CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD

No.1, Pumping Station Road, Chintadripet,
Chennai 600 002.

BID DOCUMENT

VOLUME – I

NAME OF THE WORK: Designing, providing, constructing, erection and commissioning, startup and performance trial run for 6Months followed by 5 years of O & M of 31 MLD capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technology on DBOT Basis.

W – 2/LS

TAMILNADU URBAN DEVELOPMENT PROJECT

AGREEMENT NO.

NATIONAL COMPETITIVE BIDDING
(CIVIL WORKS)
(LUMPSUM – CONTRACT)

NAME OF WORK	:	DESIGNING, PROVIDING, CONSTRUCTING, ERECTION AND COMMISSIONING, STARTUP AND PERFORMANCE TRIAL RUN FOR 6 MONTHS FOLLOWED BY 5 YEARS OF O&M OF 31 MLD CAPACITY SEWAGE TREATMENT PLANT (STP) AT THIRUVOTTIYUR WITH SELECTED MODERN TECHNOLOGY ON DBOT BASIS
PERIOD OF SALE OF BIDDING DOCUMENT	:	FROM 26.03.10 TO 27.04.10
TIME AND DATE OF PRE-BID CONFERENCE	:	DATE 06.04.10 TIME 11.00 HOURS
LAST DATE AND TIME FOR RECEIPT OF BIDS	:	DATE 28.04.10 TIME 15.00 HOURS
TIME AND DATE OF OPENING OF BIDS	:	DATE 28.04.10 TIME 15.15 HOURS
PLACE OF OPENING OF BIDS	:	OFFICE OF THE SUPERINTENDING ENGINEER (CONTRACTS & MONITORING) CMWSS BOARD No.1, PUMPING STATION ROAD, CHINTADRIPET, CHENNAI-600 002.
OFFICER INVITING BIDS	:	SUPERINTENDING ENGINEER(C&M)
PLACE OF SALE OF TENDER DOCUMENTS	:	THE INFORMATION FACILITION OFFICER CMWSSB, CHENNAI-02

INVITATION FOR BIDS

(IFB)

GOVERNMENT OF TAMIL NADU
TAMIL NADU URBAN DEVELOPMENT PROJECT - III
CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD

INVITATION FOR BIDS (IFB)

NATIONAL COMPETITIVE BIDDING

CONTRACT NO: CNT/SEW/NCB/TNUDP/ 33 /2009-10

1. The Government of India has received a loan from the International Bank for Reconstruction and Development (IBRD) towards cost of Third Tamil Nadu Urban Development Project and intends to apply a part of the funds to cover eligible payments under contracts for construction of works as detailed below. Bidding is open to all bidders from eligible source countries as defined in the IBRD guidelines for procurement. Bidders from India should, however, be registered with the Government of Tamil Nadu or other state Governments / Government of India, or State / Central Government Undertakings. **Bidders are advised to note the minimum qualification criteria specified in Clause 4 of the instructions to Bidders to quality for the award of the contract.**

2. The Managing Director, Chennai Metropolitan Water Supply and Sewerage Board, invites bids for the construction of works detailed in the table.

3. Bidding documents (and additional copies) may be purchased from the office of **The Information Facilition Officer**, CMWSS BOARD, NO.1 PUMPING STATION ROAD, CHINTADRIPET, CHENNAI -02**, from 26.03.10 to 27.04.10**, for a non-refundable fee (three sets) as indicated, in the form of cash or Demand Draft on any Scheduled bank payable at CHENNAI **in favour of The** CMWSSB. Interested bidders may obtain further information at the same address. Bidding documents requested by mail will be despatched by registered/speed post on payment of an extra amount of **Rs.1000/- The** CMWSSB will not be held responsible for the postal delay if any, in the delivery of the documents or non-receipt of the same.

4. The Bid document can also be freely downloaded from the websites: www.chennaimetrowater.tn.nic.in and www.tenders.tn.gov.in and used at free of cost. The bidders who have downloaded the bid documents, shall be solely responsible for checking the web site for any addendum / amendment issued subsequently to the bid document and take into consideration the same while preparing and submitting the bids.

5. Bids must be accompanied by bid security of the amount specified for the work in the table below, drawn in favour of THE **CMWSS BOARD, CHENNAI**. Bid security will have to be in any one of the forms as specified in the bidding documents and shall have to be valid for **45 days** beyond the validity of the bid.

6. Bids must be delivered to **THE SUPERINTENDING ENGINEER (Contracts and Monitoring)**, on or before 15.00 hrs. On 28.04.10 and will be opened on the same day at 15:15 hrs. In the presence of the bidders who wish to attend. If the Office happens to be closed on the date of receipt of bids as specified, the bids received will be opened on the next working day at the same time and venue.

7. A pre-bid meeting will be held on 06.04.10 at 11.00 hrs. At the Head Office of CMWSSB in the **office of Superintending Engineer (C&M)**, to clarify the issues and to answer questions on any matter that may be raised at that stage as stated in Clause 9.2 of 'Instructions to Bidders' of the bidding document. Non attendance at the pre-bid conference will not be the cause of disqualification of the bidders.

8. Other details can be seen in the bidding documents.

Package No.	Name of work	Approximate value of work (Rs.)	Bid security (Rs.)	Cost of document (Rs.)	Period of completion
STP Package VI	Designing, providing, constructing, erection and commissioning, startup and performance trial run for 6 months followed by 5 years of O&M of 31 MLD capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technology on DBOT Basis CNT/SEW/NCB/ TNUDP/033/2009-10	29,27,40,000/-	29,30,000/-	Rs.5000+200 (VAT) (for one set containing three copies)	90 months (1.Construction and Commissioning 24 months. 2. Performance trial run 6 months. 3.Subsequent O&M.-60 months)

9. **Address :-** (for information, Delivery & Opening of Bids)

The Superintending Engineer
(Contracts & Monitoring)
CMWSS Board
No. 1, Pumping Station Road
Chintadripet
Chennai - 600 002

Telephone No. : 044-28451300
FAX : 044-28458181
E-mail : cwssb@md2.vsnl.net.in
Website : www.chennaimetrowater.tn.nic.in
Govt. Tenders portal : www.tenders.tn.gov.in

10. **Address :- (** for purchase of Bid Document)

The Information Facilitation Officer
CMWSS Board
No. 1, Pumping Station Road
Chintadripet
Chennai - 600 002

Telephone No. : 044-28451300
Ext. 227

SUPERINTENDING ENGINEER
CONTRACTS & MONITORING

SECTION 1: INSTRUCTIONS TO BIDDERS (ITB)

Section 1: Instructions to Bidders

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A. General

1. Scope of Bid

1.1 The Managing Director, Chennai Metropolitan Water Supply and Sewerage Board (referred to as Employer in these documents) invites bids for the construction of works (as defined in these documents and referred to as "the works") detailed in the table given in IFB.

1.2 The successful bidder will be expected to complete the works by the intended completion date specified in the Contract data.

2. Source of Funds

2.1 The Government of India has received a loan from the International Bank for Reconstruction and Development (hereinafter called “the Bank”) towards the cost of Third Tamil Nadu Urban Development Project (TNUDP III) and intends to apply a part of the funds to cover eligible payments under the contract for the Works. Payments by the Bank will be made only at the request of the borrower and upon approval of the Bank in accordance with the *Loan Agreement,* and will be subject in all respects to the terms and conditions of that Agreement. Except as the Bank may specifically otherwise agree, no party other than the borrower shall derive any rights from the *Loan Agreement* or have any rights to the loan proceeds.

2.2 The loan agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, to the knowledge of the Bank, is prohibited by a decision of the United Nations Security Council, taken under Chapter VII of the Charter of the United Nations.

3. Eligible Bidders

3.1 This *Invitation for Bids* is open to all bidders from the eligible countries as defined under the *IBRD Guidelines for Procurement.* Any materials, equipment, and services to be used in the performance of the Contract shall have their origin in the eligible source countries.

3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is not associated, nor has been associated in the past, directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Borrower to provide consulting services for the preparation or supervision of the works, and any of its affiliates shall not be eligible to bid.

3.3 Government-owned enterprises in the Employer’s country may only participate if they are legally and financially autonomous, operate under commercial law and are not a dependent agency of the Borrower or Sub-borrower.

3.4 Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Bank in accordance with sub-clause 37.1.

4. Qualification of the Bidder

4.1 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.

4.2 Deleted

4.3 All bidders shall include the following information and documents with their bids in Section 2:

(a) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the Bid to commit the Bidder;

(b) Total monetary value of construction work performed for each of the last five years;

(c) Experience in works of a similar nature and size for each of the last five years, and details of works under way or contractually committed; and clients who may be contacted for further information on those contracts;

(d) Major items of construction equipment proposed to carry out the Contract;

(e) Qualifications and experience of key site management and technical personnel proposed for the Contract;

(f) Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five years;

(g) Evidence of adequacy of working capital for this contract (access to line (s) of credit and availability of other financial resources);

(h) Authority to seek references from the Bidder's bankers;

(i) Information regarding any litigation or arbitration resulting from contracts executed by the Bidder in the last five years or currently under execution. The information shall include the names of the parties concerned, the disputed amount, cause of litigation, and matter in dispute;

(j) Proposals for subcontracting components of the Works which in aggregate add to more than 20 percent of the Bid Price (*for each, the qualifications and experience of the identified sub-contractor in the relevant field should be annexed. No vertical splitting of the work for sub-contracting is acceptable*); and

(k) The proposed methodology and program of construction including Environmental Management Plan backed with equipment, materials and manpower planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the

stipulated period of completion as per milestones. Bidders may use the draft EMP covering minimum mitigation measures furnished in the Vol.II of Technical Specification for guidance.

(l) Certificate from the engineer-in-charge duly attested by the Notary Public to be furnished.

4.4 Bids from Joint ventures are not acceptable.

4.5 **A. To qualify for award of the contract, each bidder in its name should have in the last five years** *i.e., 2005-06, 2006-07, 2007 – 2008, 2008-09 and 2009-2010*

(a) Achieved, in at least two financial years, a minimum annual financial turnover (in all classes of civil engineering construction works only) of Rs. **1200 Lakh** @

(b) Satisfactorily completed as a prime contractor (or as sub contractor duly certified by the employer or main contractor supported by authorization from the employer for sub-contracting duly authorized by the main contractor for sub contracting) at least **one similar work** such as sewerage collection system, sewage pumping stations, Sewage Treatment Plants / Effluent Treatment Plant of value not less than Rs. **1200 Lakh** @

(c) The contractor or his identified sub-contractor should have executed, the following minimum quantities of work:

1. Should have designed, constructed and commissioned a Sewage Treatment Plant/ Effluent Treatment Plant with any technology of capacity not less than **6 MLD**

As an alternative to (c) (1) above, the bidder should meet one of the following three criteria with other two having fully met by the identified sub-contractors whose name and qualification details should be furnished for verification:

(i) Designed a Sewage Treatment Plant / Effluent Treatment Plant of any Technology of capacity not less than **6 MLD.**

(ii) Constructed and commissioned one sewage treatment plant / Effluent Treatment Plant with any technology of capacity not less than 6.00 MLD

(iii) Executed sewerage collection system with sewers of any pipe material of size 150 mm dia. and above for 10 km length (or) sewage pumping station of capacity **6 MLD.**

Note: In both the above cases under (c), if the contractor or his identified sub-contractor has experience in designing and construction of STP only in Waste Stabilization Pond (WSP) technology, or any other technology not opted for by the Employer under this contract, then the contractor has to provide an experienced designer with demonstrated and successful track record in the process technology being proposed by the bidders for this package.

(@) *at 2009-2010 price level. Financial turnover and cost of completed works of previous years shall be given weight age of 5% per year based on rupee value to bring them to 2009- 2010 price level.*

**The bidder has to furnish the qualification details of identified sub contractors along with the bid and ensure that the identified sub contractors are not changed during the execution of work.*

4.5B.Each bidder should further demonstrate and confirm availability:

(a) Availability (either owned or leased or by procurement against mobilization advances) of the following key and critical equipment for this work: **Civil**

Concrete mixture with hopper	10 no	7/10 Cu.ft. capacity each
Needle vibrators	20 no.	20-50 mm needle each
Earth mover (J.C.B.)	2 no	0.5 Cu. m. each
Trucks/tippers/dumpers	5 no	6 - 10 Tonnes, each
Dewatering pumps (Total)	100 HP	Various capacity
Rigs for pile foundation	5 no	
Mechanical		
Chain Pulley Block	5 no	5 T capacity
Tools and plants for jointing pipes	5 no	
Pipe cutting machinery	3no	
Hydraulic Mobile crane (boom ht. 6 m) min	3 no	10 T capacity
Welding transformers for structural steel work welding	5 no	
Mobile DG set	4 no	63 KVA
Drilling Machine	3 no	upto 16mm drill size
Electrical		
Earth tester	1 no	500 V
Megger	1 no	500 V
Soil resistivity measurement kit	1 no	four peg method
Multimeter	1 no	0-500VAC,0-100A-AC, 0-20A DC, 0-2000 A DC,

NOTE: Based on the studies, carried out by the Engineer the minimum suggested major equipment to attain the completion of works in accordance with the prescribed construction schedule are shown in the above list.

The bidders should, however, undertake their own studies and furnish with their bid, a detailed construction planning and methodology supported with layout and necessary drawings and calculations (detailed) as stated in clause 4.3 (k) above to allow the employer to review their proposals. The numbers, types and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.

(b) availability for this work of a Project Manager with minimum of 10 years in the project of the size similar to the present work and other personnel with adequate experience as required.

(i) Project Manager - B.E. with Chemical/ Environmental/ Civil Engg – 1 No.

(ii) Senior Engineer - B.E. with Mechanical/ Electrical Engg. – 1 No.

(c) Liquid assets and/or availability of credit facilities of no less than Rs. **350 Lakhs** in the format given in Section 2.

(Credit lines/letter of credit/certificates from Banks in the specified format for meeting the funds requirement etc.) -

4.5 C Deleted.

4.6 Sub-contractors' experience and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria except to the extent stated in 4.5 (A) above.

4.7 Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity = (A*N*1.5 - B)

Where

A = Maximum value of civil engineering works executed in any one year during the last five years (updated to 2009-2010 price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited. **2** years.

B = Value, at 2009-2010 price level, of existing commitments and on-going works to be completed during the next **2** years

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.

4.8 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and anywhere else in their bids and/or

- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc. for which the bidders will disclose such instances of poor performance during last 5 years ; and/or

- participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the employer.

5. One Bid per Bidder

5.1 Each bidder shall submit only one bid for one contract. A bidder who submits or participates in more than one Bid (other than as a subcontractor who will not submit its bid as bidder or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

6. Cost of Bidding

6.1 The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

7. Site visit

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

B. Bidding Documents

8. Content of Bidding Documents

8.1 The set of bidding documents comprises the documents listed in the table below and addenda issued in accordance with Clause 10:

Invitation for Bids
Section 1 Instruction to Bidders
Section 2 Forms of Bid and Qualification Information
Section 3 Conditions of Contract
Section 4 Contract Data
Section 5 Specifications
Section 6 Drawings
Section 7 Activity Schedule
Section 8 Forms of Securities

8.2 Of the three sets of the bidding documents supplied, two sets should be completed and returned with the bid.

9. Clarification of Bidding Documents

9.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex and facsimile) at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification, which he received earlier than 15 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.

9.2 Pre-bid meeting

9.2.1 The bidder or his official representative is invited to attend a pre-bid meeting which will take place at Office of **The Superintending Engineer (Contracts and Monitoring)**, at 11.00 hours on 06.04.10.

9.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

9.2.3 The bidder is requested to submit any questions in writing or by cable to reach the Employer not later than one week before the meeting.

9.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in Sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.

9.2.5 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

10. Amendment of Bidding Documents

10.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.

10.2 Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing to all the purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Employer.

10.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

C. Preparation of Bids

11. Language of the Bid

11.1 All documents relating to the bid shall be in the English language.

12. Documents comprising the Bid

12.1 The bid submitted by the bidder shall comprise the following:

(a) The Bid (in the format indicated in Section 2).
(b) Bid Security;
(c) Priced Activity Schedule;
(d) Qualification Information Form and Documents;

and any other materials required to be completed and submitted by bidders in accordance with these instructions. The documents listed under Sections 2, 4 and 7 of Sub-Clause 8.1 shall be filled in without exception.

12.2 Deleted

13. Bid Prices

13.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced **Activity Schedule** submitted by the Bidder.

13.2 The bidder shall fill in rates and prices and line item total (both in figures and words) for all items of the Works described in technical specification **listed in the Activity Schedule** along with total bid price (both in figures and words). *Items for which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Activity Schedule.* Corrections, if any, shall be made by crossing out, initialing, dating and rewriting. The bidder shall fill in the rates and prices for both fixed and variable cost for each year for the Operation and Maintenance.

13.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause shall be included in the total Bid Price submitted by the Bidder.

Note: *"Bidders may like to ascertain availability of excise/custom duty exemption benefits available in India to the contracts financed under World Bank loan/credits. They are solely responsible for obtaining such benefits which they have considered in their bid and in case of failure to receive such benefits for reasons whatsoever, the employer will not compensate the bidder (contractor). Where the bidder has quoted taking into account such benefits, he must give all information required for issue of certificates in terms of such notifications as per form attached to the Qualification Information in the bid. To the extent the employer determines the quantity indicated therein are reasonable keeping in view the bill of quantities, construction programme and methodology, the certificates will be issued within 60 [sixty] days of signing of contract and no subsequent changes will be permitted. No certificate will be issued for items where no quantity/capacity of equipment is indicated in the statement. The bids which do not conform to the above provisions will be treated as non responsive and rejected. Any delay in procurement of the construction equipment /machinery/goods as a result of the above shall not be a cause for granting any extension of time."*

13.4 The **lump sum price** quoted by the bidder is subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 47 of the Conditions of Contract.

14. Currencies of Bid and Payment

14.1 The **lump sum price** shall be quoted by the bidder entirely in Indian Rupees.

15. Bid Validity

15.1 Bids shall remain valid for a period not less than ninety days after the deadline date for bid submission specified in Clause 20. A bid valid for a shorter period shall be rejected by the employer as non-responsive.

15.2 In exceptional circumstances, prior to expiry of the original time limit, the employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his bid security for a period of the extension, and in compliance with Clause 16 in all respects.

15.3 Deleted

15.4 Deleted

16. Bid Security

16.1 The Bidder shall furnish, as part of his Bid, a Bid security in the amount as shown in column 4 of the table of IFB for this particular work. This bid security shall be in favour of THE MANAGING DIRECTOR, CMWSSB, CHENNAI and may be in one of the following forms:

- a bank guarantee issued by a nationalized / scheduled bank located in India or a reputable bank located abroad in the form given in Section 8; or

- Certified cheque, Bank draft or Letter of Credit in favour of THE MANAGING DIECTOR, CMWSSB payable at CHENNAI

16.2 Bank guarantees issued as surety for the bid shall be valid for 45 days beyond the validity of the bid.

16.3 Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16.1 and 16.2 above shall be rejected by the Employer as non-responsive.

16.4 The Bid Security of unsuccessful bidders will be returned within 28 days of the end of the bid validity period specified in Sub-Clause 15.1.

16.5 The Bid Security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security.

16.6 The Bid Security may be forfeited

(a) if the Bidder withdraws the Bid after Bid opening during the period of Bid validity;

(b) if the Bidder does not accept the correction of the Bid Price, pursuant to Clause 27; or

(c) in the case of a successful Bidder, if the Bidder fails within the specified time limit to

(i) sign the Agreement; or

(ii) furnish the required Performance Security.

17. Alternative Proposals by Bidders

17.1 Deleted.

18. Format and Signing of Bid

18.1 The Bidder shall prepare one original and one copy of the documents comprising the bid as described in Clause 12 of these *Instructions to Bidders*, bound with the volume containing the Form of Bid, and clearly marked "**ORIGINAL**" and "**COPY"** as appropriate. In the event of discrepancy between them, the original shall prevail.

18.2 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder, pursuant to Sub-Clauses 4.3. All pages of the bid where entries or amendments have been made shall be initialled by the person or persons signing the bid.

18.3 The Bid shall contain no alterations or additions, except those to comply with instructions issued by the employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or persons signing the bid.

18.4 The Bidder shall furnish information as described in the Form of Bid on commissions or gratuities, if any, paid or to be paid to agents relating to this Bid, and to contract execution if the Bidder is awarded the contract.

D. Submission of Bids

19. Sealing and Marking of Bids

19.1 The Bidder shall seal the original and copy of the Bid in separate envelopes, duly marking the envelopes as "**ORIGINAL**" and "**COPY**". These envelopes (called as inner envelopes) shall then be put inside one outer envelope.

19.2 The **inner and outer** envelopes shall

(a) be addressed to the at the following address:

- **The Superintending Engineer (C & M)**
CMWSSB, No.1, Pumping Station Road,
Chintadripet, Chennai -600 002

and

(b) bear the following identification:

- Bid for Designing, providing, constructing, erection and commissioning, startup and performance run followed by 5 years of O&M of **31 MLD** capacity sewage treatment plant (STP) at **THIRUVOTTIYUR** with selected modern technology on DBOT Basis.

