.1 and 7.2 above, and where it is considered necessary to forthwith order such discontinuation without prior notice of suspension to the entity.
- 8.2 In all such cases of suspension it shall be incumbent upon the Designated Authority to put the suspended entity on notice and to grant an early opportunity of post-decisional hearing.
9. Effect of Suspension, Non-Renewal, De-Registration and Demotion
- 9.1 A final order of de-registration or non-renewal in respect of a contractor/firm shall result in immediate ineligibility of the contractor/firm and its affiliates for all classes of contracts (or for classes of contracts higher than the resultant demoted class in cases of demotion) from participating in future bids or contracts or agreements for a minimum period of two years and a maximum period of ten years with effect from the date of demotion or non-renewal or de- registration, including ineligibility from evaluation in ongoing cases where a contract or agreement is yet to be finally signed. Such ineligibility shall be without compensation from or liability to the state agency. Similarly, a de registered or non-renewed contractor/firm and its affiliates shall be ineligible for award of a contract, including receipt of an order under a Rate Contract, and for entering into any contract covered by these Procedures, in cases where an order for de-registration or non-renewal has come into effect before the signing of such contract
- 9.2 Where the de-registered, non-renewed, demoted or suspended contractor/firm has already emerged as the most preferred bidder using price and/or technical criteria as specified in the Request For Proposal (or Notice Inviting Tender or Invitation To Bid or Request For Quotation by whatever name called), the procurement process shall be continued treating the de-registered, suspended, demoted or non-renewed contractor/firm as ineligible, notwithstanding any appeal, unless the Appellate Authority has pended the procurement process.
- 9.3 A de-registered or non-renewed contractor/firm shall not be eligible to receive a Request For Proposal (or Notice Inviting Tender or Invitation To Bid or Request For Quotation etc., by whatever name called) from the state agencies in cases of limited and/or restricted tendering where such issue is provided for under tender procedures.
- 9.4 In any case where the entity is suspended, de-registered, non-renewed or demoted subsequent to such issue, it shall not be considered eligible for the purposes of any technical, field or commercial evaluation or for award or signing of contract undertaken in pursuance to the Request For Proposal (or Notice Inviting Tender or Request For Quotation or Invitation To Bid etc., by whatever name called).
- 9.5 Mere initiation of a criminal or other investigation or inquiry by any authority in the Government of India or other State Governments, or by any other entity not covered under the scope of these Procedures, or the mere filing of a chargesheet or any other formal proceedings against an entity by an enforcement agency exercising powers of a court, shall not render an contractor/firm ineligible, unless the Designated Authority under these Procedures has issued its own order of suspension, non-renewal, demotion or de-registration, pursuant to or consequent or based upon the order issued by such an external agency, after satisfying itself that the order of suspension, non- renewal, demotion or de-registration against such a contractor/firm is appropriate and warranted in order to protect government or public interest in the facts and circumstances of the specific case. Similarly, a notice of proposed demotion or de-registration shall not render a contractor/firm ineligible, unless a final order for demotion, non-renewal or de-registration has been issued by the Designated Authority under these, Procedures prior to conclusion of the contract

- 9.6 The above consequences on ineligibility of a contractor/firm shall be in addition to any criminal liability that may arise out of any laws in force in India, and also in addition to any other pecuniary consequences and civil liabilities including penalties, costs or liabilities as may be imposed by procuring officials, as well as forfeiture of earnest money deposits, encashment of bank guarantees and performance bonds, risk and cost purchase, recovery of certain sums from the erring entity, and liability for compensation for losses or damages as may be provided for under contract or agreement, as may be provided for in the relevant Notice Inviting Tender, Request for Proposal, Request for Quotation, invitation to Bid and any such documents.
- 9.7 Notwithstanding anything contained in the contract, procuring officers shall not renew, expand or extend current contracts with suspended, non-renewed, demoted or de-registered contractors/firms, or otherwise extend their duration or modify them to the advantage of a contractor/firm, unless prior approval of the authority one level above the authority competent to approve the same under the contract is taken for such renewal, modification or extension: Provided further that in respect of de-registered contractors/firms, the level of prior approval shall be the state Government;
- 9.8 Termination of contracts, if considered appropriate by procuring officials, shall follow procedures as provided for under the contract and other relevant instructions of the Government.
10. Notice of Proposal for Demotion or De-Registration (and Order of Suspension or non-Renewal)
- 10.1 Demotion or de-registration shall be initiated by the Designated Authority upon receipt of information or proposals by putting a contractor/firm on notice:
- (i) That demotion or de-registration is being contemplated;
 - (ii) Of the reasons for proposed demotion or de-registration relied upon under paragraph 7 of these Procedures for the proposed demotion or de-registration,
 - (iii) Stating the period of demotion or de-registration and the proposed start and end dates for the period of demotion and de -registration;
 - (iv) That, within fifteen days of receipt of the notice, the contractor/firm may submit in writing, either in person or through a representative, information and arguments in connection contesting the proposed demotion/de-registration.
- 10.2 An order for suspension or non-renewal by the Designated Authority shall afford an opportunity for a post-decisional hearing the suspended contractor /firm, including therein:
- (i) The fact that suspension has been ordered forthwith,
 - (ii) Of the reasons for suspension or non-renewal relied upon under paragraph 7 read with paragraph 8 of these Procedures;
 - (iii) Stating the period of suspension or non-renewal with proposed effective end dates,
 - (iv) Advising that suspension or non-renewal is effective only in respect of state agencies;
 - (v) That, within fifteen days of receipt of the notice, the entity may submit in writing, either in person or through a representative, information and arguments in connection contesting the suspension or non-renewal.
11. Final Orders for Demotion/ De-Registration
- 11.1 If the Designated Authority decides to issue a final order of demotion or de registration, whether after the issue of an initial order of suspension or non-renewal or otherwise after issue of notice of proposed demotion or de registration, the contractor/firm concerned shall expeditiously be given notice of such final order.
- (i) Referring to the notice(s) of the order of suspension or non-renewal, if any, and notice of proposed demotion or de-registration,
 - (ii) Specifying the reasons for demotion or de-registration; and

- (ii) Stating the period of demotion or de-registration, including effective start and end dates.
- 11.2 If pursuant to the notice of demotion or de-registration, final orders of demotion or de-registration are not imposed, the Designated Authority shall promptly notify the contractor/firm by speed post or by registered post (acknowledgement due), in addition to the manner of publication specified under these Procedures.
- 11.3 Upon completion of the period of de-registration or demotion, a de-registered contractor/firm that has been de-registered or demoted as well as a contractor/firm whose registration has not been renewed under these Procedures shall need to make a fresh application of enlistment or empanelment as a registered contractor/firm under applicable rules and procedure for registration of contractors/firms.
12. Period of Demotion, De-Registration, Suspension and Non-Renewal
- 12.1 Demotion and de-registration shall be for a period commensurate with the seriousness of the reason(s), but not less than two years and not more than ten years in any case, including subsequent extensions of demotion or de registration orders, if any:
Provided that in case the period of demotion for an entity is less than the remaining period of registration, the order of demotion shall have the effect of restricting the renewal of registration or re-registration upon completion of registration to the demoted class for the balance period of demotion;
- 12.2. The period of suspension shall not exceed one year from the date of issue of the orders for suspension.
- 12.3 if suspension precedes a demotion or de-registration, the suspension period shall be included in determining the total demotion or de-registration period.
- 12.4 The Designated Authority may extend the demotion, non-renewal or de registration for an additional period, within the cumulative maximum permissible period of ten years, if it determines that an extension is necessary to protect government or public interest. However, demotion, non-renewal or de- registration may not be extended solely on the basis of the facts and circumstances upon which the initial orders were issued. If demotion, non- renewal or de-registration for an additional period is considered necessary, the procedure prescribed under paragraph 10 of these Procedures shall be followed for such extension.
- 12.5 The Appellate Authority may reduce de period of demotion, at affected devotion non-renewal contractor/firm's request supported by documentation, if it is satisfied upon examination of all facts and circumstances of the case, including all of the following:
- (i) That such reduction shall be in government or public interest;
 - (ii) That such reduction shall be appropriate for reasons such as newly discovered material evidence, and/or reversal of the facts, circumstances enquiry, investigation, conviction or Judgment, if any, upon which the original debarment or suspension was hand, and
- (ii) That the contractor/firm, subsequent to demotion, non-renewal de registration se suspension, has put in place sufficient remedial measures. including compliance mechanism, effective standards of conduct and other internal content systems that of the case.
- 12.6 Except in cases falling under paragraph 12.5(ii) above, reconsideration request shall not be entertained prior to two years from date of demotion, suspension, non-renewal or de-registration.
13. Affiliates and Anti-circumvention
- 13.1 Demotion, non-renewal, de-registration and suspension shall always by implication, extend to "affiliates" of a demoted or non-renewal or de-registration or suspended contractor/firm.
- 13.2 The demoted, non-renewed, de-registered or suspended contractor/firm and