- Bid Reference No: **CNT/ SEW / NCB / TNUDP / / 2010**

- DO NOT OPEN BEFORE 15.15 hours on 28.04.10

19.3 In addition to the identification required in Sub-Clause 19.2, the inner envelopes shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared late, pursuant to Clause 21.

19.4 If the outer envelope is not sealed and marked as above, the employer will assume no responsibility for the misplacement or premature opening of the bid.

20. Deadline for Submission of the Bids

20.1 Bids must be received by the employer at the address specified above no later than 15:00 hours **28.04.10.** In the event of the specified date for the submission of bids declared a holiday for the employer, the Bids will be received up to the appointed time on the next working day.

20.2 The employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

21. Late Bids

21.1 Any Bid received by the employer after the deadline prescribed in Clause 20 will be returned unopened to the bidder.

22. Modification and Withdrawal of Bids

22.1 Bidders may modify or withdraw their bids by giving notice in writing before the deadline prescribed in Clause 20.

22.2 Each Bidder's modification or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with Clause 18 & 19, with the outer and inner envelopes additionally marked "**MODIFICATION**" or "**WITHDRAWAL**", as appropriate.

22.3 No bid may be modified after the deadline for submission of Bids.

22.4 Withdrawal or modification of a Bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in Clause 15.1 above or as extended pursuant to Clause 15.2 may result in the forfeiture of the Bid security pursuant to Clause 16.

22.5 Bidders may offer discounts to, or modify the prices of their Bids only by submitting Bid modifications in accordance with this clause, or included in the original Bid submission.

E. Bid Opening and Evaluation

23. Bid Opening

23.1 The employer will open all the Bids received (except those received late), including modifications made pursuant to Clause 22, in the presence of the Bidders or their representatives who choose to attend at 15.15 hours on the date and the place specified in Clause 20. In the event of the specified date of Bid opening being declared a holiday for the employer, the Bids will be opened at the appointed time and location on the next working day.

23.2 Envelopes marked "**WITHDRAWAL**" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 22 shall not be opened. Subsequently all envelopes marked “Modification” shall be opened and the submissions therein read out in appropriate detail.

23.3 The Bidders' names, the Bid prices, the total amount of each Bid and of any alternative Bid (if alternatives have been requested or permitted), any discounts, Bid modifications and withdrawals, the presence or absence of Bid security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No bid shall be rejected at bid opening except for the late bids pursuant to Clause 21. Bids [and modifications] sent pursuant to Clause 22 that are not opened and read out at bid opening will not be considered for further evaluation regardless of the circumstances. Late and withdrawn bids will be returned un-opened to bidders.

23.4 The employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 23.3.

24. Process to be Confidential

24.1 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 effort by a Bidder to influence the employer's processing of Bids or award decisions may result in the rejection of his Bid.

25. Clarification of Bids

25.1 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 breakdowns of the prices in the activity schedule as per the Table furnished in Clause 29.6.3. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the employer in the evaluation of the Bids in accordance with Clause 27.

25.2 Subject to sub-clause 25.1, no Bidder shall contact the employer on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the employer, it should do so in writing.

25.3 Any effort by the Bidder to influence the employer in the employer's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidders' bid.

26. Examination of Bids and Determination of Responsiveness

26.1 Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents.

26.2 A substantially responsive 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 employer's 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.

26.3 If a Bid is not substantially responsive, it will be rejected by the employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

27. Correction of Errors

27.1 Bids determined to be substantially responsive will be checked by the employer for any arithmetic errors. Errors will be corrected by the employer as follows**:**

- **Where there is a discrepancy between the amounts in figures and words, the amount in words will govern**.

27.2 The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected, and the Bid security may be forfeited in accordance with Sub-Clause 16.6 (b).

28. Deleted

29. Evaluation and Comparison of Bids

29.1 The employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause 26.

29.2 In evaluating the Bids, the employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors pursuant to Clause 27; or

(b) making an appropriate adjustments for any other acceptable variations, deviations; and

(c) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Clause 22.5.

(d) Other factors considered in evaluation include the optimal land usage.

The evaluation shall be made based on the area occupied by the plant which includes the area occupied by the civil structures, service roads inside the plant, area for green belt.

29.3 The employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the employer shall not be taken into account in Bid evaluation.

29.4 The estimated effect of the price adjustment conditions under Clause 47 of the *Conditions of Contract*, during the period of implementation of the Contract, will not be taken into account in Bid evaluation.

29.5 Deleted.

29.6.1 On the basis of life cycle cost of the plant by adding the capitalized cost of the O&M for 5 years which includes cost of power at the rate of Rs.3.50 per kwh and cost of chemicals as furnished by the bidder and discounted to net present value at 10% for the Five years period.

30. Deleted

F. Award of Contract

31. Award Criteria

31.1 Subject to Clause 32, the employer will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price, provided that such Bidder has been determined to be (a) eligible in accordance with the provisions of Clause 3, and (b) qualified in accordance with the provisions of Clause 4. **For comparison, the bid price will be calculated as given in Clause 29.**

31.2 Deleted

32. Employer's Right to accept any Bid and to -reject any or all Bids

32.1 Notwithstanding Clause 31, the employer reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

33.1 The Bidder whose Bid has been accepted will be notified of the award by the employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the *Conditions of Contract* called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

33.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 34.

33.3 The Agreement will incorporate all agreements between the employer and the successful Bidder. It will be signed by the employer and kept ready for signature of the successful bidder in the office of employer within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the employer.

33.4 Upon the furnishing by the successful Bidder of the Performance Security, the employer will promptly notify the other Bidders that their Bids have been unsuccessful.

34. Performance Security

34.1 Within 21 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the employer a Performance Security in any of the forms given below for an amount equivalent to 5% of the Contract price

- a bank guarantee in the form given in Section 8; or

- Certified cheque/Bank draft, in favour of THE CMWSSB, payable at CHENNAI

34.2 If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued either (a) at the Bidder's option, by a Nationalized/Scheduled Indian bank or (b) by a foreign bank located in India and acceptable to the Employer or (c) by a foreign bank through a correspondent Bank in India [scheduled or nationalized].

34.3 Failure of the successful bidder to comply with the requirements of sub-clause 34.1 shall constitute a breach of contract, cause for annulment of the award, forfeiture of the bid security and any such other remedy the Employer may take under the contract, and the Employer may resort to awarding the contract to the next ranked bidder.

35 Advance Payment and Security

35.1 The employer will provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to maximum amount, as stated in the Contract Data.

36. Adjudicator

36.1 The employer proposes that Thiru. **V.Rajagopal** shall be appointed as Adjudicator under the Contract, at a daily fee of Rs. 5,000/- plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in the Bid. If in the Letter of Acceptance, the employer has not agreed on the appointment of the Adjudicator, the Adjudicator shall be appointed by the President, Institution of Engineers, Tamil Nadu Chapter, at the request of either party.

37. Fraud and Corruption

37.1 It is the Bank's policy to require that Borrowers (including beneficiaries of Bank loans), as well as bidders, suppliers, and contractors and their sub contractors under Bank-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Bank:

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

(i) "Corrupt practice"[...2] is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party.

(ii) "fraudulent practice"[...3] is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "Collusive practice "[4] is an arrangements between two or more parties designed to achieve an improper purpose, including to influence improperly the action of another party;

(iv) "coercive practice"[5] is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the action of party;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigation in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under sub-clause 37-1 (e) below.

(b) will reject a proposal for award if it determines that the bidder recommended for award has, directly, or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question,

---

[1] In this contract, any action taken by a bidder, supplier, contractor, or a sub-contractor to influence the procurement process or contract execution for undue advantage is improper

[2] "another party" refers to a public official acting on relation to the procurement process or contract execution) In this context, "public official "– includes World Bank Staff and employees of other organizations taking or reviewing procurement decisions.

[3] "a party" refers to a public official the terms "benefit" and "obligation" relate to the procurement process or contract execution and the "act or omission" is intended to influence the procurement process or contract execution.

[4] "parties" refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial non competitive levels.

[5] a "party" refers to a participant in the procurement process or contract execution.

(c) will cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of the loan engaged in corrupt, fraudulent, collusive, or coercive practices during the procurement or the execution of

that contract, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur.

(d) will sanction a firm or individual, including declaring ineligible, either indefinitely or for a stated period of time, to be awarded a Bank-financed contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, a Bank-financed contract, and

(e) will have the right to require that a provision be included in bidding documents and in contracts financed by a Bank loan, requiring bidders, suppliers, and contractors and their sub-contractors to permit the Bank to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by the Bank.

37.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 23.2 and 59.2 (h) of the Conditions of Contract.

SECTION 2: FORMS OF BID, QUALIFICATION INFORMATION AND LETTER OF ACCEPTANCE

Table of Forms:

- **CONTRACTOR'S BID**
- **QUALIFICATION INFORMATION**
- **LETTER OF ACCEPTANCE**
- **NOTICE TO PROCEED WITH THE WORK**
- **AGREEMENT FORM**

Contractor's Bid

Description of the Works: Designing, providing, constructing, erection and commissioning, startup and performance run for 6 months followed by 5 years of O&M of 31 MLD capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technology on DBOT Basis.

BID No. : CNT/SEW/NCB/TNUDP/ /2010

To : The Superintending Engineer (C & M), CMWSSB

Address : No.1, Pumping Station Road,
Chintadripet, Chennai.-600 002

GENTLEMEN,

Having examined the bidding documents including addendum, we offer to execute the Works described above in accordance with the Conditions of Contract, Specifications, Drawings and Activity Schedule accompanying this Bid for the Contract Price of _____ *[in figures]* (_____) *[in letters]*.[1]

The advance Payment required is: Rupees _____.

We accept the appointment of **Thiru. V.Rajagopal** as the Adjudicator.

(OR)

We do not accept the appointment of **Thiru. V.Rajagopal** as the Adjudicator and propose instead that _____ be appointed as Adjudicator whose daily fees and biographical data are attached.

This Bid and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

We also undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

---

1. To be filled in by the Bidder, together with his particulars and date of submission at the bottom of the Form of Bid.

Name and address of agent	Amount	Purpose of Commission or gratuity

_____

(if none, state “none”)

We hereby confirm that this Bid complies with the Eligibility, Bid Validity and Bid Security required by the Bidding documents.

Yours faithfully,
Authorized Signature:

Name & Title of Signatory:
_____

Name of Bidder : _
_____

Address :
_____

Qualification Information

The information to be filled in by the Bidder in the following pages will be used for purposes of post qualification as provided for in Clause 4 of the Instructions to Bidders. This information will not be incorporated in the Contract.

1. **For Individual Bidders**

1.1 Constitution or legal status of Bidder
[Attach copy]

Place of registration:
_____

Principal place of business:
_____

Power of attorney of signatory of Bid
[Attach]

1.2 Total value of Civil Engineering construction
Work executed and payments received in the last five years**
(In Rs. Million)

2005- 2006_____β
2006- 2007_____
2007- 2008_____
2008- 2009_____
2009- 2010_____

1.3.1 Work performed as prime contractor (in the same name) on works of a similar nature (STP, ETP, Sewerage Collection System, Sewage Pumping Stations only) over the last five years. **

Project Name	Name of the Employer*	Description of work	Contract No.	Value of contract (Rs. Million)	Date of issue of work order	Stipulated period of completion	Actual date of completion*	Remarks explaining reasons for delay and work completed

** (List all STP / ETP designed / constructed by the firm in the last 5 years with details.)

1.3.2 Quantities of work executed as prime contractor (in the same name and style) in the last five years: i.e., 2004-05 to 2008-09

Year	Name of the Work	Name of the Employer *	Quantity of work performed		Remarks * (indicate contract Ref)
			STP/ETP Capacity		
			Design	Construction	
2005-2006					
2006-2007					
2007-2008					
2008-2009					
2009-2010					

*****_Attach certificate(s) from the Engineer(s)-in-Charge_
β _Attach certificate from Chartered Accountant._

1.3 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

A. Existing commitments and on-going works:

Description of work	Place & State	Contract No. & date	Name and address of Employer	Value of Contract Rs. In Million	Stipulated Period of completion	Value of Remaining work to be completed	Anticipated date of completion
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

B. Works for which bids already submitted:

Description of work	Place and State	Name and address of Employer	Estimated value of work	Stipulated period of completion	Date when decision is expected	Remarks if any
(1)	(2)	(3)	(4)	(5)	(6)	(7)

***** _Attach certificate(s) from the Engineer(s)-in-Charge_.

1.5 The following items of Contractor's Equipment are essential for carrying out the Works. The Bidder should list all the information requested below. Refer also to Sub Clause 4.3 (d) of the Instructions to Bidders.

Item of equipment	**Requirement**		**Availability Proposals**			**Remarks regarding condition and from whom to be purchased/ or leased**
			Owned / leased/ to be procured	**Nos. / Capacity**	**Age/ Condition**	
CIVIL	no	Capacity				
Concrete mixture with hopper	10 no	7/10Cu.ft. capacity each				
Needle vibrators	20 no	20-50mm needle each				
Earth mover (J.C.B.)	2 no	0.5 Cu. m. each				

Item of equipment	Requirement		Availability Proposals			Remarks regarding condition and from whom to be purchased/ or leased
			Owned / leased/ to be procured	Nos. / Capacity	Age/ Condition	
Trucks/tippers/ Dumpers	5 no	6-10Tonnes, each				
Dewatering pumps (Total)	100 HP	Various capacity				
Rigs for pile foundations	5 no					
MECHANICAL						
Chain Pulley Block	5 no	5T capacity				
Tools and plants for jointing pipes	5 no					
Pipe cutting machinery	3 no					
Hydraulic mobile crane	1 no	10 M.T (boom ht. 6 m min)	.			
Welding transformers for structural steel work welding	2 no					
Mobile DG set	4 no	63 KVA				
Drilling Machine	3 no	upto 16mm drill size				
ELECTRICAL						
Earth tester	1 no	500 V				
Megger	2 no	500 V and 1000V				
Soil resistivity measurement kit	1 no	four peg method				
Multimeter	1 no	0-500VAC, 0-100A- AC, 0-20A DC, 0-200 A DC,				
Clip on type ammeter	1 no	0-500 A				
Set of crimping tool for all sizes of cables(copper and aluminium)	2 set					
Tester	1 no	2 KV HV				
Tong tester	1 no	0-500 A				

1.6 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data. Refer also to Sub Clause 4.3 (e) and 4.5 (B) (b) of instructions to Bidders and Sub Clause 9.1 of the Conditions of Contract.

Position	Name	Qualifications	Years of experience (general)	Years of experience in the proposed position
Project Manager				
Senior Engineer				

1.7 Proposed subcontracts and firms involved. [Refer ITB Clause 4.3 (j)]

Sections of the works	Value of Sub-contract	Sub-contractor (name and address)	Experience in similar work

1.8 Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports (in case of companies/corporation), etc. List them below and attach copies.

1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents *[sample format attached]*.

1.10. Name, address, and telephone, telex, and fax numbers of the Bidders' bankers who may provide references if contacted by the Employer.

1.11 Information on litigation history in which the Bidder is involved.

Other party (ies)	Employer	Cause of dispute	Amount involved	Remarks showing present status

1.12 Statement of compliance under the requirements of Sub Clause 3.2 of the instructions to Bidders.

1.13 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. [Refer ITB Clause 4.1 and 4.3 (k)].

2. Joint Ventures – Deleted

3. Additional Requirements

3.1 Bidders should provide any additional information required to fulfill the requirements of Clause 4 of the Instructions to the Bidders, if applicable.

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES *– CLAUSE 4.5 [B] [c] OF ITB

BANK CERTIFICATE

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

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

__ Sd. __

Name of Bank
Senior Bank Manager
Address of the Bank

(No other certificate for credit facility will be accepted.)

(Name of the Project)

(Declaration regarding customs/excise duty exemption for materials/
Construction equipment bought for the work)

From ……. To: ……

(Bidder's Name and Address) (Name of the Employer)

Dear Sir:

Re: *[Name of Work]* …… -

Certificate for Import/Procurement of Goods/Construction Equipment

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

2. We are furnishing below the information required by the employer for issue of the necessary certificates in terms of the Government of India Central Excise Notification No. 108/95 and Customs Notification No. 85/99.

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

Items	Make/ Brand Name	Capacity [where applicable]	Quantity	Value	State whether it will be procured locally or imported [if so from which country]	Remarks regarding justification for the quantity and their usage in works
Materials						
[a] Cement						
b] Steel						
c] Others (Please Specify)						
Construction Equipment						

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

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

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

Date: _____ (Signature)

Place: _____ (Printed Name)

(Designation) _____

(Common Seal) _____

This certificate will be issued within 60 days of signing of contract and no subsequent change will be permitted.

Letter of Acceptance

(Letter head paper of the Employer)

_____[date]

To: _____

_____ [name and address of the Contractor]

Dear Sirs,

This is to notify you that your Bid dated _____ for execution of the _____

_____ [name of the contract and identification number, as given in the Instructions to Bidders] for the Contract Price of Rupees ———————— _____ (_____) [amount in words and figures], as corrected and modified in accordance with the Instructions to Bidders[1] is hereby accepted by our Agency.

We accept/do not accept that _____ be appointed as the Adjudicator[2].

We note that as per bid, you do not intend to subcontract any component of work.

[OR]

We note that as per bid, you propose to employ M/s. ..... as sub-contractor for executing.....

[Delete whichever is not applicable].

You are hereby requested to furnish Performance Security, plus additional security for unbalanced bids in terms of ITB clause 29.5, in the form detailed in Para 34.1 of ITB for an amount of Rs.————— within 21 days of the receipt of this letter of acceptance valid upto 28 days from the date of expiry of Defects Liability Period i.e. upto ..... and sign the contract, failing which action as stated in Para 34.3 of ITB will be taken.

We have reviewed the construction methodology submitted by you along with the bid in response to ITB Clause 4.3[k] and our comments are given in the attachment. You are requested to submit a revised Program including environmental management plan as per Clause 27 of General Conditions of Contract within 14 days of receipt of this letter.

Yours faithfully,

Authorized Signature

Name and Title of Signatory
Name of Agency

1 Delete "corrected and" or "and modified" if only one of these actions applies. Delete "as corrected and modified in accordance with the Instructions to Bidders" if corrections or modifications have not been effected.

2 To be used only if the Contractor disagrees in his Bid with the Adjudicator proposed by the Employer in the "Instructions to Bidders."

Issue of Notice to proceed with the work

(Letter head of the Employer)

———————— (date)

To

———————————————— (name and address of the Contractor)

_____

_____

Dear Sirs:

Pursuant to your furnishing the requisite security as stipulated in ITB clause 34.1 and signing of the contract agreement for the construction of ———————— @ a Bid Price of Rs.———————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

signatory authorized to sign on behalf
of Employer)

Agreement Form

Agreement

This agreement, made the _____ day of _____20_____, between_____ _____[name and address of Employer] (hereinafter called "the Employer)" and _____ _____ _____[name and address of contractor] (hereinafter called "the Contractor" of the other part).

Whereas the Employer is desirous that the Contractor execute _____ _____ _____ _____[name and identification number of Contract] (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at a contract price of Rs.....

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.

2. In consideration of the payments to be made by the employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.

3. The employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

   i) Letter of Acceptance;
   ii) Notice to proceed with the works;

iii) Contractor's Bid;
iv) Contract Data;
v) Conditions of contract (including Special Conditions of Contract);
vi) Specifications;
vii) Drawings;
viii) Activity Schedule; and
ix) Construction methodology
x) Any other document listed in the Contract Data as forming part of the contract.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of

_____

was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said

_____

_____

_____

in the presence of:

Binding Signature of the Employer _____ ___

Binding Signature of Contractor _____

SECTION 3: CONDITIONS OF CONTRACT

Conditions of Contract

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19. Safety		49. Liquidated Damages	
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		F. Special Conditions of Contract (Part I to VI)	

Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

The **Adjudicator** is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in Clauses 24 and 25. The name of the Adjudicator is defined in the Contract Data.

Activity Schedule means the priced and completed Activity Schedule forming part of the Bid.

Compensation Events are those defined in Clause 44 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Engineer in accordance with Sub Clause 55.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.3 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.

The **Contractor's Bid** is the completed Bidding document submitted by the Contractor to the Employer.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; **months** are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.

The Employer is the party who will employ the Contractor to carry out the Works.

The **Engineer** is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the execution of the works and administering the Contract.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

The **Site** is the area defined as such in the Contract Data.

Site Investigation Reports are those which were included in the Bidding documents and are factual interpretative reports about the surface and sub-surface conditions at the site.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Engineer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.

Temporary Works are works designed, constructed, installed, and removed by the Contractor, which are needed for construction or installation of the Works.

A **Variation** is an instruction given by the Engineer, which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about the Conditions of Contract.