- another entity to which such as order can extend shall be presumed to be affiliates for the purpose of these Procedures
- (i) If either one controls, or has the power to control the other, or
 - (ii) A third party controls or has the power to control both.
- 13.3 Indices of control include, but are not limited to, interlocking management or ownership, identity of interests amongst employee, owners or members or shared facilities.
- 13.4 Particular care needs to be taken by procuring officers to ensure that a demoted or non-renewed or de-registered or suspended contractor/firm does not transact contracts or agreement under different name or division, either through a transfer of assets of demoted or non-renewed or de-registered or suspended contractor/firm to another legal entity or otherwise.
14. Consolidated List of Demoted, Non-renewed, De-Registered and Suspended Contractors/Firms
- 14.1 A nodal officer specifically notified by the Government shall ensure that an updated list of demoted, non-renewed, de-registered and suspended entities, as informed by the Designated Authority, is always maintained on the official website of the Unified Registration System.
- 14.2 In particular, such nodal officer shall be responsible for:
- (i) Compiling and maintaining a current, consolidated and searchable list of all demoted, non-renewed, de-registered or suspended entities (including their known affiliates), complete in all respects such as scope, period and coverage of orders of demotion, de-registration, non-renewal or suspension; and
 - (ii) Providing within such list the name and telephone number of Designated Authorities and Appellate Authority, and
 - (iii) Providing within such list the official contact person responsible for its maintenance and distribution
15. Responsibilities of Procuring Officials
- 15.1 Procuring officials of the state agencies of the Government shall ensure full compliance with the provisions of these Procedures, and shall be responsible, in particular, for the following:
- (i) That appropriate procedures are established to implement the substantive and procedural aspects of these Procedures:
 - (ii) That their actions are coordinated with internal and external agencies and offices so as to enable receipt of prompt information relevant to potential breaches of entities' obligations that may require cases to be placed before Designated authorities for their consideration for suspension, non-renewal, demotion or de-registration; and
 - (iii) That ineligibility of demoted, non-renewed, de-registered or suspended entities is given effect to forthwith in accordance with the terms of the orders for demotion, non-renewal, de-registration or suspension, especially through a careful watch on the consolidated list as provided for under Rule 14 above.
16. Clarifications and Amendments
- 16.1 All clarifications and amendments to these Procedures shall be issued under the authority of the General Administration Department.

Performance Security for Works Contract Period

Option 1: (Demand Guarantee)

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of the Employer]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Contractor, (hereinafter called "the Applicant")]* has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert name of the contract and brief description of the Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (*[insert amount in words]*),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for its demand or the sum specified therein.

This guarantee shall be valid until the date of issue of the **Works Contract Completion Certificate**.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

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

¹ The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency(cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.

Performance Security for O&M Contract Period

Option 1: (Demand Guarantee)

[Insert Guarantor letterhead or SWIFT identifier code]

Beneficiary: [Insert name and Address of the Employer]

Date: [Insert date of issue]

PERFORMANCE GUARANTEE No.: [Insert guarantee reference number]

Guarantor:[Insert name and address of place of issue, unless indicated in the letterhead]

We have been informed that [insert name of Contractor, (hereinafter called "the Applicant") has entered into Contract No. [insert reference number of the contract] dated[insert date]with the Beneficiary, for the execution of [insert name of the contract and brief description of the Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of [insert amount in figures]([insert amount in words]),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for its demand or the sum specified therein.

This guarantee shall be valid until the date of issue of the **Final Contract Completion Certificate**.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded. _____

[signature(s)]

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

APPENDIX-1**Qualification Information**In case of JV all the members have to furnish the details separately

1.1	Constitution or legal status of Bidder/attach copy]				
	Place of registration of Firm/ Company (in case of other than individuals)				
	Principal place of business:				
	Name of Power of attorney holder of signatory of Bid (bidder)/ attachcopy]				
1.2	Total annual volume of civil engineering construction work executed and payments received each year in the immediate five years preceding the year in which tenders are invited. (Attach certificate from Chartered Accountant)- indexed @ 10% (ten percent) compounded per year	Financial Year	(Rs. in crores)		
			"Civil engineering construction work" Turn over in the year	Add for indexing	Total
				1.61	
				1.46	
				1.33	
				1.21	
				1.10	

Note:

- Proprietary firm, partnership firm with the certificate of registration by register/article and Memorandum of Association with Certificate of Incorporation.
- Mention and highlights the year, which the tendered considers for evaluation for the Committee

APPENDIX - 2**Information regarding minimum one similar work, performed by primeContractor (Lead partner)**

- (i) One Work completed as similar work during last Fiveyears
- (ii) Or being executing one such similar work

Sno	Project	Name of Employer	Value of Contract	Contract No.	Date of Issue of Work Order	Stipulated Date of Completion	Actual Date Of Completion	Valueof WorkDone	Remarks explaining reasons for Delay, if any; and the amount of deductions due to delay also mention if any claim or dispute is pending in any forum.
1	2	3	4	5	6	7	8	9	10

Note :-

- (i) Attach certificates from the Engineer in charge not below the rank of Executive Engineer or equivalent.
- (ii) Tenderer may attach certified copies of work order and completion certificate issued by Engineer in charge not below the rank of CMO

APPENDIX – 3- Work Performed prime Contractor on all classes of Civil Engineering Construction Works over the last five years

Sno	Project Name	Name of Employer	Description of Work	Value of Contract	Contract No.	Date Of Issue Work Order	As per Agreement Date of Completion	Actual Date Of Completion	Year wise value of work done as per certificate of employer Rs. In Lacs						Remarks explaining Reasons for Delay if Any and the amount Of deductions due to Delay also mention if Any claim or dispute Is pending in any Forum.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Note: -

- Certificate of Completion of the Works, in sufficient detail to verify the contract name, value and completion time issued by Engineer in charge not below the rank of CMO or equivalent.
- Tenderer to attach the supporting documents in lieu of information provided in Table above

APPENDIX - 4

Existing commitments and on going all classes of civil engineering construction works. (For calculation of component B in case of Bid capacity)

Sno	Project Name	Description of Work	Contract No & Year	Name & Address Of the Employer	Value of Contract (Rs. Lakhs.)	Date of Issue of Work Order	Stipulated Date of Completion	Stipulated period of Completion in Months	Anticipated date Of Completion	Value of Work done Up to date of issue Of N.I.T (Rs. Lakhs) **	Probable value of Works Remaining To be Completion (Rs. Lakhs) **	Anticipated Months Required Completion of balance works	Value of Claims Or Dispute If Any pending
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Note –

- ** Enclose certificates from Engineer (s) in charge (Not below the rank of CMO or equivalent) for value of work remaining to be completed, value of work done, anticipated date of completion.
- Tenderer to attach the supporting documents in lieu of information provided in Table above
- The details of works in hand indicating name of work, Agreement no. work. work order no. and date, amount of contract, period of completion, value of work done and balanced work in hand with details of work on the date of submission of Tender.

APPENDIX - 5

Availability of Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below.

Item of equipment	Total number available	Description n, make, and age (Years), and capacity	Condition (new, good, poor) and number available	Nos. (i)Owned, (ii) leased, or (iii) to be purchased	If these are in use in some work, mention the details.	No. of equipments proposed to be utilized <i>in this work</i> (Out of total Nos.)
1	2	3	4	5	6	7

Note :In case of JV all the members can furnish the details jointly

APPENDIX – 6**List of Technical persons to be deployed on Contract work- Detailed requirement as given in scope of work**

Postion	Numbers	Professional Qualification	Total Expereince years	In similar works (years)	Expereince of similar works in the present postion (Years)

Note :In case of JV all the members can furnish the details jointly

APPENDIX – 7

Financial reports for the immediate previous five years: balance sheets, profit and loss statements, audited auditors' reports, etc., list below and attach copies. (For Lead partner only)

Year	Income Tax Clearance Certificate (optional)	Balance Sheet	Profit & loss statement	Reserve brought forward in any	Net credit Balance if any [for debit show (-)]	Auditors , Report	Other information if the bidder wishes to submit
1	2	3	4	5	6	7	8

APPENDIX – 8**Information on current claims, arbitration, litigation in which the Bidder is involved.**

SI. no.	Name of Other party(s)	Agt. No. date year and Deptt.	Brief of cause of claims, arbitration /dispute (give reference of contract details)	Where Litigation pending (in the department/Court/a arbitration) (mention Deptt./Court /Arbitration)	Amount Involved/ claimed

Note:-Can use separate sheets for each agreement if necessary

In case of JV all the members shall furnish the details separately

APPENDIX – 9- MOU SCADA**Memorandum of Understanding**

This Memorandum of Understanding is entered on _____ 2023 by and between
M/s _____. (Hereinafter referred to as "Bidder"), a company incorporated under
the _____ with its registered office

AND

M/s _____ (hereinafter referred to as System Integrator of Sensors
(Flow, Pressure & Level/PLC-SCADA System/Water Quality Monitoring System), a
company incorporated _____ and having its Corporate Office at

Bidder shall be referred to as "Parties" and individually as "Party"

WITNESS

**Whereas _____ Nagar Panchayat has invited bid for Improvement of water supply
scheme at _____ (Name of scheme with System tender no.)**

Whereas _____ is System Integrator of Sensors (Flow, Pressure & Level/PLC-SCADA
System/Water Quality Monitoring System and, Water field of SCADA-PLC Quality
Monitoring System & Sensors and Automation Control System for Water/Waste Water
Supply Projects.

Whereas, _____ are in the business of turnkey execution of water supply project for and
various other Industrial Sectors & Infrastructure Projects.