2.2 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor's Bid
(4) Contract Data
(5) Conditions of Contract including Special Conditions of Contract
(6) Specifications
(7) Drawings
(8) Activity Schedule
(9) Construction Methodology
(10) Any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

3.1 The language of the Contract and the law governing the Contract are stated in the Contract Data.

4. Engineer's Decisions

4.1 Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. Delegation

5.1 The Engineer may delegate any of his duties and responsibilities to other people except to the Adjudicator after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Subcontracting

7.1 The Contractor may subcontract with the approval of the Engineer but may not assign the Contract without the approval of the employer in writing. Subcontracting does not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors. The Contractor shall as referred to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modification.

9. Personnel

9.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data (9) to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their

qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.

9.2 If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's Risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's Risks

11.1 The Employer is responsible for the excepted risks which are (a) in so far as they directly affect the execution of the Works in the Employer's country, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor's design.

12. Contractor's Risks

12.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Agreement Period including the O&M period, in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor's risks:

(a) loss of or damage to the Works, Plant and Materials;

(b) loss of or damage to Equipment;

(c) loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and

(d) Personal injury or death.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor

should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of insurance shall not be made without the approval of the Engineer.

13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports

14.1 The Contractor, in preparing the Bid, shall rely on any site Investigation Reports referred to in the Contract Data, supplemented by any information available to the Bidder.

15. Queries about the Contract Data

15.1 The Engineer will clarify queries on the Contract Data.

16. Contractor to Construct the Works

16.1 The Contractor shall construct and install the Works in accordance with the Specification and Drawings as approved by the Employer, and as per instructions of Engineer.

16.2 The Contractor shall also operate and maintain the plant in accordance with the specification and as per instructions of the Engineer.

17. The Works to Be Completed by the Intended Completion Date

17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

18. Approval by the Engineer

18.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for design of Temporary Works.

18.3 The Engineer's approval shall not alter the Contractor's responsibility for design of the Temporary Works

18.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works where required.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer before their use.

19. Safety

19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. Possession of the Site

21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

22.1 The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1 The Contractor shall carry out all instructions of the Engineer which comply with the applicable laws where the Site is located.

23.2 The Contractor shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the accounts and records of the Contractor and its sub-contractors relating to the performance of the Contract, and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank. The Contractor’s attention is drawn to Sub-Clause 64 (Corrupt or Fraudulent Practices) which provides, inter alia, that acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under Sub-Clause 23.2 constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility under the Procurement Guidelines)

24. Disputes

24.1 If the Contractor believes that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to the Adjudicator within 14 days of the notification of the Engineer's decision.

25. Procedure for Disputes

25.1 The Adjudicator shall give a decision in writing within 28 days of receipt of a notification of a dispute.

25.2 The Adjudicator shall be paid daily at the rate specified in the Contract Data together with reimbursable expenses of the types specified in the

Contract Data and the cost shall be divided equally between the Employer and the Contractor, whatever decision is reached by the Adjudicator. Either party may refer a decision of the Adjudicator to an Arbitrator within 28 days of the Adjudicator's written decision. If neither party refers the dispute to arbitration within the above 28 days, the Adjudicator's decision will be final and binding.

25.3 The arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract. The Arbitrators shall give a decision in writing within 120- days of start of the proceedings. The Arbitration shall entertain only those issues which have been earlier referred to the Adjudicator and either party is dissatisfied with the decision given by the Adjudicator.

26. Replacement of Adjudicator

26.1 Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not fulfilling his functions in accordance with the provisions of the Contract; a new Adjudicator will be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority designated in the Contract Data at the request of either party, within 14 days of receipt of such request.

B. Time Control

27. Program

27.1 Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a Program including Environmental Management Plan showing the general methods, arrangements, order, and timing for all the activities in the Works along with monthly cash flow forecast.

27.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.

27.3 The Contractor shall submit to the Engineer, for approval, an updated Program at intervals no longer than the period stated in the Contract

Data. If the Contractor does not submit an updated Program within this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

27.4 The Engineer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Engineer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

28. Extension of the Intended Completion Date

28.1 The Engineer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.

28.2 The Engineer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Engineer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

29. Deleted

30. Delays Ordered by the Engineer

30.1 The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.

31. Management Meetings

31.1 Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the progress and the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

31.2 The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

32.1 The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price or delay the execution of works. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate is to be provided by the Contractor as soon as reasonably possible.

32.2 The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

C. Quality Control

33. Identifying Defects

33.1 The Engineer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect

33.2 The contractor shall permit the Employer's Technical auditor to check the Contractor's work and notify the Engineer and Contractor of any defects that are found. Such a check shall not affect the Contractor's or the Engineer's responsibility as defined in the Contract Agreement.

34. Tests

34.1 If the Engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

34.2 All pipes, specials, electrical and mechanical items shall be subjected to Third Party inspection at the cost of Employer. The Contractor shall provide all necessary details such as manufacturer's/supplier's address and location of the manufacturing site well in advance to the Employer for such purpose and should cooperate with the Third party inspection agency for carrying out the required tests

35. Correction of Defects

35.1 The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

35.2 Every time notice of a Defect is given, the Contractor shall correct the notified defect within the length of time specified by the Engineer's notice.

35.3 The Contractor shall correct the defects noticed during the Operation and Maintenance of the Plant within the time specified in the Engineers notice.

36. Uncorrected Defects

36.1 If the Contractor has not corrected a Defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

36.2 If the Contractor has not corrected the defects during the operation and Maintenance of the Plant within the Engineers notice, the Engineer will access the cost of having the defect corrected and the Contractor will pay this amount.

Note: Where in certain cases, the technical specifications provide for acceptance of works within specified tolerance limits at reduced rates, Engineer will certify payments to Contractor accordingly.

D. Cost Control

37. Activity Schedule

37.1 The Contractor shall provide updated Activity Schedules within 14 days of being instructed to by the Executive Engineer. The activities on the Activity Schedule will be coordinated with the activities on the Program.

37.2 The Contractor shall show delivery of Materials to the Site separately on the Activity Schedule if payment for materials on Site shall be made separately.

38. Changes in the Quantities

38.1 The Activity Schedule shall be amended by the Contractor to accommodate changes of program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.

39. Variations

39.1 All Variations shall be included in updated Programs and Activity Schedule produced by the Contractor.

40. Payments for Variations

40.1 The Contractor shall provide the Engineer with a quotation (with breakdown of unit rates) for carrying out the Variation when requested to do so by the Engineer. The Engineer shall assess the quotation, which shall be given within seven days of the request or within any longer period stated by the Engineer and before the Variation is ordered.

40.2 Deleted.

40.3 If the Contractor's quotation is unreasonable (or if the contractor fails to provide the Engineer with the quotation within a reasonable time specified by the Engineer in accordance with Clause 40.1) the Engineer may order the Variation and make a change to the Contract Price which shall be based on Engineer's own forecast of the effects of the Variation on the Contractor's costs.

40.4 If the Engineer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

40.5 The Contractor shall not be entitled to additional payment for costs which could have been avoided by giving early warning.

41. Cash flow forecasts

41.1 When the Program or Activity Schedule is updated, the contractor is to provide the Engineer with an updated cash flow forecast.

42. Payment Certificates

42.1 The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously along with the details of measurement of the quantity of works executed in a tabulated form as approved by the Engineer.

42.2 The Engineer shall check the details given in the Contractor's monthly statement and within 14 days certify the amounts to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 51(4) of the Contract Data (Secured Advance).

42.3 The value of work executed shall be determined by the Engineer after due check measurement of the quantities claimed as executed by the Contractor.

42.4 The value of work executed shall comprise the value of completed activities in the Activity Schedule.

42.5 The value of work executed shall include the valuation of Variations and Compensation Events.

42.6 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

43. Payments

43.1 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer within 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made upto the date when the late payment is made at 8% per annum.

43.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

43.3 Activities for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

44. Compensation Events

44.1 The following are Compensation Events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) The Employer modifies the schedule of other contractors in a way which affects the work of the contractor under the contract.

(c) The Engineer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.

(d) The Engineer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.

(e) The Engineer unreasonably does not approve for a subcontract to be let.

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of Letter of Acceptance from the information issued to Bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

(g) The Engineer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(h) Other contractors, public authorities, utilities or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

(i) The advance payment is delayed.

(j) The effect on the Contractor of any of the Employer's Risks.

(k) The Engineer unreasonably delays issuing a Certificate of Completion.

(l) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

44.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Engineer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

44.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Engineer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Engineer shall adjust the Contract Price based on Engineer's own forecast. The Engineer will assume that the Contractor will react competently and promptly to the event.

44.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer.

45. Tax

45.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

46. Currencies

46.1 All payments shall be made in Indian Rupees.

47. Price Adjustment

47.1 Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with the following principles and procedures and as per formula given in the contract data:

(a) The price adjustment shall apply for the work done from the start date given in the contract data upto end of the initial intended completion date or extensions granted by the Engineer and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the contractor.

(b) The price adjustment shall be determined during each quarter from the formula given in the contract data.

(c) Following expressions and meanings are assigned to the work done during each quarter:

R = Total value of work done during the quarter. It would include the amount of secured advance for materials paid for (if any) during the quarter, less the amount of the secured advance recovered, during the quarter. It will exclude value for works executed under variations for which price adjustment will be worked separately based on the terms mutually agreed.

47.2 To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clauses in the contract, the rates and

prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.

47.3 Price escalation clause for O & M over 5 years

The Project Manager Shall adjust the contract price if taxes, duties and other levies are changed between the date 28 days before the submission of bids for the contract and the date of the last completion certificate. The adjustment shall be the change in the amount of tax payable by the contractor, provided such changes are not already reflected in the contract price or a result of price adjustment clause. If taxes are identifiable if needs to be noted that adjustment will work in both directions viz, if there is a decrease in tax rates, the contractors will be paid less and vice versa.

48. Retention

48.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Contract Data until Completion of the whole of the Works under capital cost indicated in the Activity Schedule

48.2 On Completion of the whole of the Works half the total amount retained is repaid to the Contractor and half when the Defects Liability Period has passed and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected

48.3 On completion of the whole works, under capital cost indicated in the Activity Schedule the contractor may substitute retention money *(balance half)* with an “on demand” Bank guarantee.

49. Liquidated Damages

49.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

49.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the over payment calculated from the date of payment to the date of repayment at the rates specified in Sub Clause 43.1.

50. Bonus

The Employer shall pay bonus to the Contractor of the amount and extent stated in the Contract Data for early completion of the whole works.

51. Advance Payment

51.1 The Employer shall make advance payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

51.2 The Contractor is to use the advance payment only to pay for Equipment, Plant and Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Engineer.

51.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance (mobilization and equipment only) payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, or Liquidated Damages.

51.4 Secured Advance:

The Engineer shall make advance payment in respect of materials intended for but not yet incorporated in the Works in accordance with conditions stipulated in the Contract Data.

52. Securities

52.1 The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The Performance Security shall be valid until a date 28 days from the date of expiry of Defects Liability Period and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion.

52.1 The Performance Security for the O & M contract shall be furnished within 14 days from the date of commencement of O & M at the end of construction Contract. In case of failure of the Contractor to furnish the required performance security for O&M Contract within the stipulated time, Employer shall encash the performance security for construction Contract. The Performance Security for O&M Contract shall be valid until 28 days from the date of handing over the Works to the Employer on completion of O&M period. The Bank Guarantee of a Consortium shall be in the name of the Consortium.

53. Deleted

54. Cost of Repairs

54.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions

E. Finishing the Contract

55. Completion

55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the Works and the Engineer will do so upon deciding that the Work is completed.

55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of operation and maintenance and the Engineer will do so upon deciding that the Work is completed.

56. Taking Over

56.1 The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion of operation and Maintenance of the Plant.

57. Final Account

57.1 The Contractor shall supply to the Engineer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days

of receiving the Contractor's revised account. This needs to be done separately after construction and Operation & Maintenance.

58. Operating and Maintenance Manuals

58.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

58.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

59. Termination

59.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

59.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Engineer;

(b) the Engineer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 28 days;

(c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment certified by the Engineer is not paid by the Employer to the Contractor within 56 days of the date of the Engineer's certificate;

(e) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;

(f) the Contractor does not maintain a security which is required;

(g) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(h) if the contractor, in the judgment of the Purchaser has engaged in fraud and corruption, as defined in GCC Clause 64, in competing for or in executing the Contract.

59.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 59.2 above, the Engineer shall decide whether the breach is fundamental or not.

59.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

59.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

60. Payment upon Termination

60.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a certificate for the value of the work done less advance payments received up to the date of the issue of the certificate, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

60.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.

61. Property

61.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer if the Contract is terminated because of a Contractor’s default.

62. Release from Performance

62.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

63. Suspension of World Bank Loan or Credit

63.1 In the event that the World Bank suspends the Loan or Credit to the Employer, from which part of the payments to the Contractor are being made:

(a) The Employer is obligated to notify the Contractor of such suspension within 7 days of having received the World Bank’s suspension notice.

(b) If the Contractor has not received sums due to it upon the expiration of the 28 days for payment provided for in Sub-Clause 43.1, the Contractor may immediately issue a 14-day termination notice.

64. Corrupt or Fraudulent Practices

64.1 If the Employer determines that the Contractor has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices, in competing for or in executing the Contract, then the may, after giving 14 days notice to the Contractor, terminate the Contractor's employment under the Contract and expel him from the Site, and the provisions of Clause 59.5 shall apply.

64.2 Should any employees of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with Clause 9.1 (Personnel)

64.3 For the purposes of this Sub-Clause:

(a) defines, for the purposes of this provision, the items set forth below as follows:
(i) Corrupt practice[46] is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party.

(ii) "fraudulent practice[47] is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation:

(iii) "collusive practice[48] is an arrangement between two or more parties designed to achieve an improper purpose including to influence improperly the actions of another Party:

(iv) "coercive practice [49] is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party ;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering of concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice, and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under Clause 23 (Instructions, Inspections and Audits)

(b) will reject a proposal for award if it determines that the bidder recommended for award has, directly, or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question,

(c) will cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of the loan engaged in corrupt, fraudulent, collusive, or coercive practices during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur.

(d) will sanction a firm or individual, including declaring ineligible, either indefinitely or for a stated period of time, to be awarded a Bank-financed contract if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing, a Bank-financed contract, and

(e) will have the right to require that a provision be included in bidding documents and in contracts financed by a Bank loan, requiring bidders, suppliers, and contractors and their sub-contractors to permit the Bank to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by the Bank.

....[46] "another party" refers to a public official acting in relation to the procurement process or contract execution) In this context, "public official" inclusive World Bank staff and employees of other organisations taking or reviewing procurement decisions.

....[47] "a party" refers to a public official , the terms "benefit" and "obligation" relate to the procurement process or contract execution and the "act or omission" is intended to influence the procurement process or contract execution.

....[48] "parties" refers to participants in the procurement process (including public officials) attempting to establish bid prices at articificial non competitive levels.

....[49] a "party " refers to a participant in the procurement process or contract execution.

F. Special Conditions of Contract

1. **LABOUR:**

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer may require.

2. **COMPLIANCE WITH LABOUR REGULATIONS**:

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK.

a) Workmen Compensation Act 1923 :- The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

b) Payment of Gratuity Act 1972 :- Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more or on death the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

c) Employees P.F. and Miscellaneous Provision Act 1952: The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:

(i) Pension or family pension on retirement or death, as the case may be.
(ii) Deposit linked insurance on the death in harness of the worker.
(iii) Payment of P.F. accumulation on retirement/death etc.

d) Maternity Benefit Act 1951:- The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

e) Contract Labour (Regulation & Abolition) Act 1970:- The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

f) Minimum Wages Act 1948:- The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employments.

g) Payment of Wages Act 1936:- It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

h) Equal Remuneration Act 1979:- The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.

i) Payment of Bonus Act 1965:- The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/-per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above upto Rs.3500/- per month shall be worked out by taking wages as Rs.2500/-per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the

State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

j) Industrial Disputes Act 1947:- The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

k) Industrial Employment (Standing Orders) Act 1946:- It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

l) Trade Unions Act 1926:- The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

m) Child Labour (Prohibition & Regulation) Act 1986:- The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

n) Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979:- The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home upto the establishment and back, etc.

o) The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996 :- All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

p) Factories Act 1948 :- The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

3. SUB-CONTRACTING (GCC Clause 7)

Please add the following as Clause 7.2:

The contractor shall not be required to obtain any consent from the Employer for:

a) the sub-contracting of any part of the Works for which the Sub-contractor is named in the contract;

b) the provision of labour; and

c) the purchase of materials which are in accordance with the standards specified in the Contract.

Beyond this if the contractor proposes sub-contracting any part of the work during execution of works, because of some unforeseen circumstances to enable him to complete the work as per terms of the contract; the Engineer will consider the following before according approval:

- The contractor shall not sub-contract the whole of the Works.

- The contractor shall not sub-contract any part of the Work without prior consent of the Engineer. Any such consent shall not relieve the contractor from any liability or obligations under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the contractor, his agents or workmen.

- The Engineer should satisfy whether (a) the circumstances warrant such sub-contracting; and (b) the sub-contractors so proposed for the Work possess the experience, qualifications and equipment necessary for the job proposed to be entrusted to them in proportion to the quantum of work to be sub-contracted.

- If payments are proposed to be made directly to that sub-contractor, this should be subject to specific authorization by the prime contractor so that this arrangement does not alter the contractor's liability or obligations under the contract.

(Note: 1. All bidders are expected to indicate clearly in the bid, if they proposed sub-contracting elements of the works amounting to more than 20 percent of the Bid Price. For each such proposal the qualification and the experience of the identified sub-contractor in the relevant field should be furnished along with the bid to enable the employer to satisfy himself about their qualifications before agreeing for such sub-contracting and include it in the contract. In view of the above, normally no additional sub-contracting should arise during execution of the contract.

2. However [a] sub contracting for certain specialized elements of the work is not unusual and acceptable for carrying out the works more effectively; but vertical splitting of the works for subcontracting is not acceptable [b] In any case, proposal for sub-contracting in addition to what was specified in bid and stated in contract agreement will not be acceptable if the value of such additional sub-contracting exceeds 25% of value of work which was to be executed by Contractor without sub-contracting.

3. Assignment of the contract may be acceptable only under exceptional circumstances such as insolvencies/liquidation or merger of companies etc.)

4. <u>ARBITRATION</u> (GCC Clause 25.3)

The procedure for arbitration will be as follows:

a) In case of Dispute or difference arising between the Employer and a domestic contractor relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996. The arbitral tribunal shall consist of 3 arbitrators one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties and shall act as Presiding

arbitrator. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding Arbitrator shall be appointed by the President of the Institution of Engineers (India), Tamil Nadu Chapter.

(b) In the case of dispute with a Foreign contractor the dispute shall be settled in accordance with provisions of UNCITRAL Arbitration Rules. The Arbitral Tribunal shall consist of three Arbitrators one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties, and shall act a presiding arbitrator. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding arbitrator shall be appointed by the President of the Institution of Engineers (India), Tamil Nadu Chapter.

(c) If one of the parties fails to appoint its arbitrator in pursuance of sub-clause (a) and (b) above within 30 days after receipt of the notice of the appointment of its arbitrator by the other party, then the President of the Institution of Engineers (India), Tamil Nadu Chapter both in cases of the Foreign Contractor as well as Indian Contractor, shall appoint the arbitrator. A certified copy of the order of the President of the Institution of Engineers (India), Tamil Nadu Chapter making such appointment shall be furnished to each parties.

(d) Arbitration proceedings shall be held at Chennai, Tamilnadu, India, and the language of the arbitration proceedings and that of all documents and communications between the parties shall be English.

(e) The decision of the majority of arbitrators shall be final and binding upon both parties. The cost and expenses of Arbitration proceedings will be paid as determined by the arbitral tribunal. However, the expenses incurred by each party in connection with the preparation, presentation, etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such party or on its behalf shall be borne by each party itself.

(f) Where the value of the contract is Rs.50 millions and below, the disputes or differences arising shall be referred to the Sole Arbitrator. The Sole Arbitrator should be appointed by agreement between the parties; failing such agreement, by the appointing authority, namely the President of the Institution of Engineers (India), Tamil Nadu Chapter.

(g) Performance under the contract shall continue during the arbitration proceedings and payments due to the contractor by the owners shall not be withheld, unless they are the subject matter of the arbitration proceedings.

5. <u>PROTECTION OF ENVIRONMENT</u>:

Add the following as GCC Clause 16.2:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

Salient features of some of the major laws that are applicable are given below:

The Water (Prevention and Control of Pollution) Act, 1974, This provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

The Air (Prevention and Control of Pollution) Act, 1981, This provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

The Environment (Protection) Act, 1986, This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property.

The Public Liability Insurance Act, 1991, This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

6. LIQUIDATED DAMAGES

Sub-clause 49.1:
Substitute the last sentence with the following:

"Time is the essence of the contract and payment or deduction of liquidated damages shall relieve the contract from his obligations to complete the work as per agreed construction program and milestones or from any other of the contractor's obligations and liabilities under the contract."