Bidder is submitting its bid and has decided to enter a Memorandum of Understanding with
M/S _____ to work with them as Automation Technology Provider for
above mentioned water supply project, as per the requirements of the above project.

NOW, THEREFORE BOTH THE PARTIES HERETO AGREE AS FOLLOWS: -

- 1) Bidder is submitting their bid in MOU with _____.
- 2) _____ will be the System Integrator & Technology Provider for
SCADA and Automation products to be used in this project like PLC, SCADA, Sensor,
Water Quality Monitoring System etc. as per the requirements of the above project.
- 3) _____ shall provide following equipment & technical support limited
to scope of supply to Bidder, as per the scope of tender document
 - Selection & Supply of SCADA-PLC Software
 - Selection & Supply of Sensors/Water Quality Monitoring Systems as part of the project
along with standard warranty for related scope of work, as per project requirement.
 - _____ will extend the required supervision support to the bidder for the
completion commissioning, trial run and 5 years O&M of the water supply project
- 4) _____ will be the Main bidder and shall have the complete authority to sign
all documents & agreement with _____r Nagar Panchayat, Bidder shall be fully
responsible for the total execution of the contract including all contractual obligations and
receipt of payment due in accordance with the contract terms.
- 5) _____ responsibility is wrt to supply of SCADA-PLC, Sensors & Water Quality
Monitoring System for the project. to its partner and is not liable for any contractual terms
and conditions which is agreed between both parties.
- 6) M/s _____ shall provide and commit such resources as are necessary to
perform their scope of work for the successful completion of the project. Bidder shall attend
all review meetings for the project as and when called for by _____ Nagar Panchayat,

(Improvement of water supply scheme at _____) till the completion of the project and during the O&M periods, _____ shall also attend the same whenever required by Bidder/ _____ Nagar Panchayat,

7) M/s _____ shall be responsible for the supply of SCADA-PLC, Sensors & water Quality Monitoring System to the Bidder.

8) This MOU shall be effective from the date as mentioned in the first page of the Agreement and shall terminate on the happening of any of the following: -

a) The pre-qualification bid/ tender submitted by Bidder is rejected or is unsuccessful in the bid.

b) The client notifies the parties that they will not proceed with the project.

c) Any of the parties to this agreement is declared insolvent by a Court of competent jurisdiction.

9) This MOU is made specifically for the work of execution of works related to the pre-qualification bid for project and shall remain valid for the entire tenure of contract up to fulfilment of contractual obligation.

In witness whereof the parties thereto have caused this Contract to be executed the day and year first before written.

WITNESS:-

SIGNED By: _____

SIGNED By: _____

For and on behalf of the Biider in the presence
of

For and on behalf of the System Integrator in the
presence of

WITNESS:-

1. Sign:-.....
Name:-.....
Address:-.....
Date:-.....

2. Sign:-.....
Name:-.....
Address:-.....
Date:-.....

APPENDIX – 10

DELETED

APPENDIX – 11-MOU with registered Substation Contractor

This MOU is made on this ____ day of ____ 2023 between M/s. _____ a company incorporated under the Companies Act, 1956, having its _____ and Registered office at _____, (main Bidder) and M/s _____, Registered office at _____ [Substation Contractor's Company Name]

Whereas "_____" is interested in bidding for " Engineering, Procurement, Construction, testing, commissioning of _____ Existing Water Supply scheme including Trial run, 12 months Defects Liability period and 5 years Operation and Maintenance of all Project Components/whole scheme" TENDER No. _____. (hereinafter referred as "Project").

SCOPE OF WORK

On allotment of the work to "_____" for the said project. "_____" [Substation Contractor's Company Name] ", shall all execute all sorts of work involved in successfully installation of substation works as per scope of work, technical specifications and other conditions outlined in the tender documents

"_____" [" confirms as under:

1. possesses the minimum experience required for the installation of substations as a pre-qualification criterion.
2. holds all valid and necessary registrations and certifications in Chhattisgarh and India for installation of substation works.
3. has not been blacklisted anywhere in India in the last five years or stopped/abandoned/was asked to stop the works.
4. has the necessary expertise and experience in executing water supply projects involving substations.
5. shall comply with all applicable laws, regulations, and standards related to electrical installations, safety, and environmental protection.
6. shall provide all required documentation, including QAPs, technical drawings, specifications, TPIs and certifications, related to the installation of substations in the water supply project as per requirement of tender document.
7. shall comply with all applicable regulations and guidelines issued by the Central Electricity Authority (CEA), State Electricity Board (SEB), and any other relevant regulatory authorities.
8. shall ensure that all substation equipment and materials used in the project are of approved quality, conforming to technical specifications outlined in the tender document and relevant Indian standards.
9. shall ensure the availability of trained and competent personnel for the Design, installation, testing, and commissioning of the substation, including qualified engineers and technicians.
10. shall adhere to the project timeline and complete the substation installation within the stipulated timeframe.
11. shall ensure the quality and reliability of the substation installation, meeting the specified performance criteria and industry standards.
12. shall provide a warranty for the installed substation equipment and undertake necessary maintenance and repairs during the defects liability period and operation and maintenance phase as per tender document.