Add the following as Sub clause 49.2:

Liquidated damage for O&M shall be levied as per the following from the monthly payments to the Contractor.

1). The Liquidated Damages will be levied during adverse operating period subject to the conditions stipulated in Clause 3.0 , Chapter VII of Vol II

2) Silt / *Sludge removal*

If the contractor fails to remove silt / sludge in the treatment plants from the date of receipt of letter from the, then the silt / sludge will be removed by the Employer by engaging other agencies and the cost will be recovered from the Contractor at Rs. 500/cubic meter.

3) Liquidated damages for deficiencies in operation and maintenance is listed below:

S. No	Description	Nature of Deficiency	Penalty
I	**Deficiency in manpower**		
	Plant Operator	Not present on duty	Rs 1000 per day.
	Lab Chemist	Not present on duty	Rs. 500 per day
	Junior Engineer/Electrical Superintendent./ Sewer Inspector/ Chemist	Not present on duty	Rs. 500 per day
	Electrician	Not present on duty	Rs.100 per day
	Helper	Not present on duty	Rs.100 per day
2	**Deficiency in Service**		
	Clearing of site	Not attended up to 1 day	Rs.500 per day beyond 1 day.
	Non-compliance with safety measures (e.g. not wearing safety belt, helmets, etc.) and first aid facilities	Any time on duty	Rs.500 per occurrence
	Non-observance of Preventive Maintenance Schedule	Any time on duty	Rs.500 per occurrence
	House Keeping	Not kept up tidy	Rs.500 per day
	Delay in getting the equipments repaired within specified period	To be specified by the considering type of equipment	Rs.500 per day
3.	**Non-Compliance of Env. Management Measures (as referred in Section IX and any specific additional measures as outcome of Environmental Assessment)**		
	Disruption of utility lines during construction (water supply, telephone lines, etc.)	Unscheduled disruption without prior notice	Rs. 500/- per day beyond 1 day
	Traffic diversions, barricading and signage for public convenience	Deviation from approved plans by the engineer	Rs. 500/- per day beyond 1 day
	Tree cutting	Tree cutting without prior approval and written permission from Engineer	Penalty levied by competent authority + Rs. 1000/- and remedial corrective action
	Construction camp site management	Any deviation from the Minimum Environmental Management Measures	Rs. 500/- per day beyond 10 working days
	Conditions of Consent to Establish/Consent to operate	Non-Compliance or any occurrence during the contract period	Rs. 1000/- per day beyond 5 working days

	Debris disposal	Any litigation during construction and operation phase of the project	Remedial action within 1 day + Rs. 500/- per day
	Non-compliance with any other measures	Case to case basis	Rs. 500 – 1000/- per day after 5 working days as per Engineer's discretion

4) Liquidated damage for power consumption:

Power Consumption	Exceeding the power Consumption calculated for the quantity of sewage treated for the month based on the power consumption furnished by the bidder.	The Excess power cost will be recovered from the Contractor.

5) Liquidated damages will be levied as below for non compliance of treated effluent standards.

Event triggering the recovery of Liquidated Damages	*During the O & M Period*		*Liquidated Damages recoverable on Termination as a percentage of the immediately preceding years' Fixed and Variable Payments*
	Liquidated Damages	*Frequency*	
Non conformance with BOD Standards	Rs 2.00	For every 1000 litres for every day of non conformance	5 %
Non conformance with TSS Standards	Rs 2.00	For every 1000 litres for every day of non conformance	5 %
Non conformance with faecal coliform	Rs 2.00	For every 1000 litres for every day of non conformance	5 %

7. PAYMENT

Add the Following as GCC Clause 42.7 for O&M

42.7 Billing and Payment procedure

1) The Contractor shall prepare and submit to the Employer, each month, invoice for Payments receivable by the Contractor with all supporting documents. The Calculations shall be submitted between the first and fifth working day of the month for the preceding month.

2) The payment calculations shall include

a) Fixed Payments

b) Variable Payments
c) Liquidated Damages as per Clause 4.4

3) The Employer shall have fifteen (15) calendar days from receipt of such invoice to notify in writing to the Contractor its acceptance thereof or the grounds for disputing such invoice. The shall pay to the Contractor the accepted amounts, within thirty (30) calendar days from the date of acceptance.

4) If there is any dispute in the whole or part of any invoice submitted by the Contractor, the Employer shall pay such amount of the invoice in question which is not in dispute and shall be entitled to withhold the balance pending resolution of the dispute. Any or withheld, but subsequently found to be properly payable following the resolution of such dispute, shall not carry any interest

Note: Payment towards Variable Cost will be made only as per actual quantity of sewage treated.

8. Indemnification

1) The Contractor to indemnify the employer against the following

a) The Contractor shall at its own expense make good any physical loss or damage to the Facility occasioned by it in the course of the performance of its obligations under this Contract if and to the extent such loss or damage is caused by the wilful misconduct or failure to follow Good Industry Practices of the Contractor, any sub-contractor or their respective agents or employees.

b) The Contractor shall indemnify, defend and hold harmless the Employer and its shareholders and their respective directors, officers, employees, agents and affiliates against any and all claims of loss, damage and expense of whatever kind and nature, including all related costs and expenses incurred in connection therewith, in respect of personal injury to or death of third parties and in respect of loss of or damage to any third party to the extent that the same arises out of:

i) Any breach by the Contractor of its obligations hereunder;

ii) Any negligent act or omission on the part of the Contractor, its subcontractors or their respective agents or employees; and

iii) Any wilful misconduct or breach of statutory duty on the part of the Contractor, its subcontractors or their respective agents and employees.

c) The Contractor shall indemnify, defend and hold harmless the Employer and its shareholders and their respective directors, officers, employees, agents and affiliates against any and all claims of loss, damage and expense of whatever kind and nature, including all related costs and expenses incurred in connection therewith in respect of the death or injury to any person employed by the Contractor or its subcontractors in connection with the performance of the Contractor's obligations hereunder except to the extent that such death or injury is caused by the acts or omissions of the , its shareholders , its contractors (other than the Contractor, its agents, employees or any subcontractor) or their respective directors, employees or agents.

9. Limitation of liability

1) The total liability of the Contractor shall not exceed the yearly Fixed and Variable Payments.
2) This clause shall not limit the liability of the Contractor:

a) under any other provisions of the Contract which expressly impose a greater liability,

b) in case of fraud, wilful misconduct or unlawful acts, or

c) in case of acts or omissions of the Contractor which are contrary to the most elementary rules of diligence which a conscientious contractor would have followed in similar circumstances.

10. Securities

Substitute the last sentence of GCC Clause 52.1 as follows:

"50% of the Performance Security shall be valid until a date 28 days from the date of expiry of Defects Liability Period and the balance 50% of the Performance Security shall be valid until a date 28 days from the date of expiry of Agreement Period."

Add the following as GCC Clause 52.2:

52.2 Release of Performance Securities

(i) 50% Performance Security towards capital cost will be released after expiry of Defects Liability Period along with settlement of final accounts after recovering any amount due.

(ii) The balance 50% of Performance Security will be released after expiry of the Operation and Maintenance Period of 5 years commencing from the date of completion of performance trial run of the plant after recovering any amount due.

11. Add the following as GCC Clause No. 65:

65. Special Conditions for Operation and Maintenance

65.1 Definitions

65.1.1 Clearance: Any consent, license, approval, permit, ruling, exemption or other authorization of whatsoever nature which is required to be granted by any Competent Authority to undertake, implement, operate and maintain the Facility.

65.1.2 Competent Authority: Any agency, legislative, judicial or executive authority, department, ministry, public or statutory person, whether autonomous or not, of the Government of India or GOTN or any other sub-division or instrumentality thereof.

65.1.3 Facility: Shall mean the entire plant and premises to be designed and constructed in accordance with the provisions of Contract and including any additions, modifications, alterations, replacement and repairs as may be made thereto from time to time.

65.1.4 Good Industry Practice: In respect of the Contractor, its subcontractors, and all other such third party agents of the Contractor, practice methods, techniques and standards, as changed from time to time, that are generally accepted for use in international sewage treatment facility construction, development, operations and maintenance taking into account conditions in India.

65.1.5.Minimum Output Standards Refers to values of output requirements of facility as agreed between the Employer and the Contractor at the time of issue of Taking over Certificate.

65.1.6. Nominal Flow 31.00 mld is the design flow of the Facility.

65.1.7 Operations and Maintenance Period (O&M Period)

The period commencing on the date of issue of Taking Over Certificate and ending on the Termination Date i.e. after 5 years of O&M contract period.

65.1.8Contract Completion date

Five years from the date of issue of Taking over Certificate (or) as extended as per the provisions of this section 2.2 (or) the date on which the contract is terminated according to Clause 1

65.2 The Contract

65.2.1 Term

The terms and conditions of this section will be in effect during the O&M Period for a period of five years and any extended period as per clause 65.2.2, unless expressly specified otherwise.

65.2.2 Extension of Term

The O&M Period can be extended for a further period of 6 months based on such terms acceptable to both Parties ("Contractor" and the "employer")

Either Party ("Contractor" or the "employer") may notify its intention to extend the O&M Period at least six months before its expiry and commence discussions with the other Party.

65.2.3 Expiry of Term

On expiry of the Term, the Contractor shall return the Facilities in the designed operational condition failing which the Employer shall forfeit the retention and recover Liquidated Damages from the Contractor**.**

65.3 During the pre-operations stage (within the construction period)

Without limiting the Contractor's obligations during the O&M Period, the Contractor shall

a) Identify and acquire all Clearances required for the operation of the Facility and for the fulfilment of his obligations under this section.
b) Obtain and maintain the insurance identified in Clause12

12. INTELLECTUAL PROPERTY

1) All Intellectual Property conceived, originated, devised, developed or created by the Contractor specifically for the Facility or the carrying out of the obligations under this Contract shall vest in the Employer as sole beneficial owner and shall be disclosed to the Employer upon its coming into existence.

2) Source code for computer programmes and associated documentation, storage media shall be made available to the Employer by the Contractor free of cost

3) Any Intellectual Property of the Employer that is required in connection with the performance of the obligations of the Contractor shall be made available to the Contractor free of charge for the purposes of this Contract alone

4) Prior to concluding any Contract with any third parties relating to the supply of materials specifically created by third parties for the purposes of this Facility, the Contractor shall request such third party to grant licenses to each of the Contractor and the Employer with rights to sub-license any Successor Operator in relation to all Intellectual Property which may arise in connection herewith. If that third party refuses to grant such licenses, the Contractor shall refer that matter to the Employer and shall act in accordance with the Employer's instructions as to the terms on which such Contract may be concluded.

5) The Contractor shall, as far as practicable, use its best efforts

   a) To procure that Intellectual Property owned or developed by third parties and utilised by the Contractor in connection with the performance of its obligations under this Contract for the production of treated sewage from the Facility and otherwise for the Facility but for no other purpose on reasonable terms

   b) To ensure that no Intellectual Property of a third party is otherwise used in the performance of the Contractor's obligations under this Contract without the approval from the Employer

1	License / Use of Technical Information	For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and non-transferable license (without the right to sub-license) to the Employer under the patents, utility models or other industrial property rights owned by the Contractor or by a third party from whom the Contractor has received the right to grant licenses there under, and shall also grant to the a non-exclusive and non-transferable right (without the right to sub-license) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how or other intellectual property right from the Contractor or any third party to the . Employer The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or Employer, if they are furnished to the directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.
2	Confidential Information	The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GC Clause 16.

The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data and other information received from the for any purpose other than the design, procurement of Plant, construction or such other work and services as are required for the performance of the Contract.

The obligation of a party under GC Sub-Clauses 16.1 and 16.2 above, however, shall not apply to that information which

(a) now or hereafter enters the public domain through no fault of that party
(b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto
(c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality

The above provisions of this GC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.

The provisions of this GC Clause 16 shall survive termination, for whatever reason, of the Contract.

SECTION 4: CONTRACT DATA

Contract Data

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract:	**Clause Reference**
· The Schedule of Operating and Maintenance Manuals	[58]
· The Schedule of Other Contractors	[8]
· The Schedule of Key Personnel	[9]
· The Methodology and Program of Construction	[27]
· The Schedule of Key and Critical equipment to be deployed on the work as per agreed program of construction	[27]
· Site Investigation reports	[14]

The Borrower is Government of India/Government of Tamil Nadu/ Thiruvottiyur Municipality [1.1]

The World Bank means International Bank for Reconstruction and Development (IBRD) and loan refers to an IBRD Loan [1.1]

The employer is

Name: The Managing Director (1.1)

Address: CMWSSB, No.1 Pumping Station Road, Chintadripet, Chennai -02

Name of authorized Representative: The Chief Engineer, CMWSSB.

The Engineer is (1.1)

Name: The Superintending Engineer,

Address: CMWSSB, No.1 Pumping Station Road, Chintadripet, Chennai -02

Name of Authorized Representative: The Executive Engineer,

The Adjudicator appointed jointly by the employer and Contractor is:

Name : Thiru.V.Rajagopal,

Address: Old No 7/3, New No 13/3, Shyams Nest,
Second Main Road.
Raja Annamalaipuram, Chennai 600 028
phone 044 – 24620177

The name and identification number of the Contract is: Designing, providing, constructing, erection and commissioning, startup and performance run of 6 months followed by 5 years of O&M of 31 MLD capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technologies on DBOT Basis.

Bid No: CNT/SEW/NCB/TNUDP/ /2010

The Works consist of Designing, providing, constructing, erection and commissioning, startup and performance run of 6 months followed by 5 years of O&M of 31 MLD capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technology on DBOT Basis.

[brief summary, including relationship to other contracts under the Project].

The Start Date shall be the date of issue of notice to proceed with the work. (1.1)

The Intended Completion Date for the whole of the Works is 90 months with the following milestones: [17, 28]

Milestone dates: Physical works to be completed Period from the date of issue of notice to proceed with the work

Milestone 1: Detailed designs and drawings including EIA with EMP	- 3 months.
Milestone 2: Civil works 10%	- 6 months.
Milestone 3: Civil works 55%; Electrical 40% & Mechanical works 10%	- 12 months.
Milestone 4: Civil works 95%; Electrical 95%& Mechanical works 65%	- 18 months.
Milestone 5: Civil works 100%; Electrical & Mechanical works 100%	- 24 months
Milestone 6: Operation and Maintenance of the Plant 100%	- 60 months.

Note: The bidder has to furnish the physical milestone targets for completion of various units of the STP in line with the above percentage target upon the award of the contract along with the work program and methodology.

The following documents also form part of the Contract: None [2.3]

The Contractor shall submit a revised Program including Environmental Management Plan (in such form and detail as the Engineer shall reasonably prescribe) for the Works within 14 days of delivery of the Letter of Acceptance. [27]

The Site Possession Dates shall be: The date of issue of notice to proceed with the work [21]

The Site is located at Manali Road, Santhankkadu Village, Thiruvottiyur and is defined in drawings enclosed.

The Defects Liability Period is 365 days. [35]

Insurance requirements are as under:

		Minimum Cover for Insurance	Insurance Premium
(i)	Works and Plant and Materials	**Rs.29,27,40,000**	**Rs. 4,60,284.00**
(ii)	Loss or damage to Equipment	**Rs 10,00,000**	
(iii)	Other Property	**Rs10, 00,000**	
(iv)	Personal injury or death insurance: a) for other people;	**Rs 20,00,000(For 4 occurrence each of Rs 5,00,000)**	
	b) for Contractor's Employees	In accordance with the statuary requirements applicable to India	

[13]

The following events shall also be Compensation Events: None [44]

The period between Program updates shall be 60 days. [27]

The amount to be withheld for late submission of an updated Program shall be Rs. 5,00,000/- [27]

The language of the Contract documents is English [3]

The law which applies to the Contract is the laws of Union of India [3]

The currency of the Contract is Indian Rupees. [46]

Fees and types of reimbursable expenses to be paid to the Adjudicator [25]
Rs. 5,000/- per day plus reimbursable as per actual.

Appointing Authority for the Adjudicator: President of the Institution of Engineers, Tamil Nadu Chapter [26]

The formula (e) for adjustment of prices are: [47]

Adjustment for labour component

(i) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$V_L = 0.85 \times P_l/100 \times R \times (L_i - L_o)/L_o$

V_L = increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local labour.

L_o = the average consumer price index for industrial workers for Thiruvottiyur centre for the quarter preceding the date of opening of Bids as published by Labour Bureau, Ministry of Labour, Government of India.

L_i = The average consumer price index for industrial workers for Thiruvottiyur centre for the quarter under consideration as published by Labour Bureau, Ministry of Labour, Government of India.

P_l = Percentage of labour component of the work.

R = value of works as defined in clause 47.1 of the conditions of contract

Adjustment for cement component

(ii) Price adjustment for increase or decrease in the cost of cement procured by the contractor shall be paid in accordance with the following formula.

$V_c = 0.85 \times P_c/100 \times R \times (C_i - C_o)/C_o$

V_c = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for cement

C_o = The all India average wholesale price index for cement for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

C_i = The all India average wholesale price index for cement for the quarter under consideration as published by Ministry of Industrial Development, Government of India, New Delhi

P_c = Percentage of cement component of the work

Adjustment for steel component

(iii) Price adjustment for increase or decrease in the cost of steel procured by the Contractor shall be paid in accordance with the following formula:

$V_s = 0.85 \times P_s/100 \times R \times (S_i - S_o)/S_o$

V_s = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for steel

S_o = The all India average wholesale price index for steel (Bars and Rods) for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

S_i = The all India average wholesale price index for steel (Bars and Rods) for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_s = Percentage of steel component of the work

Note: For the application of this clause, index of Bars and Rods has been chosen to represent steel group.

Adjustment of Bitumen component

(iv) Price adjustment for increase or decrease in the cost of bitumen shall be paid in accordance with the following formula:

$V_b = 0.85 \times P_b/100 \times R \times (B_i - B_o)/B_o$

V_b = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rate for bitumen.

B_o = The average official retail price of bitumen at the IOC depot at Thiruvottiyur on the day 30 days prior to date of opening of Bids.

B_i = The average official retail price of bitumen at IOC depot at Thiruvottiyur for the 15th day of the middle calendar month of the quarter under consideration.

P_b = Percentage of bitumen component of the work.

Adjustment of POL (fuel and lubricant) component

(v) Price adjustment for increase or decrease in cost POL (fuel and lubricant) shall be paid in accordance with the following formula:

$V_f = 0.85 \times P_f/100 \times R \times (F_i - F_o)/F_o$

V_f = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for fuel and lubricants.

F_o = The average official retail price of High Speed Diesel (HSD) at the existing consumer pumps of IOC at Thiruvottiyur on the day thirty days prior to the date of opening of Bids.

F_i = The average official retail price of HSD at the existing consumer pumps of IOC at Thiruvottiyur for the 15th day of the middle calendar month of the quarter under consideration.

P_f = Percentage of fuel and lubricants component of the work.

Note: For the application of this clause, the price of High Speed Diesel oil has been chosen to represent fuel and lubricants group.

Adjustment for Plant and Machinery Spares component

(vi) Price adjustment for increase or decrease in the cost of plant and machinery spares procured by the Contractor shall be paid in accordance with the following formula:

$V_p = 0.85 \times P_p/100 \times R \times (P_i - P_o)/P_o$

V_p = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for plant and machinery spares

P_o = The all India average wholesale price index for heavy machinery and parts for the quarter preceding the date of opening of Bids as published by the Ministry of Industrial Development, Government of India, New Delhi

P_i = The all India average wholesale price index for heavy machinery and parts for the quarter under consideration as published by Ministry of Industrial Development, New Delhi

P_p = Percentage of plant and machinery spares component of the work

Note For the application of this clause, index of Heavy Machinery and Parts has been chosen to represent the Plant and Machinery Spares group.

Adjustment of Local materials

(vii) Price adjustment for increase or decrease in cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula:

$V_m = 0.85 \times P_m/100 \times R \times (M_i - M_o)/M_o$

V_m = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for local materials other than cement, steel, bitumen and POL.

M_o = The all India average wholesale price index (all commodities) for the quarter preceding the date of opening of Bids, as

published by the Ministry of Industrial Development, Government of India, New Delhi.

M_i = The all India average wholesale price index (all commodities) for the quarter under consideration as published by Ministry of Industrial Development, Government of India, New Delhi.

P_m = Percentage of local material component (other than cement, steel, bitumen and POL) of the work.

Adjustment for DI pipes and specials

(vii) Price adjustment for increase or decrease in the cost of **DI pipes & specials** shall be paid in accordance with the following formula:

$V_D = 0.85 \times P_p/100 \times R \times (D_i - D_o)/D_o$

V_D = Increase or decrease in the cost of work during the quarter under consideration due to changes in the rates for **DI pipes & specials**

D_o = The all India average wholesale price index for Pig iron for **the quarter in which the Bids are opened** as published by the Ministry of Commerce & Industry, Government of India, New Delhi

D_i = The all India average wholesale price index for Pig iron for the quarter under consideration as published by Ministry of Commerce & Industry, New Delhi

P_D = Percentage of **DI pipes & specials** component of the work

The following percentages will govern the price adjustment for the entire contract:

1.	Labour - P_l	—— %
2.	Cement - P_c	—— %
3.	Steel - P_s	—— %
4.	Bitumen - P_b	—— %
5.	POL - P_f	—— %
6.	Plant & Machinery Spares - P_P	—— %
7.	Other materials - P_m	—— %
8.	Pipes and Specials	—— %
	Total	100%

The above has to be furnished by the bidder based on his design, work plan and methodology along with the bid separately for construction of STP and O&M.

Price adjustment for increase or decrease in cost of all works carried out by the contractor shall be paid in accordance with the following formula during the O&M period:

R = Value of work as defined in Clause 47.1 of Conditions of Contract.

$V_m = 0.85 \times R \times (M_i - M_o)/M_o$

V_m = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for all commodities.

M_o = The all India average wholesale price index (all commodities) for the quarter preceding the date of opening of Bids, as published by the Ministry of Industrial Development, Government of India, New Delhi.

M_i = The all India average wholesale price index (all commodities) for the quarter under consideration as published by Ministry of Industrial Development, Government of India, New Delhi.

The proportion of payments retained (retention money) shall be 6% from each bill Subject to a maximum of 5% of final contract price [48]

The liquidated damages for the whole of the construction works are Rs. 1, 36,080/- per day and that for the milestone are as under: [49]

For milestone 1	Rs. 816/- per day
For milestone 2	Rs. 7250/- per day
For milestone 3	Rs 56070/- per day
For milestone 4	Rs. 63130/- per day
For milestone 5	Rs. 8830/- per day

The maximum amount of liquidated damages for the whole of the construction works is ten percent of final contract price.

Maximum Liquidated Damages for O&M: The maximum Liquidated Damages payable by the Contractor in any month shall not be more than 5 % of the payment receivable by the Contractor for the year.

The maximum Liquidated Damages payable by the Contractor in a year shall not be more than 15 % of the payment receivable by the Contractor towards O&M for the year.

The maximum liquidated damages payable by the Contractor on Termination shall not be more than 25 % of the payment receivable by the Contractor towards O&M for the year preceding the Termination.

Bonus for early completion of whole works is Rs. 1, 36,080/- per day of early completion. [50]
The maximum amount of bonus for the whole of the works is 5% of final contract price.

The amounts of the advance payment are: [51]

Nature of Advance	Amount (Rs.)	Conditions to be fulfilled
1. Mobilization	10% of the Contract price	On submission of un-conditional Bank Guarantee. (to be drawn before end of 20% of Contract period)
2. Equipment (This advance is not applicable for equipment already owned or hired/ leased by the contractor.)	Nil	
3. Secured advance (for electro mechanical equipments,	75 % of contract value or market value or invoice value, whichever is less.	a) The materials are in-accordance with the specification for Works; b) Such materials have been delivered to site, and are properly stored and protected

pipes and valves only and not for civil construction materials like cement, sand, aggregate, steel etc.,)

against damage or deterioration to the satisfaction of the Engineer. The contractor shall store the bulk material in measurable stacks.;

c) The Contractor's records of the requirements, orders, receipt and use of materials are kept in a form approved by the Engineer and such records shall be available for inspection by the Engineer;

d) The contractor has submitted with his monthly statement the estimated value of the materials on site together with such documents as may be required by the Engineer for the purpose of valuation of the materials and providing evidence of ownership and payment thereof;

e) Ownership of such materials shall be deemed to vest in the Employer for which the Contractor has submitted an Indemnity Bond in an acceptable format; and

f) The quantity of materials are not excessive and shall be used within a reasonable time as determined by the Engineer.

(The advance payment will be paid to the Contractor no later than 15 days after fulfillment of the above conditions).

Repayment of advance payment for mobilization and equipment: [51]

The advance shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 15 percent of the Contract Price or two months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 15 percent of the amounts of all Interim Payment Certificates until such time as the advance has been repaid, always provided that the advance shall be completely repaid prior to the expiry of the original time for completion.

The Securities shall be for the following minimum amounts equivalent as a percentage of the Contract Price: [52]

Performance Security for 5 per cent of contract price.

The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section 8 of the Bidding Documents.

The date by which operating and maintenance manuals are required is within 28 days of issue of certificate of completion of whole or section of the work, as the case may be. [58]

The date by which “as-built” drawings (in appropriate scale) in 5 sets including soft copies are required is within 28 days of issue of certificate of completion of whole or section of the work, as the case may be. [58]

The amount to be withheld for failing to supply “as built” drawings and/or operating and maintenance manuals *by the date required is Rs.20, 00,000/- [58]

The following events shall also be fundamental breach of contract: [59.2]

1. The Contractor has contravened Sub-clause 7 of GCC read with SCC and Clause 9.0 of GCC

2. The contractor does not adhere to the agreed construction program and agreed environmental management plan (Clause 27 of GCC) and also fails to take satisfactory remedial action as per agreements reached in the management meetings (Clause 31) for a period of 60 days.

3. The contractor fails to carry out the instructions of Engineer within a reasonable time determined by the Engineer in accordance with GCC Clause 16.1 and 23.1.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be 20 percent. [60]

SECTION 5: TECHNICAL SPECIFICATIONS

Please refer to Volume II of the bid document

SECTION 6: DRAWINGS & PERFORMANCE GUARANTEE

Drawings

Index

1. Index plan
2. FMB Sketch of STP site
3. SPOT levels of STP site
4. Raw sewage entry point and treated effluent disposal point

1. Appendix – I

Performance Guarantee for Various Parameters of Effluent for Various Units are given below as stipulated in Para 2.1 of Page 88 of Volume II (O&M)

1. Treated final effluent characteristics **shall not exceed** the following values.

BOD_5 at 20^0C	10 mg/L
Suspended solid	10 mg/L
pH	6.5 to 8.5
COD	100 mg/l
Faecal coliform	200 MPN/100 mL.
Oil & Grease	5 mg/L

2.	Grit chamber	Grit removal	All particles of size 0.15 mm & above shall be removed 100%. Organic content in washed grit shall not exceed 3%

2.GUARANTEE

We guarantee the following

a) Final effluent quality & unit wise performance parameters as specified in Appendix I.

b) Performance of all the equipments and system as per specification.

Date Signature of tenderer

WITNESS :

Signature

Name

Occupation

Address

SECTION 7: ACTIVITY SCHEDULE

1 General

The price schedule given here is broadly for the following works:

- Civil Works
- Electrical & Mechanical Works
- Performance Trial Run (6 months)
- Operation, maintenance & monitoring Works. (5 Years)

Each item in the price Schedule of Activities shall be individually priced in ink and the same shall be added up to the Bid Cost. No column in the price Schedule shall be left blank. The price quoted by the Bidder must allow for all works as per the detailed specifications and for all contractual obligations whether separately specified or not.

The rates and prices in the price Schedule shall, except in cases separately provided for, be deemed to cover all the contractual obligations under this contract.

2 Civil Works

The Civil works shall include all the works indicated in the Scope of Work and Technical Specifications given in Volume I &II. Any additional item if required from process point of view and for better performance of the plant shall be considered while quoting offer.

All items under Civil works are inclusive of all excavation in any type of strata at required depth, including dewatering of Sub-soil Water for Concreting and other works, refilling the sides of excavation after construction of structure, disposing of surplus soil etc. complete as detailed in Volume I & II and as directed by the Engineer in Charge.

All items of Piping works for STP shall be inclusive of excavation in any type of strata, including supply, laying, jointing and testing of all pipelines, specials, valves, all types of labour, construction of sewer appurtenances and valve chambers, pipe support pedestals complete in all respects as detailed in Volume I & II and as directed by engineer-in-charge.

3 Electrical, Mechanical and Instrumentation works

The scope of work under the contract shall include all the work indicated in the Scope of Work and Technical Specifications given in Volume I & II.

4 Performance Run, Operation, Maintenance & Monitoring Works

The scope of work under the contract shall include all the work as specified in the Scope of Work and Technical Specifications given in Volume I & II.

5 Cost Break Up

As the bid is a lump sum price, total cost of works has been split into units and the percentage cost of each unit is stipulated (see Table 1 below) to facilitate the unit wise payments. Cost of an individual unit shall be worked out on the basis of the stipulated percentage and agreed cost of the work. The percent value stipulated for the unit is for completion of the entire work related to the unit as per detailed specifications and requirements mentioned in the bid document and overall requirement for successful commissioning and operation of the plant in accordance with applicable requirements. In case any addition or deletion in these unit items takes place after designs are approved for the unit, the actual cost for the purpose of payment will be worked out on the basis of quantities as per the approved drawings and prevailing schedule of rates in being adopted by the employer. If the work of a unit is deleted by the employer from the

scope of contract before approval of the detailed drawings, the cost of such deleted unit will be decided on the basis of the stipulated percentages in Table.1 to be furnished by the bidder.

It shall be explicitly noted by the bidders that the tables given below shall be referred only for facilitating the payments to the contractor and shall not be any way referred to, for defining and restricting the scope of work under the contract.

TABLE – 1: Activity Schedule

Sl. No	Unit and Stage of Construction	% Of finalized cost
I	**Process and Hydraulic Design and Detailed Engineering**	
a)	Submission and acceptance of detailed designs, drawings and estimates.	
b)	Hydraulic process design and layout of the plant.	
c)	Structural design and construction drawing for primary units.	
d)	Structural design and construction drawing for secondary units.	
e)	Structural design and construction drawing for sludge handling, treatment arrangements unit and auxiliary units.	
II.	Submission and acceptance of detailed Environmental Assessment Report.	
III.	Construction of the following l components of the plant	
1	Receiving Chamber	
	Civil	
2	Screen Chamber	
A	Civil	
B	Mechanical including	
	Screens	
3	Grit Chamber and Parshall Flume	
A	Civil	
B	Mechanical including	
	Grit Mechanism with all associated accessories	
4	Distribution Box and Bypass arrangement	
	Civil	
5	Secondary Treatment units(Each unit to be specified by the bidder for civil , Mechanical & electrical works	

6	Chlorination Tank / Chlorination House	
A	Civil	
B	Mechanical including	
	Chlorinator with all accessories	
7	Sludge Sump and Pump House	
A	Civil	
B	Mechanical including	
	Sludge Sump Blowers and Air Grid	
	Centrifuge Feed Pumps	
8	Centrifuge House	
A	Civil	
B	Mechanical including	
	Dewatering Polymer Dosing System	
	Centrifuge	
9	Administrative Building including Furniture and Laboratory Equipments	
	Civil	
10	Internal Roads, Pathways, Pavements, Storm water	
	Civil	
11	Misc. Civil works like, Compound Wall, Entry Gate,	
	Civil	
12	Site Clearance, Disposal/ Plot Development – Landscaping etc.	
	Civil	
13	Electrical Works including (Bidder to specify various units)	
14	Others if any	

1- Chemicals

The bidder should list the chemical consumption & the approximate (+/-10%) delivered rate of the chemicals at the project site to be used by them for the STP.

This information is to be used for evaluating the bids.

Chemical / Utilities	Units	Delivered Rate in Rs. / Unit	Daily Consumption	Total cost for design capacity	Total cost per mld
Gas Chlorine	Kg/day/mld				
Dewatering Polyelectrolyte	Kg/day/mld				

Cost of chemical for design capacity =

Cost of chemical per mld =

2-Electric Load List

1 S No	2 Drive For	3 Total Nos	4 Nos Operating	5 Nos Standby	6 Operating Hours / day	7 Drive Rating KW	8 Operating Power kWh/day	9 Guaran-teed Consum-ed Power KWh/day	10 Guaran-teed Consumed Power per mld KWh/day
1.	Screening								
2.	De-gritting								
3.	Aeration								
4.	Sludge Pumping								
5.	Sludge Treatment								
6									
7									
8									
9	Others etc								

For sewage Treatment

Total connected Power, kW _____

Total operating power, kw _____

Total Consumed Power KWh/day /31.00mld _____

Total Consumed Power KWh/day /mld _____

Note: (i) Since the flow of sewage will be minimum in the initial period, the bidder is requested to furnish the power consumption per mld

(iI) If an arithmetical error is found in Power consumption calculation, the same will be corrected in accordance with ITB Clause 27.

The contractor shall submit the running bills to the engineer in charge at the rate of one (1) RA bill per month.

Being a lump sum contract, the payments through RA Bills will be made to the contractor on the basis of stage wise break-up of payment. The stage wise payment of different units is specified in Table 2.0 and Table 3.0. A part of work will become eligible for payment as per the percentage to be furnished by the bidder in Table 2 only on completion of particular stage of work. Intermediate payments on prorate basis or as per actual measurements shall not be made.

Table-2: PAYMENT SCHEDULE FOR CIVIL WORKS

S. No.	Unit and Stage of Construction	% of Cost of Unit
I	**Process and Hydraulic Design and Detailed Engineering**	
a)	Submission and acceptance of detailed designs, drawings and estimates.	
b)	Hydraulic process design and layout of the plant.	
c)	Structural design and construction drawing for primary units.	
d)	Structural design and construction drawing for secondary units.	
e)	Structural design and construction drawing for sludge handling, treatment arrangements unit and auxillary units.	
II.	Submission and acceptance of detailed Environmental Assessment Report.	
III.	Construction of the following l components of the plant	
1	**Receiving Chamber**	
	Approval of Design and Drawings	
	Excavation	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
2	**Screen Chamber**	
	Approval of Design and Drawings	
	Excavation	
	Concreting of Raft	
	Concreting of Walls (1/2 height)	
	Concreting of Walls (full height)	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
3	**Grit Chamber and Parshall Flume**	
	Approval of Design and Drawings	
	Excavation	
	Concreting of Raft	
	Concreting of Walls (1/2 height)	
	Concreting of Walls (full height)	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
4	**Distribution Box and Bypass arrangement**	
5	**Secondary Treatment units**	

	Approval of Design and Drawings	
	Excavation	
	Concreting of Foundation	
	Concreting of Walls (1/2 height)	
	Concreting of Walls (full height)	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
6	**Chlorination Tank**	
	Approval of Design and Drawings	
	Excavation	
	Concreting of Foundation	
	Concreting of Walls (1/2 height)	
	Concreting of Walls (full height)	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
7	**Sludge Sump and Pump House**	
	Approval of Design and Drawings	
	Excavation	
	Concreting of Foundation	
	Concreting of Walls (1/2 height)	
	Concreting of Walls (full height)	
	Entire Completion of Civil Works	
	Successful Hydraulic Testing and Commissioning	
	Consistent Performance of the Plant	
8	**Centrifuge House**	
	Approval of Design and Drawings	
	Excavation	
	RCC Framed Structure	
	Entire Completion of Civil Works	
9	**Administrative Building including Furniture and Laboratory Equipments**	
	Approval of Design and Drawings	
	Excavation	
	RCC Framed Structure	
	BBM and Plastering	
	Entire Completion of Civil Works	

10	**Internal Roads, Pathways, Pavements, Storm water drainage**	
	Approval of Design and Drawings	
	Preparation of Road Structure	
	Laying of Storm Water drains	
	Construction of Pavements	
	Entire Completion of Works	
11	**Misc. Civil works like Compound wall/, Entry Gate,**	
	Approval of Design and Drawings	
	Entire Completion of Works	
12	**Site Clearance, Disposal/ Plot Development – Landscaping etc.**	
	Approval of Design and Drawings	
	Entire Completion of Works	
13.	Others if any	

TABLE 3 - OPERATION AND MAINTENANCE COST
SUMMARY OF FIXED AND VARIABLE PAYMENTS
ABSTRACT

Sl. No.	**O&M Period**	**O&M Cost (In Rs.)**		
		Fixed (A)	**Variable (B)**	**Total (A+B)**
1	1st year			
2	2nd year			
3	3rd year			
4	4th year			
5	5th year			
	Grand Total			

(A) Fixed Cost

Sl. No.	**O&M Period**	***Manpower (In Rs.)**	**Maintenance works including Civil, Mechanical**	**Maintenance of Office etc. (In Rs.)**	**All repairs including spares & Replacement Oil & Grease**	**Total Cost (In Rs.)**
1	**2**	**3**	**4**	**5**	**6**	*7*=**5***+4+5+6*
1	1st year					
2	2nd year					
3	3rd year					
4	4th year					
5	5th year					

** Furnish category wise break up.*

(B) Variable Costs

Sl. No.	O&M Period	Chemicals and other consumables cost (In Rs.)		
		Unit Cost	**Estimated Flow**	*Annual Cost*
		Rs./Per MLD	*(MLD)*	*Rs. Lakhs /Year*
1	**2**	**3**	*4*	*5 = (3*4*365)/10^5*
1	1st year		24.60	
2	2nd year		25.00	
3	3rd year		25.50	
4	4th year		26.00	
5	5th year		26.20	

Note: 1. The land that will be required for STP, Roads and drains, and other buildings/facilities will be indicated by the bidder for both the Intermediate Phase design flow of 31 MLD and the ultimate flow of 45 MLD. The drawings shall be provided with required designs, as per clause 4.9, Para 2.1 of Page 6 of Volume- II. The proportionate cost of land at Rs 6500 per sq.m to be utilized for construction of STP which includes the various components of the STP, roads, drains and green belt all around will be added in the bid price and the lowest evaluated substantially responsive bidder will be awarded the contract.

The bidder has to provide the details of requirement of land as follows.

(a) Land required for construction of STP for the intermediate capacity of 31 MLD ……..m²

(b) Land required for augmenting the capacity of STP to the ultimate capacity of 45 MLD ……..m²

2. The flow measurement is based on the ultrasonic flow transmitter provided in the raw sewage pumping mains and the payment will be made accordingly

3. In the initial years, the sewage flow into the STP is likely to be less than the design flow. Hence the performance of STP in terms of chemical and power consumption can not be assessed for the design capacity, In such case , at the end of trial run period the Employer shall assess the power consumption and chemical consumption for the designed capacity of 31 MLD on the basis of guaranteed power and chemical consumption /mld given by the bidder. If there is any variation between the actual consumption and the guaranteed consumption, the difference in cost of power and chemical consumption shall be calculated for the estimated quantities of flow as given in Section 7 – Activity schedule, Table (B) Variable costs under Abstract of Operation and Maintenance cost; for all the 5 years of O&M period, and a recovery shall be effected for the amount from the final bill for capital works. The details of chemical consumption and power consumption shall be furnished in the format given below:

A. chemicals

Chemical / UtilitiesChemical Utilities	Units	Delivered Rate in Rs. / Unit	Daily Consumption	Total cost for design capacity	Total cost per mld
Gas Chlorine	Kg/day/mld				
Dewatering Polyelectrolyte	Kg/day/mld				

Cost of chemical for design capacity =

Cost of chemical per mld =

B.Electric Load List

1 S. No	2 Drive For	3 Total Nos	4 Nos Operating	5 Nos Standby	6 Operating Hours / day	7 Drive Rating KW	8 Operating Power kWh/day	9 Guaran-teed Consumed-ed Power KWh/day	10 Guaran-teed Consumed Power per mld KWh/day
1.	Screening								
2.	De-gritting								
3.	Aeration								
4.	Sludge Pumping								
5.	Sludge Treatment								
6									
7									
8									
9	Others et								

For sewage Treatment

Total connected Power, kW _____
Total operating power, kW _____
Total Consumed Power KWh/day / **31.00 mld** _____
Total Consumed Power KWh/day /mld _____

Note: (i) Since the flow of sewage will be minimum in the initial period, the bidder is requested to furnish the power consumption per mld

(iI) If an arithmetical error is found in Power consumption calculation, the same will be corrected in accordance with ITB Clause 27.

4. (a) For capital works, the payment will be made to the contractor on the basis of stage wise breakup of payments of different units as per Table 2

(b) For Trial Run, the payment will be made on monthly basis, a prorate basis.

(c) For O&M works, the payment (fixed & variable payments) will be made to the contractor on monthly basis based on “Abstract of O&M Cost”. The payment towards variable cost shall be worked out as per actual quantity of sewage treated, based on the flow measured through ultrasonic flow meter.