Note: All necessary certificates, shall be submitted by the bidder as documentary proof along with the bidding documents for the Project. Failure to provide the required documentation may result in disqualification of the Contractor's bid.

In witness whereof the parties thereto have caused this Contract to be executed the day and year first before written.

WITNESS:-

SIGNED By:_____

For and on behalf of the Bidder in the presence of

SIGNED By:_____

For and on behalf of the Electric Substation Contractor in
the presence of

WITNESS:-

3. Sign:-.....
Name:-.....
Address:-.....
Date:-.....

4. Sign:-.....
Name:-.....
Address:-.....
Date:-.....

APPENDIX – 12**CONTACT PERSONS**

(Clients for whom the work has been carried out by the bidder)

SI No.	Name of CMO of the Division	Divisional	STD Code	Phone No. Office/ residence	Name District
1	2	3	4	5	6

Note :In case of JV all the members can furnish the details jointly

APPENDIX – 13(In case of JV all the members has to furnish the details separately)**Affidavit on Non-Judicial stamp of Rs. 100**

I..... S/o.....

Aged..... years..... resident..... of.....

.....(address.....

.....)

(For and on behalf of.....), do

here by and herewith solemnly affirm / state on oath that: -

1. All documents and Information's furnished are correct in all respects to the best of my knowledge and belief
2. I have not suppressed or omitted any information as is required.
3. I am/ We are neither black listed nor debarred by Govt. of India / Other State Govt. Departments/ Chhattisgarh State Govt. Departments/Nagar Panchayat.
4. Not being CDR by any bank
5. I hereby authorize the Nagar Nigam/Nagar Palika/Nagar Panchayat Officials to get all the documents verified from appropriate source(s) and in case of any ambiguity found in any of the information provided or documents submitted at any stage during the currency of project, department is at liberty to take any action, either by penalizing or blacklisting for next atleast 3 years, in exercise of above action the department can engage other contractor/agency to complete the balance works at my Risk & Cost and the costs and the charges incurred in any way in carrying on and completing the balance works are to be paid to the department by me.

Deponent

(.....
.....)Authorized signatory / for and on behalf of
.....

Witness 1.....

Witness 2.....

(Affix**Seal)****Verification**

I..... S/o..... do here by affirm

that the contents stated in Para 1 to 5 above are true to the best of my knowledge and believe and are based on my / our record.

Verified that this date of 202... at (Place).....

Deponent

Seal of attestation by a Public

Notary with date Authorized signature / for and on behalf of.....

Appendix-14- Declaration (on Non-Judicial stamp of Rs. 100)(for lead partner)**Affidavit**

I, the undersigned, do hereby declare /solemnly affirm / state on oath that on the behalf of M/s....., that I/We have visited and inspected the site..... (**project name and System tender no**) carefully and have acquainted myself/ourselves with full and complete knowledge and understanding of the Project/site, prevailing conditions, complete scope of work and other Employer's requirements.

I/We, hereby also affirm that if any items/components which may not be mentioned in the tender, but are necessarily required for successful commissioning of the Plant/system/scheme with desired outputs and complete functions in all respects are inclusive in our quoted Price and no further extra charges consequent on misunderstanding or otherwise will be claimed.

Deponent

(.....
.....)Witness 1
Witness 2Authorized signatory / for and on behalf of
.....**(Affix Seal)****Verification**

I..... S/o..... do hereby affirm that the contents stated above are true to the best of my knowledge and believe and are based on my / our record.

Verified that this date of 202... at (Place).....

Deponent

Seal of attestation by a Public

Notary with date Authorized signature / for and on behalf of.....

Appendix-15 (In case of JV all the members have to furnish the details separately)**AFFIDAVIT-(Declaration of conflict of Interest)**

(Note: This affidavit should be on a non-judicial stamp paper of Rs. 100/- and shall be attested by Magistrate/Sub-Judge/Notary Public)

I,.....(Name of the bidder authorized representative of the bidder) son/daughter of resident of (full address), aforesaid solemnly affirm and state as under :

I hereby certify that all the information furnished with the bid submitted in response to notice inviting bid number Dated: issued by ULB.....(authority inviting bids) for Scheme(name and identification of work) are true and correct.

I hereby certify that I have been authorized by..... (Company name) to sign on their behalf, the bid mentioned above.

Information furnished in the bidding documents is correct in all respects to the best of my knowledge and belief.