A. PRICE SCHEDULE FOR CONSTRUCTION

Sl. No.	Description of Activity (with brief specification and reference to Book of specification)	Rate	
		In figures (in Rs.)	In words
I a.	**Capital cost:** Submission and acceptance of detailed designs, drawings and estimates.		
b.	Hydraulic process design and layout of the plant.		
c.	Structural design and construction drawing for primary units.		
d.	Structural design and construction drawing for secondary units.		
e.	Structural design and construction drawing for sludge handling, treatment arrangements unit and auxiliary units.		
II	Submission and acceptance of detailed Environmental Assessment Report.		
III 1. 2.. 3. 4. 5.	Construction of the following components of the plant Receiving Chamber Screening units De-gritting units Distribution box & Bye-pass arrangement Secondary Units		
6	Chlorination Tank		
7.	Sludge Sum p and Pump house		
8.	Centrifuge House		
9.	Administrative Building including Furniture and Laboratory Equipments		

		Rate	
10.	Internal Roads, Pathways, Pavements, Storm water drainage		
	Misc. Civil works like Compound Wall/, Entry Gate,		
12.	Site Clearance, Disposal/ Plot Development – Landscaping etc.		
13.	Electrical Works including (Bidder to specify various units)		

B. PRICE SCHEDULE FOR PERFORMANCE TRIAL RUN (6MONTHS)

Sl.No	Trail run and performance period	O & M Cost in Rs.		
		Fixed (A)	Variable (B)	Total (A+B)
1	For 6 Months			

C. PRICE SCHEDULE FOR O&M

Sl. No.	Description of activity (with brief specification and ref. to Book of specification	Rate		Amount (in Rs.)
		In Worlds	In figures (in Rs.)	
1	O&M cost for operation and maintenance of the plant for five years			
	Fixed cost (Man power, maintenance of all Civil Structures and entire plant House Keeping, all repairs including spares & Replacement, Oil & Grease Cost)			
	i) First year			
	ii) Second year			
	iii) Third Year			
	iv) Fourth Year			
	v) Fifty year			
2	Variable cost (excluding TNEB Power charges, Diesel cost for D.G set and Chlorine Dosage costs) covering consumables, Chemicals and cost for safe disposal of grit and sludge.			

	i) First year			
	ii) Second year			
	iii) Third Year			
	iv) Fourth Year			
	v) Fifty year			
	Total Bid price(in figures			
	(in words)			

(1) Item for which no rate or price has been entered in will not be paid for by the employer when executed and shall be deemed covered by the other rates and prices in the **Activity Schedule** (refer: ITB Clause 13.2 and GCC Clause 43.3).

(2) Unit rates and prices shall be quoted by the bidder in Indian rupee [ITB Clause 14.1].

(3) Where there is a discrepancy between the rate in figures and words, the rates in words will govern. [ITB Clause 27.1]

SECTION 8: FORMS OF SECURITIES

Forms of Securities

Acceptable forms of securities are annexed. Bidders should not complete the Performance and Advance Payment Security forms at this time. Only the successful Bidder will be required to provide Performance and Advance Payment Securities in accordance with one of the forms, or in a similar form acceptable to the Employer.

Annex A: Bid Security (Bank Guarantee)

Annex B: Performance Bank Guarantee

Annex C: Bank Guarantee for Advance Payment

Annex D: Performance Bank Guarantee for O&M

Annex A

BID SECURITY (BANK GUARANTEE)

WHEREAS, _____ *[name of Bidder]* (hereinafter called "the Bidder") has submitted his Bid dated _____ *[date]* for the construction of _____ *[name of Contract]* (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that We _____ *[name of bank]* of _____ *[name of country]* having our registered office at _____ (hereinafter called "the Bank") are bound unto _____ *[name of Employer]* (hereinafter called "the Employer") in the sum of _____[1] for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

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

THE CONDITIONS of this obligation are:

(1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;

or

(2) If the Bidder having been notified of the acceptance of his bid by the Employer during the period of Bid validity:

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or

(b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or

(c) does not accept the correction of the Bid Price pursuant to Clause 27;

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

This Guarantee will remain in force up to and including the date _____[2] days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE OF THE BANK _____

WITNESS _____ SEAL _____

[Signature, name, and address] _____

1 The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16.1 of the Instructions to Bidders.

2 45 days after the end of the validity period of the Bid. Date should be inserted by the Employer before the Bidding documents are issued.

Annex B

PERFORMANCE BANK GUARANTEE

To: _____ *[name of Employer]*
_____ *[address of Employer]*

WHEREAS _____ *[name and address of Contractor]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ *[name of Contract and brief description of Works]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of _____ *[amount of guarantee]* [1] _____ *[in words]*, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ *[amount of guarantee]*[1] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 28 days from the date of expiry of the Defects Liability Period.

Signature and seal of the guarantor _____
Name of Bank _____
Address _____
Date _____

---

1 An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract including additional security for unbalanced Bids, if any and denominated in Indian Rupees.

Annex C

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ *[name of Employer]*
_____ *[address of Employer]*
_____*[name of Contract]*

Gentlemen:

In accordance with the provisions of the Conditions of Contract, sub clause 51.1 ("Advance Payment") of the above-mentioned Contract, _____ *[name and address of Contractor]* (hereinafter called "the Contractor") shall deposit with _____ *[name of Employer]* a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of _____ *[amount of guarantee]*[1] _____ *[in words]*.

We, the _____ *[bank or financial institution]*, as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ *[name of Employer]* on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding _____ [amount of guarantee][1] _____ *[in words]*.

We further agree that no change or addition to or other modification of the terms of the Contract or of Works to be performed there under or of any of the Contract documents which may be made between _____ *[name of Employer]* and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ *[name of Employer]* receives full repayment of the same amount from the Contractor.

Yours truly,

Signature and seal: _____
Name of Bank/Financial Institution: _____
Address: _____
Date: _____

1 An amount shall be inserted by the bank representing the amount of the Advance Payment, and denominated in Indian Rupees.

Annex D

PERFORMANCE BANK GUARANTEE FOR O&M

(To be stamped in accordance with Stamp Act if any, of the Country of the Issuing Bank)

Bank Guarantee No.: ..... Date:.....

To..... (Name of the Purchaser)

Whereas..... (Name of the Purchaser) hereinafter called "the Contractor" has undertaken, in pursuance of contract No..... dated..... 20... To carry out..... (Description of Goods and Services) hereinafter called "the Contract".

AND WHEREAS it has been stipulated by you in the said contract that the Contractor shall furnish you with a Bank Guarantee by a recognized Bank for the sum specified therein as security for compliance with the Supplier's performance obligations under the contract for Annual Maintenance and Repairs of the entire system including cost of spares after warranty period for next five years.

AND WHEREAS we have agreed to give the Contractor a Guarantee.

THEREFORE WE hereby affirm that we are Guarantors and responsible to you on behalf of the Contractor, up to a total of Rs..... (Amount of guarantee in words and figures) being 2.5% of the total cost of equipment and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the contract and without cavil or argument, any sum or sums within the limit of Rs. ……. (Amount of guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until ..... day of ..... 20.....

Signature and Seal of Guarantors

.....
.....
Date: ..... 20...

NOTE:

1. SUPPLIERS SHOULD ENSURE THAT SEAL AND CODE No. OF THE SIGNATORY IS PUT BY THE BANKERS, BEFORE SUBMISSION OF THE BANK GUARANTEES.

CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD

No.1, Pumping Station Road, Chintadripet,
Chennai 600 002.

VOLUME – II

SECTION – 5

TECHNICAL SPECIFICATIONS

NAME OF THE WORK : Designing, providing, constructing, erection and commissioning, startup and performance run of 6 months followed by 5 years of O & M of 31 mld capacity sewage treatment plant (STP) at THIRUVOTTIYUR with selected modern technology on DBOT Basis.

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I. SCOPE OF WORK

1.0 Introduction:

On behalf of the Thiruvottiyur Municipality, CMWSSB intends to undertake the following works on DBOT Basis:

"Designing, Providing, Constructing, Erecting and Commissioning, Start-up and Performance Run for 3 months followed by 5 years of Operation & Maintenance of 31 MLD capacity Sewage Treatment Plant (STP) based on selected modern technology at Sathankkadu village, Thiruvottiyur on DBOT basis"

The offers shall be based on the bidder's own design and operating philosophy which is to be based on the selected modern treatment technologies and should be within the overall framework and guidelines specified by CMWSSB in the bid document and its specifications. The bidder's design for the entire facility shall be such that the project shall

- § Requires minimum land space
- § Requires minimum energy for treatment of sewage
- § Generates treated effluent that can be recycled

Planning of the entire system should be done in such a manner so as to optimize capital and operational costs of treatment of sewage and maintenance of appurtenant works.

2. Scope of work

The scope of work includes receiving the raw water sewage from 600mm/800mm Size PSC pipe line and pumping to various units for treatment. Finally the treated effluent shall be disposed to B'Canal to a distance of 250.00 m. The average ground level of the STP site is +0.600 m. The sewage at inlet chamber will be delivered at +9.0 m through pumping. The average bed level of the disposal point @ B'canal is (-) 1.83 m .The Maximum Flood level of the B'canal is +2.49 m. The disposal of treated effluent is through NP3 R.C.C pipes conforming to I.S Specification.

The scope of the work shall include but not be limited to the following.

2.1 The design shall be based on any one of the following technologies:

i) Activated Sludge Process.
ii) Modified Activated Sludge process.
iii) Fluidized Aerobic Bio Reactor (FAB).
iv) Cyclic Activated Sludge Process.
v) Sequential Batch Reactor (SBR).

2.2 Site clearance, site surveys, soil investigation, submission of process design and hydraulic design calculations, plant lay out and hydraulic flow diagram (Process & Instrumentation diagram), preparation & submission of detailed Environmental Assessment Report, preparation & submission of civil, architectural, General Arrangement Drawings & structural design of all civil works, electrical & mechanical equipment drawings including equipment installation drawings, supporting calculations & technical information, instrumentation & control system, construction of

STP of required capacity (31 mld) including necessary bypass arrangements after de-gritting for aeration & chlorination as per approved designs, testing, commissioning, performance testing of process units & trial run for a period of six months, landscaping of plant area, internal roads with access to all units, illumination of the entire STP yard, pathways, storm water drainage, compound wall all around & gates, administrative building including store house for tools and spares (covering a plinth area of 60 sqm), laboratory (covering an area of 30 sqm) with water supply and waste water disposal arrangements, O&M manual and as-built drawings for all civil, electrical & mechanical works. All units shall be provided with draining arrangements with suitable valves.

2.3 Supply and providing safety equipments namely gas mask, breathing apparatus, Air hose respirator, portable lighting equipment, non sparking lighting equipment, portable air blowers, safety belts, inhalators and diver suit at the commencement of O&M.

2.4 Training the municipal staff for a period of six months during the maintenance period.

2.5 Handing over of the Plant in good working condition with all relevant documents such as as-built drawings, physical & operational condition of the assets, rights on proprietary technologies, software, systems, O&M manual, periodical reports along with soft copy to Thiruvottiyur Municipality.

2.6 The offer shall be based on the bidders design, build, operate and transfer concept to be specified by the bidder.

2.7 Design shall be such that the plant requires minimum land foot print within the available land leaving area for future expansion of STP

3. GENERAL:

3.1 The fee paid to TNEB for permanent power supply connection shall be deposited by the employer directly. IT SHOULD BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROJECT POWER REQUIREMENT, PREPARE AN APPLICATION FOR THE TNEB AND HELP THE EMPLOYER WITH REQUIRED INFORMATION AND ASSISTANCE IN THIS REGARD. All other costs related to obtaining such approval are in the scope of contract. It will be the total responsibility of contractor to obtain approval of entire electrical installation from electrical inspector. The charges alone will be paid by CMWSSB

3.2 Power supply room of required area as per TNEB requirements shall be provided near transformer yard as required.

3.3 Illumination of STP Yard with suitable arrangement for better operation and maintenance of plants.

3.4 R.R Masonry Compound wall with MS gate of size suitable for entry of lorry etc.

4. PROPOSED TREATMENT SCHEME

4.1 Receiving of Sewage

Raw Sewage will be delivered through 600mm/800mm dia PSC pipe with invert level of +9.00 m from the ground level of +0.600 m into a Receiving Chamber to be constructed in this contract and from where it will be taken into down stream screens. The function of the Receiving Chamber is to reduce the incoming velocity. Receiving Chamber shall be of adequate size to meet the requirements of

workability inside it. The flow from the receiving chamber will lead to screen Chamber.

4.2 Coarse Screening

After the receiving chamber minimum two numbers of coarse screens are to be provided for removal of up stream of Wet well for removal of floating and oversized material coming with the sewage. One shall be mechanically operated and must be suitable for sewage applications. The other shall be of Manual screen as standby. The coarse screens should be capable to screen out most of the medium & large floating and oversized material such as plastic rags, debris, weeds, paper, cloth, rags etc which could clog the waste water pump impellers. The coarse screen shall be inclined bar screen. It should be of sturdy design to take care of all sorts of materials envisaged in the gravity sewer. The bar screen shall be of stainless steel flats. The screenings shall be dropped on conveyor above the top of the screen channel. A conveyor system of suitable width shall be provided which shall be adjacent to the screens. The screening material as collected will drop automatically into a wheelbarrows for its disposal.

4.3 Fine Screening

Fine screen channels to be provided up stream of Grit removal system Minimum two nos. of Fine screens are to be provided for removal of fine floating material coming with the sewage. It shall be mechanically operated and must be suitable for sewage applications. There shall be minimum one number of Manual fine screen as standby. The fine screens should be capable to screen out most of the medium & fine floating and material such as hair, debris, weeds, paper, rags etc. which could clog the downstream units. The Fine screen shall be inclined bar screen. It should be of sturdy design and the bar screen shall be of stainless steel flats. The screenings shall be dropped on conveyor above the top of the screen channel. A conveyor system of suitable width shall be provided which shall be adjacent to the screens. The screening materials as collected will drop automatically into a wheelbarrows for its disposal.

4.4 De-gritting

Screened Sewage will be gravitable to minimum two numbers of Grit separator tank for removal of grit and small inorganic particulars matter of specific gravity above 2.65 and particle size above 150 microns. The Grit separator tank shall be of RCC construction complete with mechanical internals and square in size. The grit separated shall be properly collected and be transferred for disposal. The degritted sewage shall flow through open channels from the grit separators and confluence into a single channel of suitable width.

4.5 Flow Measurement

A Flow measurement unit in the form of ultrasonic flow transmitter shall be provided in the common header of the raw sewage Pumps.

4.6 Secondary Treatment Process.

Screened, de-gritted sewage shall be fed into the Secondary Biological Treatment system to meet the treated effluent quality prescribed in 4.11.

4.7 Chlorination System

The Treated Sewage from the Secondary treatment units will be collected in a chlorination tank where chlorine will be added for disinfection at suitable dosing rate with necessary mixing arrangements. The treated sewage is to be disposed into the water stream by suitable outfall arrangements.

4.8 Sludge Handing System

The sludge from the Treatment Plant shall be collected in a sludge sump where it is aerated continuously for mixing. The aerated sludge shall be treated through mechanical dewatering system with required aeration and polymer dosing before de watering. Safe disposal of sludge can be proposed by any one of the processes namely thickening, digestion, aeration and de watering. The sludge cake shall be transported to the compost yard of the municipality in a safe manner. The centrate shall be re circulated into the inlet of the receiving chamber.

4.9 Design criteria:

The process considered shall be one among the technologies mentioned in 2.1 for treatment of sewage. The Tenders are to adopt the same nomenclature used for various treatment units in their design report as used in the tender documents.

The STP shall be designed for 31 mld capacity. The land provided is for augmenting the capacity to the ultimate flow of 45 mld. The General Arrangement Drawing (GAD) of STP units, both for intermediate stage flow of 31 MLD and Ultimate stage flow of 45 MLD shall be provided; supported by hydraulic sizing calculation, and showing the arrangements of roads, drains and green belt all around and administrative blocks/laboratories/ other utilities and buildings. The unit arrangements shall be optimized as much as possible. However the detailed design shall be furnished for only 31 mld.

To the extent possible, the plant must be designed in modules so as to augment the capacity as and when the plant reaches its designed capacity. It is also informed that the expected sewage flows can not be generated immediately after construction and that they are likely to increase gradually and that the STP should be able to perform at the designed levels with these low flows.

The process design of various units shall be done as per the norms prescribed in the CPHEEO Sewerage Manual (Latest Edition) and with the following criteria for guidelines. Any other specific criteria required for designing the units for the technology proposed by the bidder shall be get approved by the Employer by providing due justification.

4.	De gritting	Average flow –31 mld. No. of units-2 Nos.(Working-1 No, Stand by-1 No) Surface overflow rate – 960m^3/m^2/day Velocity –0.15m to 0.30m/sec Detention time-60sec.
5.	Primary Clarifier- Centrally driven if required.	Average flow –31 mld Peak factor –2.25 Overflow rate– 35-50m^3*/m^2/day(Avg flow) 80-120 m^3/m^2/day (Peak Flow)
6.	Aeration (for ASP)	Average flow –31 mld Peak factor –2.25 MLSS-3000-4000 mg/lit MLVSS/MLSS –0.80 F/M=0.3-0.5 kg BOD 5day/ Kg MLSS/day HRT- 4-5 Hours. Kg of O2 required/Kg of BOD removed-0.8 to 1.0 Return Sludge-25-50%
7.	Secondary Clarifier (if required) (for ASP)	Average flow –31 mld Peak factor –2.25 Overflow rate– 15-25m^3*/m^2/day(Avg flow) 40-50 m^3/m^2/day (Peak Flow)
8.	Sludge Handling Units	The sludge handling units have to be designed by the contractor as required in clause 4.8 of Chapter I, Section 5: Technical Specification
9.	Chlorine contact Tank	Dosage-10ppm Contact time- 30 minutes Average flow-31 mld
10.	Other Secondary Treatment system	Bidder to specify as per deign

Sl.No	Name of the Unit	Design parameter
1.	Receiving Chamber	Average Flow- 31 mld. Peak Factor-2.25 Detention Time-60 secs.
2.	Coarse screen	Average flow –31 mld. No. of units-2 Nos.(Mechanical-1 No, Manual-1 No) Approach velocity at Avg flow –0.3m/sec Velocity through screen at average flow- 0.6m/sec Velocity through screen at Peak flow- 1.2 m/sec
3.	Fine Screen	Average flow –31 mld. No. of units-2 Nos.(Mechanical-1 No, Manual-1 No) Approach velocity at Avg flow –0.3m/sec Velocity through screen at average flow- 0.6m/sec Velocity through screen at Peak flow- 1.2 m/sec

4.10 Raw Sewage Quality

An abstract of Raw Sewage Characteristics is indicated in the following Table:

Sr.	Parameters	Range	UOM
1)	Biochemical Oxygen Demand	320	mg/l
2)	Chemical Oxygen Demand	700	mg/l
3)	Total Suspended Solids	400	mg/l
4)	Total Kjeldahl Nitrogen (as N)	45	mg/l
5)	Total Phosphorus (as PO4)	10	mg/l
6)	Fecal Coliform	10^6	Nos./100ml
7)	Total Coliform	10^7	Nos./100ml
8)	pH	6.5 to 8.5	
9)	Oil & Grease	15	mg/l

4.11 Treated Effluent Quality

The contractor shall design the process in such a way that the treated effluent quality attains the following limits or even better.

S. No.	Parameters / Pollutants		Values
1)	Biochemical Oxygen Demand	:	Less than or equal to 10 mg/l
2)	Chemical Oxygen Demand	:	Less than or equal to 100 mg/l
3)	Total Suspended Solids	:	Less than or equal to 10 mg/l
4)	Fecal Coliform	:	Less than or equal to 200 MPN /100 ml
5)	Ph	:	6.5 to 8.5
6)	Oil & Grease	:	Less than or equal to 5 mg/l

4.12 Free Board

A Free Board of 0.5 m. should be provided in the each unit and designed accordingly.

4.13 Pathway and Staircase

RCC Platforms with GI railing shall be provided at the upper level to enable operation of the railings shall be provided around the entire periphery of the as well as for the platform. The entire structure is to be as per IS 3370 including the platform for the gates. RCC staircase 900 mm wide shall be provided for access from the ground level to the top of the unit & to the operating platforms with GI. Pathways for access to various units from the road shall be provided with appropriate precast tiles conforming to I.S specification.

5. As-built Drawings:

The contractor shall submit six copies with one set of originals of completion plans & LS plans as executed with all the details for all items of work including sewerage system, pumps, pumping main, pumping station & treatment plant. The contractor shall also submit all the above in a compact disc (in AutoCAD –2004) in a suitable readable scale as approved by the Engineer.

The contractor shall also submit six copies of operation & maintenance manual for all items of works for proper maintenance of the system in future. The successful contractor shall also maintain the entire system for a period of five years from the date of satisfactory commissioning of the project.

6. SPECIFICATION

6.1 INTERPRETATION:

In this contract the following works shall be understood as having the meaning herein assigned to them.

a) "Contractor" means the person or persons or firm or company contracting for the work specified, including his or their executors or administrators or legal representatives or successor.

b) "Engineer" means the Superintending Engineer or his representative or any other Engineer appointed from time to time by the CMWSS Board to act as such in connection with these works. Whenever any work is specified to be done or materials supplied to the satisfaction of the Engineer, it shall be taken as including his properly authorized assistance and duly authorized representatives.

c) "Works" mean works to be constructed, completed and maintained in accordance with this contract.

d) TNBP – Tamil Nadu Building Practice

e) IS – Indian Standard

f) ISS – Indian Standard Specification

g) BIS – Bureau of Indian Standards

II GENERAL SPECIFICATIONS

1. Contractor's Responsibility

The information given hereunder and provided elsewhere is given in good faith but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim whatsoever will be entertained on the plea that information supplied by the Engineers is erroneous or insufficient.