The near relations in CGUADD are not in employment of the firm/company. (Note:-By the term near relatives is meant Wife, Husband, Parents and Son, Brother, Sister, Brother-in-law, Father-in-law, Mother-in-law etc.) (if working mention the name/names)

.....
.....

The name of near relative (if any) who retired/ removed within the last two years. (If None, clearly State None)

.....
.....

No near relative is working as Financial Accountant in the CGUADD (if working mention the name)

.....
.....

No person is working in the company in any capacity, who are near relatives to any Officer in CGUADD (If working mention the name)

.....
.....

Our company/firm/ or otherwise is not under the clarification of ineligibility for corrupt and fraudulent practices by the Central Government, the State Government or any public undertaking, autonomous body, authority by whatever name called under the Central or the State Government. as mention in clause 1(F) of tender document.

I hereby authorize the CGUADD to get all the documents verified from appropriate sources (s).

Deponent

Place :

Date :

* Not applicable if the bidder is an individual and is signing the bid on his own behalf.

Verification

I..... S/o..... do here by affirm that contents stated above and contents submitted in technical & financial bid are true to the best of my knowledge and believe and are based on my/our record.

Verified that this date of at (Place).....

Deponent

Appendix-16- For Similar works

In case of JV, each members have to submit the followings details separately: -

S.No	Name of Department	Name of similar project/work	Components Executed	Date of Award	Date of Completion

- Attach certificates from the Engineer in charge not below the rank of Examiner or equivalent.
- Tenderer may attach certified copies of work order and completion certificate issued by Engineer in charge not below the rank of Executive Engineer

Appendix-17-
JOINT VENTURE AGREEMENT

(Note : This agreement should be on a non-judicial stamp paper of Rs.500/- and shall be attested by Magistrate/Sub-Judge/ Notary Public)

This Joint Venture Agreement executed on this Day of 2023

BETWEEN

M/S, a Company/Proprietorship Firm/Partnership Firm incorporate under the Law of companies Act 1956/2013 and having its registered/principal office at (GST No.....) through its proprietor S/o (herein after called the “Partner-I”/“Lead Partner” which expression shall include its successors, executors and permitted assigns)

AND

M/s a Company/Proprietorship Firm/ Partnership Firm under Firm (GST No.) and having its registered/principal office at Through its Partner Mr. S/o (herein after called the “Partner-II”/“Second Partner” which expression shall include its successors, executors and permitted assigns)

This agreement is for the purposes of submission of bid as per the TENDER DOCUMENT NO. dated and entering into a contract in case of award for the work of (name of Worsk) and name of ULB)

AND WHEREAS as per Tender document, Joint Venture bids will also be considered by the ULB_____ provided they meet the specific requirements in that regard.

NOW THIS INDENTURE WITNESSETH AS UNDER -

In consideration of the above premises and agreements all the partners to this Joint Venture do hereby now agree as follows:

We the partners in the Joint Venture hereby confirm that the name and style of the Joint Venture shall be “..... /” “Joint Venture.”

FORMATION AND PRINCIPAL PLACE OF BUSINESS

Formation -

The partner of the Joint Venture do hereby form a Joint Venture pursuant to the laws of state of Chhattisgarh in order for the Joint Venture to carry on the purposes for which provision is made herein

Principal Place of Business -

The Joint Venture Partner shall maintain principal place of business at The partners of the Joint Venture may re-locate its office from time to time or have additional offices as the partners may determine.

PURPOSE OF THE JOINT VENTURE -

The object of the Joint Venture to bid and perform Tender No. dated: from) For

..... and to deal with the same in any manner what so ever.

TERM -

Duration of MoU and this Agreement shall be valid during the entire execution period/DLP/O&M period and any extension thereafter/currency of the contract including the period of extension, if any.

PERCENTAGE OF PARTICIPATION -

JOINT VENTURE PARTNER	PARTNER	PERCENTAGE
1. M/S	Lead Partner (Partner 1)
2. M/s	Other Partner (Partner 2)
TOTAL -		

PARTICIPATION -

Both the partners have decided to perform the above mention work of _____ in their above proportionate work.

The Joint Venture Agreement should indicate precisely the role and responsibilities of both the members of JV in respect of planning, design, construction equipment, key personal, work execution, and financing of the project including testing trial run, defect Liability period & O&M period of the works. Both members of JV should have active participation in execution during the contract. This should not be varied/modified subsequently without prior approval of the competent authority

Component wise breakup table for Experience Certificate -

PARTICULARS OF THE SCHEME	ACTIVE PARTICIPATION IN EXECUTION OF COMPONENTS	
	LEAD PARTNER	SECOND PARTNER

Number of partners in a Joint Venture shall not exceed 2 (two-including lead partners).