2. Construction Water

The Contractor shall make his own arrangement for the fresh water required for the manufacturing of the pipes, construction of civil works and testing of pipeline as well as for the potable water required for his factory & labour camps.

3. Construction Power

The Contractor shall make his own arrangement for supply of electrical energy required at his sites and the works from the Tamil Nadu Electricity Board.

The Contractor is forewarned that there can be interruptions in power supply for reasons beyond the control of the Tamil Nadu Electricity Board and therefore the Contractor is advised to make his standby arrangement to provide and maintain all essential power supply for his work area at his expense. The Contractor shall not be entitled to any compensation for any loss or damage to his machinery or any equipment or any consequential loss in progress of work and idle labour.

4. Survey

The Contractor shall, at his own expense provide and maintain survey stations which he may require to carry out the works and shall remove the same on completion of the works. The Contractor shall, at his own expense, carry out all the necessary surveys, measurements and setting out of the works and shall for this purpose engage qualified and competent engineering surveyors whose names and qualifications shall be submitted to the Engineer for his approval.

The Contractor shall for the purpose of checking the survey and setting out, provide to the Engineer all the assistance, which he may require. The surveyor shall be selected having appropriate experience and as far as possible, the same surveyor shall be provided throughout the contract period. Before commencing any work at any locations, the Contractor shall give the Engineer not less than two days notice of his intention to set out or give levels for any part of the work in order that arrangements may be made for

inspection. The Contractor shall provide for the sole use of the Engineer and his staff, all necessary survey instruments and other equipment and all technicians, labour and attendants which the Engineer may require for checking the setting out and marking of the works. The Contractor shall maintain in good working order at all time during the period of contract the instruments provided by him, for the proper setting out of the works. The Contractor shall make available at his own expense, any poles, staging templates.

5. Temporary Fencing

The Contractor shall, at his own expense, erect and maintain in good condition temporary fences and gates along the boundaries of the areas assigned, if any, to him by the Employer for the purpose of the execution of the works.

The Contractor shall, except when authorized by the Engineer, confine his men, materials and plant within the site of which he is given possession. The Contractor shall not use any part of the site for purposes not connected with the works unless prior written consent of the Engineer has been obtained. Access shall be made to such areas only by way of approved gateways.

6. Return of Labour and Plant

The Contractor shall supply to the Engineer by 9 a.m. every working day a return of the men employed by him and his sub-contractors on the previous working day and all of the work on which they were engaged specifying also the number employed in each trade. He shall also supply monthly any other returns which may be required as to the number of men and constructional plant employed and the nature and type of the work done.

7. Sanitary Facilities

The Contractor shall provide and maintain in a clean and sanitary condition adequate W.C.'s and wash places which may be required on the various parts of the site for use of his employees, to the satisfaction of the Engineer. The Contractor shall make all arrangements for the disposal of sewage or drainage in accordance with the directions of the Engineer.

8. Restricted Entry to Site

The Contractor shall get the prior permission of the Engineer before any person not directly connected with the works visits the site.

9. Existing Services

Drains, pipes, cables, overhead electric wires and similar services encountered in the course of the works shall be guarded from injury by the Contractor at his own cost, so that they may continue in full and uninterrupted use to the satisfaction of the Employer and the Contractor shall not store materials or otherwise occupy any part of the 'site' in a manner likely to hinder the operation of such services. Should any damage be done by the Contractor on any mains, pipes, cables or lines (whether above or below ground), whether or not shown on the drawings, the Contractor must make good or bear the cost of making good the same without delay to the satisfaction of the Engineer and of the Employer.

10. Local Roads and Haul Roads

The approach roads and other public roads in the state may be used by the Contractor to haul construction materials and equipment subject to restriction of load carrying capacity on the roads in particular over bridges and culverts. However, the Contractor will have to pay customary vehicles license and permit fees for use of public roads.

The Contractor shall plan transportation of construction materials to site in such a way that road accidents are avoided.

11. Permission for Road Cuts

Wherever the Contractor considers that it is necessary to cut through an existing road or track he shall submit details to the Engineer for approval, a minimum of seven days before such work commence.

In the event of cutting a road by the Contractor without permission from the Engineer the Contractor shall pay compensation as claimed by the owner of the road until it is restored at the cost of the erring Contractor.

Trench Digging:

Digging of trench by the Contractor beyond the length than that is specified by the Engineer shall invite a fine of Rs.500/- per day till such time the damage is restored.

12. Temporary Diversion of Roads

During the execution of the works the Contractor shall make at his cost all necessary provision for the temporary diversion of roads, cart-tracks, footpaths, drains, water courses, channels etc., Should he fail to do so, the same shall be done by the Engineer and the cost thereof will be recovered from the Contractor.

13. Notice to Telephone, Railways & Electricity Supply under Takings / Depts., etc.

The Employer shall deposit an amount to the respective local bodies/Highways department for restoration of road surface after completion of pipe laying work. The Employer shall obtain general permission to cut the road.

Before commencing operations the Contractor has to obtain specific permission from local bodies/Highways Department when he wants to cut any section of the road. Where operations involve cutting of roads, shifting utilities etc. during the process of work, the Contractor shall also give notice to the concerned authorities viz. the panchayats/ the Municipalities, the Railway department, the Electricity Board, Telegraphs department, the Traffic department attached to the police and other departments or companies as may be affected by the work. The notice should identify the specific details so that the necessary diversion of traffic may be arranged and permissions obtained. The Contractor shall co-operate with the department concerned and provide for necessary barricading of roads, protection to existing underground cables etc. met with during the excavation of trenches. The Contractor shall provide at his own expenses watching and lighting arrangements during day and night and erect required notice board such as “Caution Road closed for Traffic” etc. He should also provide and maintain at his own cost the necessary supports for underground cables etc. to afford best protection to them in consultation with the authorities in-charge of the properties and to their best satisfaction. The Contractor has to make necessary arrangements to get supply of electricity from TNEB for operating the machinery and equipments. The Employer will pay the necessary service connection and S.D. charges. The Contractor should obtain all approvals for the installation and commissioning of machinery and accessories offered by them from the respective inspecting authorities such as CEIG or CIFG etc., Fees if any, to be paid to the inspecting authorities will be reimbursed by the Employer.

14. Barricading

The pit / trench shall be barricaded on all four sides. The Contractor who has dug up the trench shall be responsible for any mishap, which may occur. Non-barricading of trenches by the Contractor shall be liable for a fine of Rs.500/- per day.

15. Length of Trench Open at One Time

The Pipe line shall be excavated in such length as may be ordered by the Engineer depending on the nature of the ground, the depth from the surface and the risk of damage to the adjoining property. The pipes shall not be covered until they may have been tested to the satisfaction of the Engineer. But in bad ground in close proximity to buildings or in other places where the Engineer shall consider necessary he may limit the length of trench so that there shall not be more than three pipes lengths from the refilled trench to the unbroken ground ahead.

16. Watching and Lighting

The Contractor shall at his expense provide at the site of work sufficient lighting and watching and fencing by night and by day and shall in every respect conform to the police regulations in these matters and he shall free and relieve the Employer, Should he neglect to do so, the same shall be provided by the Engineer and the cost thereof will be recovered from the Contractor.

17. Filling in Holes and Trenches Etc.

The Contractor immediately upon completion of the Works shall fill up holes and trenches which may have been made or dug, level the mounds, or heaps or earth that may have been raised or made, and clear away all rubbish which may have become superfluous or have been occasioned or made in the execution of the works, and the Contractor shall bear and pay all costs, charges etc. Failure to carry out the work within two days will attract a fine of Rs 500/- per day.

18. Power to Vary Work

The Engineer reserves the power to vary, extend or diminish the quantities of Work, to alter the line, level, or position of any work to increase, change or decrease the size, quantity, description, character or kind of any Work, to order the Contractor to execute the Works or any part thereof, by day or night Work, or to add or to take from the Work included in the contract as he may think proper without violating the contract and the Contractor shall not have any claim upon the Employer for any such variation, extension, diminution, alteration, increase, change or decrease other than for the Work actually done, calculated according to the prices tendered and accepted in this contract.

19. Extra or Varied Work

If the Engineer uses the power reserved to him under Clause 18 above an order in writing signed by the Engineer, shall be given to the Contractor to that effect and any Work executed under such order shall be paid for at the rates set forth in the Schedule of Prices prevailing at the time of execution where such rates in the opinion of the Engineer apply. This shall apply to unforeseen items of work which are not found in the Bill of Quantities. If the rates are not available in the Schedule of Prices, a rate or price shall be agreed upon between the Engineer and the Contractor in writing and failing their agreement the Contractor shall forthwith execute such order and the Engineer shall determine the rates or prices at which the work shall be paid of.

20. Free Flow of traffic

While executing the work, as soon as possible, the Contractor should allow as much traffic as possible on the roads/streets, by refilling the trenches cut across.

21. Tools and Plants

All tools and plants required for the work including sheet piles and timber for shoring and strutting, pump sets etc. shall be supplied by the Contractor at his own cost. The rate for

the relevant items of work are inclusive of all such tools and plants and apparatus required for the execution of the work.

22. Excess Materials

The Contractor shall be responsible for the procurement of required quantity of materials like pipes, specials, machinery, electrical items etc. Any materials procured for the work, if found excess due to any reasons after completion of the works, shall be taken back by the Contractor and the Employer / Engineer shall not be responsible for such excess materials. Amount paid if any for such excess materials shall be deducted from any bills payable to the Contractor.

23. Commissioning of Works

The Contractor shall be responsible for successful commissioning and stabilizing the plant before the commencement of operation and maintenance period of five years.

24. General

Before submitting the bids, the bidder should carefully go through all the bid documents, drawings and also inspect the place of work so as to get full and first hand knowledge of the site conditions based on which he has to quote his rate.
The process submitted should be a well-established process for treatment of sewage. The tenderness are to adopt the same nomenclature used for various treatment units in their design report as used in the tender document.

24.1 Accidents

It shall be the duty of the Contractor to arrange for the execution of the works in such a manner as to avoid the possibility of the accidents to persons or damage to the properties at any stage of the progress of work. Nevertheless he shall be held wholly responsible for any injury or damage to persons and properties which may occur irrespective of any precautions he may take during the execution of the works. The Contractor shall make good all claims and loss arising out of such accidents and indemnify the Employer from all such claims and expenses on account thereof.

24.2 Flood Damages etc.

The Contractor has to take risk insurance at his cost against losses due to unprecedented floods and other acts of God. No claim shall be entertained on this account and paid for.

24.3 Water and Lighting

The Contractor shall pay all fees and provide water and light as required from Municipal mains or other sources and shall pay all charges, therefor (including storage tanks, meters etc.) for the use of the works and workmen, unless otherwise arranged and decided on by writing with Engineer. The water used for the works shall be free from earthy vegetable or organic matter and from salts or other substances likely to interfere with the setting of mortar or otherwise prove harmful to the work and conform to relevant standards.

24.4. Rates

The Contractor shall particularly note that the accepted rates of the various items shall be inclusive of all incidental charges such as bailing by manual labour, dewatering, shoring etc. if found necessary during the execution and no extra shall be due therefore on any account during the currency of the contract, unless stated other wise.

24.5. Royalty Charges

The Royalty will be charged for the materials obtained from P.W.Department, or other Government quarries. Assistance as necessary will be given to the Contractor by the Engineer. No plot rent shall be charged for materials stacked on Employer's lands during the course of construction provided all such materials are removed within one month after the work is completed. Royalty or charges due in the case of private quarries and private bodies shall be paid by the Contractor.

24.6. Payment to Labourer

The Contractor should note, that in the event of emergency, he shall pay all Labourer every day and if this is not done, the Employer shall make requisite payment and recover the cost from the Contractor. The Contractor shall not employ any labourer below the age of 15 years.

24.7 Night Works

If night work is required to fulfill the agreed rate of progress and to complete the work within the period stipulated, prior written approval is necessary and all arrangement shall be made by the Contractor including lighting without any claim for extra rate.

24.8. Errors, Omissions and Discrepancies

In the case of errors, omissions, and/or disagreement between the written and the scaled dimensions on the drawings or between the drawings and the specifications, the following order of precedence shall apply;

i) In case of discrepancies in dimensions of any item of work as described between the descriptive specifications and detailed working drawings, the dimensions given in the detailed working drawings shall apply.

ii) In case of discrepancies in description of scope of work between what is indicated in the item of work given in Bill of Quantities and the corresponding detailed technical specifications, the latter shall apply.

iii) Figured dimensions shall supersede scaled dimensions. The drawings on a large scale shall take precedence over those on a smaller scale.

iv) Drawing issued as construction drawings from time to time shall supersede the corresponding drawings previously issued.

24.9. Equivalence of Standards and Codes

Whenever reference is made in the contract to the respective standards and codes in accordance with which plant, equipment or materials are to be furnished and work is to be performed or tested the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly set forth in the contract. Where such standards and codes are national in character, or relate to a particular country or region, other authoritative standards which ensure equal or higher quality than the standards and codes specified will be accepted subject to the prior review and written approval by the Engineer. Difference between the standards specified and the proposed authoritative standards must be fully described in writing by the Contractor and

submitted to the Engineer well in advance for approval. If on the prior review, the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards set forth in the contract document.

24.10 Bidder to Satisfy Himself

It will be the Contractor's responsibility to satisfy himself from the inspection of the site that sufficient quantities of construction materials required for the works exist in the designated borrow areas and quarry sites.

Failure by the Contractor to have done all the things, which in accordance with this condition he is deemed to have done shall not relieve him of the responsibility for satisfactorily completing the work as required.

24.11 Employment of Scarcity Labour

If Government of Tamil Nadu declares a state of scarcity or famine to exist within 16 kms. of the project site, the Contractor shall be required to employ in his works for which he will need unskilled labour and to the extent his works can accommodate any person or persons certified to him by the Engineer to be in need of relief and the Contractor shall pay to such persons wages not below the minimum wage which the Government may fix in this behalf from time to time.

24.12 All labourers and other employees of the Contractor should be covered by a suitable accident insurance policy to cover liabilities under the Workman's Compensation Act.

24.13 Electricity Tariff

The unit rates and prices quoted by the Bidder in the Bill of Quantities shall include the cost of electric energy required for construction at the rates fixed by the Tamil Nadu Electricity Board.

III GENERAL SPECIFICATIONS FOR MATERIALS AND CIVIL WORKS

A. Materials

All materials required for the works shall be procured and supplied by the contractor himself. The materials shall be of good quality and conforming to relevant BIS. The materials which are classified for ISI marking should be supplied with ISI marking only.

1. Cement and Reinforcement:

1.1 The entire quantity of cement and steel required for the work will be procured by the contractor. The contractor is responsible for all transport and storage of the materials and shall bear all related costs. The Employer shall be entitled at any reasonable time to examine the cement and steel supplied by the contractor.

1.2 The cement procured by the contractor shall comply with the requirements of IS 269/ 1976 with the latest revision thereof for 33 grade ordinary Portland cement and IS 12330/ 2001 for Sulphate resistance cement, IS 8112/1989 with the latest revision thereof for 43 grade ordinary Portland cement IS: 12269-1987 with the latest revision therefore 53 grade ordinary Portland cement. It shall be of the best normal setting quality unless specially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. Each bag shall bear ISI Certification mark and as per specification no. 10 of TNBP volume I.

Corrosion Resistance Steel and Structural Steel:

1.3 The steel bars shall comply with the requirements set forth in the BIS Codes (Grade Fe 415, BIS Code 1786-1985) as the case may be with the latest revision thereof and the test as described for ultimate tensile strength, bend test and elongation tests.

All reinforcing steel shall be clean and free from oil, grease, loose scales or rust or other coatings of any character which would reduce or destroy the bend. Each bundle containing the bars shall bear the ISI Certification mark. All the steel bars should be **fusion bonded** Epoxy Coated as per specification of IS 13620:1993.

1.4 The cement/ steel shall be tested in nearby laboratories of Polytechnic or Engineering College by the Employer. Two samples should be taken by the Engineer in charge in the presence of the contractor or his authorized representatives or the technical personnel employed by the contractor as in the agreement. The contractor shall without extra cost provide samples and cooperate in the testing of the cement/ steel. One sample shall be got tested and the other sample shall be retained by making clear identification in the sample by the Engineer in charge so as to identify at a later date. The cost of such test shall be borne by the contractor.

1.5 All cement shall be procured in bags and shall be stored in a dry place for which the contractor shall be responsible. Consignment of bagged cement shall be properly stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in approximately in the chronological order in which it is received, but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be used unless it has been retested at the expenses of the contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 180 days from the date of initial sampling shall be rejected.

1.6 Cement which has become caked or perished shall on no account be used on the works and shall be rejected. Although the Engineer may have passed any consignment, he shall however have the power at the subsequent time to reject such consignment if he finds that any deterioration in the quality thereon has taken place.

1.7 A record of the quantity of cement/ steel procured with the name of dealer, bill number and date shall be maintained by the contractor. This should be produced for examination by the Engineer in charge at any time. The age of the cement shall be reckoned from the date of manufacture and it shall be verified by the Engineer in charge.

1.8 The rejected consignment of cement and steel should be removed from the site within two days.

2. Aggregates:

2.1 Sand for use in masonry and plaster works shall conform to relevant specification in TNBP (specification No.7) and I.S.2116/ 1985, I.S.1542/ 1977.

2.2 The coarse and fine aggregates for concrete shall conform to I.S.383/ 1970 and as specified in the relevant clauses of I.S.456/2000. Other aggregates free from deleterious materials shall be used at the concurrence and approval of the Engineer after sufficient tests have been carried out at the contractor's cost.

2.3 The maximum quantities of deleterious materials in the aggregates, as determined in accordance with I.S.2386 (Part II)/ 1963 shall not exceed the limits given in table I of I.S.383. Unless otherwise specified all coarse aggregate in RCC shall be graded aggregate of 20mm nominal size. All aggregates shall be stored in hard impervious surface to ensure exclusion of all foreign materials and as per IS 4082/1996 and specification no. 5 of TNBP volume I.

2.4 Aggregate having a specific gravity below 2.6 (saturated surface dry basis) shall not be used without the special permission of the Engineer.

3. Bricks:

3.1 Manufacture:

Common burnt clay building bricks shall conform to the requirements of IS 1077 and shall be of quality not less than class 50 with moisture absorption rate not exceeding 15% as defined in IS: 1077. The bricks shall be chamber burnt and shall not be damaged in any manner and sizes shall conform to the works sizes specified with tolerance as given in 6.2 of IS: 1077.

3.2 Samples:

The Contractor shall deliver samples of each type of brick to the Engineer, and no orders shall be placed without the written approval of the Engineer. All the bricks used in the works shall be of the same standard as the approved samples. The samples shall be preserved on site, and subsequent deliveries shall be checked for uniformity of shape, colour and texture against the samples. If in the opinion of the Engineer any deliveries vary from the standard of the samples, such bricks shall be rejected and removed from the site.

3.3 Uniformity:

The bricks selected for exposed pointed brickwork walls shall be of uniform colour, deep cherry red or copper colour and uniform texture. Only such bricks as are permitted by the Engineer shall be used.

3.4 Testing:

Samples of the bricks shall be tested in accordance with IS: 3495 by the Contractor for compliance with the aforesaid, before any order is placed, and soon after receipt of a

consignment. Tests shall be carried out as and when required by the Engineer on samples selected by the Engineer's representative.

B CIVIL WORKS

4. General:

4.1 Tamil Nadu Building Practice (TNBP) shall be strictly followed for carrying out different items of the work for which no standard specifications are available and no alternate specifications have been given under the description of works.

4.2 Where any provision of the TNBP is repugnant to or at variance with any provision under BIS or description of work, technical specifications and conditions of contract, the provisions of the latter shall be deemed to supersede the provision of the TNBP.

4.2 Design Considerations:

4.2.1 Design Submissions

The contractor shall be responsible for the safety of structures, correctness of design and drawings, even after the approval of the same by Engineer-in-Charge. Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to the Engineer-in-charge. Separate calculations for foundations or superstructures submitted independent of each other shall be deemed to be incomplete and will not be accepted by the Engineer-in-charge.

The design considerations described hereunder establish the minimum basic requirements of plain and reinforced concrete structures, masonry structures and structural steel works. However, any particular structure shall be designed for the satisfactory performance of the functions for which the same is being constructed.