In case of successful bid, the Agreement, shall be signed by both the partners of Joint Venture, so as to be legally binding on both the partners of Joint Venture.

In execution of the contract, payment, shall be done exclusively to the Lead Partner.

The Lead Member is hereby authorized by the second Member of the Joint Venture to bind the Joint Venture and receive instructions for and on their behalf. For this purpose, second member will submit a duly signed Power of Attorney.

A copy of Memorandum of Understanding (MoU) certified by Magistrate/Sub-Judge/ Notary Public on 500 Rupees stamp paper, executed between the members of Joint Venture shall be submitted along with the tender. The complete details of the members of the Joint Venture, their share and responsibility in the Joint Venture etc. particularly with reference to financial, technical and other obligations shall be furnished in the MoU.

Any change/modification in constitution of Joint Venture Firm shall not be allowed.

The lead partner of Joint Venture shall be solely responsible for any liability, penalty, insurance, testing and trial run, O&M period and other terms and conditions mentioned in this Bidding Document. In event of default by

any partner in the execution of his part of contract, both the partners shall be debarred from the tender, execution of work of CGUADD and registration in unified registration system of CGPWD.

Notwithstanding the permission to assigning the responsibilities of defaulting partner above, both the partner of Joint Venture will retain the full and undivided responsibility for the performance of their obligation under the bid.

The bid submitted shall include all the relevant information mentioned in this bidding document applicable to Joint Venture partner shall be furnished separately for each partner like affidavit as in Appendix-15 & 16 mentioning information of relatives, experience certificate, documents of check list etc. In case of failure to do so, bid shall be rejected.

Partners of the Joint Venture Firm shall be jointly and severally liable to ULB/Nagar Palika Parishad/CGUADD for execution of the project/Work/Assignment/attending meetings/Review for the allocated works etc. The Joint Venture members shall also be liable jointly and severally for the loss, damages caused to the ULB/Nagar Palika Parishad/CGUADD during the course of execution of any awarded contract or due to non-execution of the contract or part thereof. Governing Laws for Joint Venture Firm: The Joint Venture Agreement in all respect be governed by and interpreted in accordance with Indian Laws.

Subject to the terms of this Agreement, all member shall be responsible for providing technical and financial support and responsible for execution of project as per agreement.

In case of any breach of the said Contract by any of the partners of the JOINT VENTURE, we hereby agree to be fully responsible for the successful execution/performance of the contract in accordance with the terms of the Contract.

Further, if the ULB/Nagar Palika Parishad/CGUADD suffered any loss or damage on account of any breach of the contract or any shortfall in the completed water supply scheme, meeting the guaranteed performance parameters as per the technical specifications/contract documents, the lead Partner and Second Partner of the Joint Venture undertake to promptly make good such loss or damage caused to the ULB/Nagar Palika Parishad/CGUADD, on the ULB/Nagar Palika Parishad/CGUADD demand without any demur.

The financial liability of the partners to this Joint Venture Agreement, to the ULB/Nagar Palika Parishad/CGUADD with respect to the any or all claims arising out of the performance or non-performance of the contract shall, however be not limited in any way so as to restrict or limit the liabilities of either of the partner.

This Joint Venture Agreement shall be governed, construed and interpreted in accordance with Laws of India. Courts of Raipur (CG) shall have exclusive jurisdiction in all matters arising there under.

It is further agreed that this JOINT VENTURE Agreement shall be irrevocable and shall form an integral part of the Contract and shall continue to be enforceable till the ULB/Nagar Palika Parishad/CGUADD discharges the same. It shall be effective on the date first above mentioned for all purposes and intents.

Both the partners all together should meet minimum qualification criteria experience of similar nature of work. For meeting the minimum qualification criteria of experience of similar nature work, every partner must have experience of different works as defined in similar nature of works and together shall have the experience of all type of works described in similar nature of works.

The Performance Security of Joint Venture shall be in the name of the Lead Partner of the Joint Venture.

Member of any Joint Venture Firm shall not be permitted to participate either in individual capacity or as a

partner of any other Joint Ventures in the same tender. Submission or participation of more than one bid by members in individual capacity or as a partner of any other Joint Ventures in same tender will cause disqualification of all the bids submitted by the bidder.

The Lead Partner must meet 100% requirement of financial eligibility criteria required for the bid.

All other conditions as per tender document

IN WITNESS THEREOF, the partners to this Joint Venture agreement have, through their respective authorized representatives, have executed their presence and affixed their hands and common seal of their respective companies on the day, month and year first above mentioned.

FOR, M/s

FOR, M/s

(MR.)

(MR.)

Lead Partner/Partner-1

Second Partner/Partner-2

WITNESS -

WITNESS -

1

1

2

2