4.2.2 Design Loading

(a.) General

All buildings and structures shall be designed to resist the worst combination of the following loads/ stresses under test and working conditions: dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials dynamic load, vehicular load and uplift pressure etc.

i) Dead Load

This shall comprise all permanent construction including walls, floors, roofs, partitions, stairways fixed, service equipments and other items of machinery. In estimating the loads of process equipment for the purpose of design, the empty weight of the equipment including all fixtures and attached piping, but excluding contents, shall be considered. Dead loads shall be taken as per relevant BIS codes.

ii)Live Load

Live loads shall be in general as per BIS: 875. However, the following minimum loads shall be considered in the design of structures:

a) Live load

- Building (non – plant) : 250 kg/sq.m.
- Roof of Building Structures : 150 kg/sq.m.

b) Live load on floors supporting equipment : 1000 kg/sq.m. as pumps, blowers, compressors, etc.

c) Live load on all other floors and : 500 kg/sq.m. Walkways /cable trench covers. Live load on roof of Tanks/Plant : 250 g/sq.m

d) structure

e) Live load on Stairways : 500 kg/sq.m.

f) Surcharge load for underground : As per actual condition structures, if any

g) Equipment load : As per manufacturers specification

In the absence of any suitable provisions for live loads in BIS codes or as given above for any particular type of floor of structure, assumptions made must receive the approval of the Department / prior to taking up the design work. Apart from the specified live loads or any other load due to material stored, any other equipment load or possible overloading during maintenance or erection shall be considered and shall be partial or full whichever causes the most critical condition.

iii)Wind Load

Wind loads shall be as per BIS: 875.

iv) Earthquake Load

Earthquake load shall be computed as per B.I.S. 1893 taking into consideration soil foundation system, importance factor appropriate to the type of structure, basic horizontal seismic coefficient/ seismic zone factor & average acceleration coefficient as applicable.

An importance factor of 1.5 shall be considered for design of all the structures. The soil foundation system coefficient shall be considered as 1.2.

V) Dynamic Load

Dynamic Loads due to working of machines/ equipments such as pumps, blowers, compressors, switch gears, travelling cranes, etc., shall be considered in the design of structures as given by the manufacturers or in BIS code, which ever is more.

IRC Class AA (wheeled vehicle) loading shall be considered for design of structures under or by the side of roads.

4.2.3 Design Conditions for Underground or Partly Underground Liquid Retaining Structures

Liquid retaining/conveying structures including the members covering the same (such as roof of a chamber, channel etc.) shall be designed by uncracked method of design as per BIS: 3370 and 6494. Basement RC walls and slabs below ground shall also be designed by uncracked method of design as liquid retaining structures. Shear shall be checked by working stress method as per BIS: 456. Minimum temperature and shrinkage reinforcement shall be 0.3% in each direction.

All underground or partly underground liquid containing structures shall be designed for the following conditions:

a) liquid depth up to full height of wall including free board : no relief due to soil pressure from outside to be considered;

b) structure empty (i.e. empty of liquid, any material, etc.) : full earth pressure and surcharge pressure wherever applicable, to be considered;

c) partition wall between dry sump and wet sump : to be designed for full liquid depth up to full height of wall; i/c free board

d) partition wall between two compartments : to be designed as one compartment empty and other full including free board;

e) Structures shall be designed for uplift in empty conditions with the water table and due care should be taken for seasonal variation on higher side. Factor of safety against uplift shall be 1.2.

f) walls shall be designed under operating conditions to resist earthquake forces from earth pressure mobilization and dynamic water loads;

g) Underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures below base slab. The design shall be such that the minimum gravity weight (empty conditions) exceeds the uplift pressure at least by 20%.

h) For design purpose, sub soil water level is to be considered as one meter below the average natural ground level.

4.2.4 Foundations

An indicative topography survey and soil investigation report has been enclosed with the bid documents. All the data and details as provided are indicative only and bidders are advised to verify them before submission of their offers. No extra payment shall be made against any discrepancies in the above documents.

Foundation depths and the type of footings shall be appropriately computed from the parameters given in the soil report or obtained during the soil testing by the contractor whichever is stringent, and got reviewed and approved by department. Earth fill above virgin ground level till formation level shall be taken as a surcharge load and shall be added in the loads coming on foundations appropriately. In some special cases, where contractor wishes to provide the footing in continuation of the sloping floor and taking the wall footing to the minimum depths as mentioned below is not possible, the shortfall

(i) The minimum depth of foundations for all structures, equipments, buildings and frame foundations and load bearing walls shall be as per the recommendation of BIS provided adequate bearing pressure is available at that depth.

(ii) Bearing capacity of soil shall be determined as per BIS: 6403.

(iii) Care shall be taken to avoid the foundations of adjacent buildings or structure foundations, either existing or not within the scope of this contract. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. No extra claims for such adjustments shall be accepted by PMC.

(iv) A structure subjected to groundwater pressure shall be designed to resist floatation. The dead weight of empty structure shall provide a factor of safety of 1.2 against uplift during construction and service.

(v) Where there is level difference between the natural ground level and the foundations of structure or floor slab, this difference shall be filled up in the following ways.

a) In case of non-liquid retaining structures the natural top soil shall be removed till a firm strata is reached (minimum depth of soil removed shall be 500 mm) and the level difference shall be made up as per specifications. However the thickness of each layer shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction.

b) 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 of M-10 grade.

(vi) Wherever the plinth level is above the ground level, a curtain wall shall have to be provided from plinth level upto 300 mm below ground level, but not less than 1m in total height.

(vii) If pile foundations are used, the contractor shall conduct the initial routine test as per IS 2911 at his own cost, to determine the safe load bearing capacity of piles.

If pile foundations are considered desirable by the tenderer for some/all the units the piles shall be *bored cast-in-situ piles* only. To verify the load carrying capacity of the piles a minimum of two initial load tests shall be conducted and routine load tests as required as per the relevant BIS code shall also be conducted. Soil report should provide capacity of various dia. of pile considering the lowest sub soil condition. Under reamed piles shall not be allowed.

Pressure Release Valve Use of pressure release valves to reduce uplift pressure due to ground water table shall not be allowed.

4.2.5 Design Requirements

4.2.6 General

a) The Civil & Structural design shall be carried out in accordance to BIS: 456 and BIS: 3370 -2009 and other relevant Indian Codes. For the seismic forces, the structure should be designed as per IS: 1893 and all the factors as applicable.

Special care should be taken for design of base slab of Tanks having liquid depth more than 5 meter such base slabs should be designed for a settlement of 40 mm before laying the mud mat concrete. The area for the base slab should be compacted with Coarse Sand till 90% proctor density is achieved.

The following are the design requirements for all reinforced or plain concrete structures.

a) All blinding and leveling concrete shall be of minimum 100 mm thickness of concrete mix- M15, unless otherwise specified.

b) Liquid Retaining Structures/Buildings:

All structural reinforced cement concrete shall be M30 as per IS 456:2000 for severe condition and shall be designed as per IS 3370:2009.

c) The minimum reinforcement in walls, floors and roofs of liquid retaining structures in each of two directions at right angles shall be 0.3% using HYSD bars.

d) All buildings shall be provided with damp proofing for basement and floors and water proofing for roofs as specified in specific requirements.

e) Any structure or pipeline crossing below roads shall be designed for Class AA of IRC loading or as classified by the respective authority. NP3 RCC pipe (with encases) shall be used below roads inside the plant.

f) All pipes and conduits laid below the structural units such as PST, FST etc. shall be embedded in reinforced concrete of grade M30 of minimum thickness 150 mm.

f) Suitable admixtures may be used with the approval of engineer in charge.

(b) Minimum Thickness

The following minimum thickness shall be used for different reinforced concrete members, irrespective of design thickness.

(i)	Walls for liquid retaining structures except at (x)	:	200 mm
(ii)	Roof slabs for liquid retaining structures (other than slabs)	:	150 mm
(iii)	Bottom slabs for liquid retaining structures	:	200 mm
(iv)	Floor slabs including roof slabs, canopy walkways, slabs	:	125 mm
(v)	Wall of cables/ pipe trenches,	:	150 mm
(vi)	Column footings	:	300 mm
(vii)	Parapets, Chajja	:	100 mm
(viii)	Pre-Cast trench cover	:	75 mm
(ix)	Beams, columns	:	230 mm
(x)	Channels, launder	:	150 mm

5. Earth Work:

5.1 Specification

Tamil Nadu Detailed Building Practice (specification No.23 to the extent applicable) shall be followed for earthwork excavation.

5.2 Conveyance

The excavated earth, blasted rubble etc., shall be conveyed and deposited in suitable places as directed by Engineer in charge within 150m of plant site on one side of the trench only.

5.3 Disposal of Surplus Earth

The excavated soil which is surplus to that required for refilling and after allowing for settlement will have to be removed, spread and sectioned at places shown on the site during execution shown by the Employer within a radius of 5km from the site. Sectioning is to be done as detailed in TNBP. It is to be understood that no extra payment, will be made for this. The cost of removal of surplus earth after spreading/leveling/sectioning at site approved by the Engineer-in-charge to the disposal site will be borne by the Contractor by himself.

5.4 Shoring, Strutting and Baling out Water

While baling out water during excavation, care should be taken to see that the bailed out water is properly channelised to flow away without stagnation or inundating the adjoining road surfaces and properties.

All costs towards shoring, shuttering and baling out of water will be borne by the Contractor.

6. Concrete:

6.1 Specification

Concrete for use in the works shall generally comply with TNBP (specification No.30) and the relevant BIS. The concrete mix design shall be in specified proportions satisfying the maximum aggregate size, water cement ratio and required cube strength and workability as per IS 456-2000. Such concrete must be adequately vibrated to form solid mass without voids. The entire concreting works should be done only with the prior approval and in the presence of Engineer in charge.

6.2 Mixing of Concrete

The concrete shall be proportioned as far as cement and aggregates are considered by volume. The amount of water required being measured either by weight or volume. The adjustments must be made to frequent intervals at the discretion of the Engineer or his assistant to account for the moisture content of the aggregates. The mixing operation shall be performed only in a mechanical concrete mixer and shall continue until the whole batch of uniform consistency and colour is achieved. The mixing of concrete shall be done in accordance with clause 8 and 9 of IS 456-2000.

6.3 Transporting, Placing and Compacting Concrete

6.3.1 Transportation, placing and compaction of concrete mix by mechanical vibrators shall be done in accordance with clause 12 of IS 456-2000. It is imperative that all concreting operations be done rapidly and efficiently with minimum rehandling and adequate manpower shall therefore be employed to ensure this.

6.3.2 The forms shall be first cleaned and moistened before placing concrete.

6.3.3 The mix should not be dropped from such a height as it may cause segregation and air entrainment. When the mix is placed in position, no further water shall be added to provide easier workability.

6.3.4 No concrete mix shall be used for the work if it has been left for a period exceeding its initial setting time before being deposited and vibrated into its final position in the member.

6.3.5 While one concrete is being placed in position it shall be immediately spreaded and ramped sufficiently to attain dense and complete filling of all spaces between and around the reinforcement and in to the corners of form work for ensuring a solid mass entirely free from voids.

6.3.6 Construction joints required in any of the structural members shall be provided generally complying with clause 12.4 of IS 456-2000 and as directed by the Engineer in charge. The efficiency of tempering and consolidation will be judged by complete absence of air pockets, voids and honey combing after removal of form works.

6.4 Curing

6.4.1 Curing shall be done to avoid excess shrinkage or harmful effort to the members generally complying with clause 12.5 of IS 456-2000.

6.4.2 The method adopted shall be effective and any special method used must be approved by the Engineer and be subject to complete supervision.

6.4.3 Any deficiency in concreting such as cracking, excessive honeycombing, exposure of reinforcement or other fault which entail replacement of the defective part by fresh concrete and whatsoever remedy reasonable required without hampering the structural safety and architectural concept, all at the cost of contractor.

6.5 Removal of Form Work.

6.5.1 Removal of form work shall be done as per T.N.B.P. and as per I.S.456/2000 and as directed by the engineer in such a manner that no damage is caused to the concrete work.

6.6 Testing of Concrete.

6.6.1 During the course of construction works, preparation of test specimens, curing and casting of concrete shall be done in accordance with IS 1199 and IS 516 to ascertain the strength requirements and acceptance criteria indicated in IS 456-2000.The contractor shall provide all apparatus, labour and arrange to test the cubes at his own cost at the test laboratory decided by the Employer.

6.6.2 In addition to the above tests, any other test which may if desired by the Engineer in charge be carried out from time to time as per relevant specifications at the cost of contractor. In case the concrete does not meet the strength required, all corrective measures shall be taken at once at the contractor's cost.

6.6.3 The inspection and testing of structures shall be done in accordance with clause 16 of IS 456/ 2000.

7. BRICK WORKS

7.1 .Laying:

Brickwork shall be uniformly bedded, bricks being laid upwards. Each brick shall be floated and rubbed in upon such sufficient quantity of mortar that the mortar is squeezed up into the joints, but if such joints are not filled with mortar by this process they shall be flushed up with the mortar from the next succeeding bed. The courses shall be laid truly and strictly to line and horizontal level.

7.2. Bond:

Brickwork courses shall be alternately laid in stretcher bond and header bond. Damaged bricks shall not be used. The greatest care shall be taken to prevent mortar dropping on to or in any other way disfiguring or discoloring the bricks, and all edges and sides shall be kept strictly plumb and square, in-line, and flush with the required finished face. As the work proceeds, it shall be continuously checked with a 2 m long straight edge and spirit level.

7.3 Construction:

Walls shall be carried up in a uniform manner and no one portion raised more than 1 m above another at any one time, the open end being racked out. Over-hang work shall in no case be permitted. Brickwork shall be cleaned down after each day's work and newly laid brickwork shall be protected by suitable means.

7.4. Dry Weather:

In dry weather the suction rate of clay bricks shall be adjusted by wetting as necessary before use. Bricks shall be stored in a free draining area and protected from rain.

7.5. Lintels:

Where brickwork rests upon lintels or supporting ribs of concrete, the bricks shall be cut as necessary and carefully bedded so that proper support to the outer leaf of brickwork is obtained.

7.6 Pointing:

At the time of laying, all joint of exposed brickwork shall normally be raked out neatly and pointed to 15mm depth.

7.7 Approval:

All workmanship shall be strictly in accordance with the foregoing. The Engineer or the Engineer's representative reserves the right to reject any of the work on grounds of shabby workmanship. Such rejected work shall be removed and rebuilt to the Engineer's satisfaction.

7.8 Quantity of Mortar:

Quantity of mortar to be used in one Cum. of masonry shall vary from 0.30 Cum. for thin masonry to 0.32 Cum. for massive masonry of conventional bricks.

7.9 Cement Mortar:

The cement mortar to be used on the work should be generally conforming to specification No.13 of TNBP. Only sufficient mortar shall be mixed as required for immediate use. Partly set mortar shall not be used.

8. Water required for Construction:

8.1 The water used in the construction shall be of potable quality and shall be tested at the contractor's cost. The contractor has to make his own arrangements at his cost for water required for construction, testing, filling, etc., either from local bodies or from elsewhere, by paying the charges directly and arranging tanker etc., as per necessity. No claim for extra payment on account of non availability of water nearby or extra lead for bringing water shall be entertained. All required piping arrangements and pumping if required for water shall be made by the contractor at his cost. Water for mortar, mixing and curing of concrete shall be free from harmful matter or other substances that may be deleterious to concrete or steel and taken from a source approved by the Engineer. Ground water for mixing and curing shall conform to the provisions in the class 4.3 of IS 456/ 2000.

9. Admixtures:

Only where a beneficial effect is produced shall any admixture be used and that too after test has been carried out to convince the Engineer that no harmful effect will be produced by the use of such admixture and after approval by the Engineer. The admixture shall conform to IS 9103/ 1972

10. Form Work and Centering

10.1 Steel/ wooden form centering shall be used. If wooden form work is used, it shall consist of planks not less than 40mm thick and strong props. This shall be provided complying with clause 10 of IS 456/ 2000 and specification no.30.8 of TNBP. The timber for form works shall be best hard wood and got approved by the Engineer in charge.

11. Separator (Cover Block)

11.1 For bottom cover of beams, slabs etc., separators of pre cast cement mortar blocks of suitable size with wire embedment as directed shall be used and tied to the reinforcement. Between layers of reinforcements, separators consisting of pieces of bars of suitable diameter shall be used. The required cover shall be provided as per clause 24-4 of IS 456/ 2000.

12. Masonry:

12.1 All masonry works such as Random Rubble / Coarse Rubble / Brick work must be done as per TNBP Specification.

13. Plastering:

13.1 Plastering would be 12mm, 20mm and 25mm thick cement plaster either plain or with water proof cement as may be specified.

13.2 The plastering items shall be executed in thickness and cement mortar of proportion as required. Similarly the plastering shall be either ordinary or with water proof for components as required.

13.3 In case of water proof plaster standard and approved water proofing compound shall be mixed in cement mortar in required percentage as directed and then the plaster is applied.

13.4 The finishing shall be either smooth or rough as may be directed by the Engineer unless otherwise specifically mentioned in the BOQ.

13.5 Neeru finish wherever directed by the Engineer shall be done at no extra cost.

13.6 Curing and watering shall be done as directed and plaster shall be in alignment and level. Any substandard work is liable to be rejected and shall have to be re-done at contractors cost. Sand to be used shall be of approved quality only.

14. Flooring:

14.1 If cement concrete shall be provided for flooring, it shall be with minimum M20 grade with 40 mm thickness. The size of metal shall not be more than 12 mm and it shall be properly graded. A thin coat of very fine plaster shall be provided on top to give a smooth finish. The marking of false grooves to surfaces shall be made as directed.

15. Doors and Windows:

15.1 The work shall be executed as per the requirements viz. Plain planked paneled, glazed, etc., and fixture, etc., as required. Iron bars for windows and ventilators are to be provided as per specifications in TNBP.

15.2 The design of shutters and quality of wood shall be got approved form the Engineer-in-charge before manufacture. The CW/TW to be used for woodwork shall be uniform in substance straight, free from large deed knots, flows flanks. The work shall be done as per specification of TNBP latest edition. The joints shall be perfect.

15.3 Part of wood embedded in masonry shall be painted with the tar. The frames of doors, windows, ventilators, etc., shall have proper hold-fasts embedded in masonry.

15.4 The painting shall be done as per the specifications. No painting, however, shall be permitted till the woodwork is approved by the Engineer-in-charge.

15.5 Any substandard work not conforming to the specifications are liable to be outright rejected and Executive Engineer's decision in such cases shall be final and binding on the Contractor.

16. Painting:

16.1 The work shall be carried out as directed by Engineer-in-charge. It shall be white washing, distempering and /or cement painting. Shade and make shall be as directed by the Engineer and for decorative purpose, Engineer may ask for different shades to be provided for different components or different parts of the same component which the Contractor shall have

to do at no extra cost to the Employer. The priming coat as directed, scaffolding, etc., shall be included in the estimate as per the specifications of TNBP for painting.

In general, all items of works must be done as per TNBP specifications.

17. Architectural Details of the Building:

Building	Storage	Room Type	Main Structural Construction	Plinth Height (mm)	Ceiling Height (mm)	Roof	Wall		Flooring	Doors / Windows			Plaster			Painting			Roof Water Proofing
							Ext. (mm)	Int. (mm)		Door	Window	Roll. Shutter	Ext.	Int.	Ceiling	Int.	Ext.	Ceiling	
Chlorine House (As required)	Ground Floor		RCC Framed	500	5000	RCC	230	115	Acid / Alkali Tiling / Kota	Teak	Acrylic Powder Coated	MS	20 mm thk. In CM 1:4	12mm thk. In CM 1:4	6mm thk. In CM 1:3	Oil bound distemper 2m high dado in acid	Cement Paint	White Wash	India Water Proofing on Brickbat Coba or equivalent
Administra - tion cum laboratory (60 sqm)	Ground Floor	Foyer		500			230	115	Vitrified Tiles	Teak	Al. Glazed Powder Coated with vanishing blinds		20 mm thk. In CM 1:4	12mm thk. In CM 1:4	6mm thk. In CM 1:3	Luster Paint	Cement Paint	Luster Paint	India Water Proofing on Brickbat Coba or equivalent
		Plant in charge room							Vitrified Tiles	Teak	Al. Glazed Powder Coated with vanishing blinds		20 mm thk. In CM 1:4	12mm thk. In CM 1:4	6mm thk. In CM 1:3	Luster Paint	Cement Paint	Luster Paint	India Water Proofing on Brickbat Coba or equivalent
		Staff Room							Vitrified Tiles	Teak	Al. Glazed Powder Coated with vanishing blinds		20 mm thk. In CM 1:4	12mm thk. In CM 1:4	6mm thk. In CM 1:3	Luster Paint	Cement Paint	Luster Paint	India Water Proofing on Brickbat Coba or equivalent

Building	Storage	Room Type	Main Structural Construction	Plinth Height (mm)	Ceiling Height (mm)	Roof	Wall		Flooring	Doors / Windows			Plaster			Painting			Roof Water Proofing
							Ext. (mm)	Int. (mm)		Door	Window	Roll. Shutter	Ext.	Int.	Ceiling	Int.	Ext.	Ceiling	
		Laboratory							Vitrified Tiles	Teak	Al. Glazed Powder Coated with vanishing blinds		20 mm thk. In CM 1:4	12mm thk. In CM 1:4	6mm thk. In CM 1:3	Luster Paint	Cement Paint	Luster Paint	India Water Proofing on Brickbat Coba or equivalent
		Toilet							Glazed	Sintex	Al. Glazed louvers					Oil Paint			
		Passage							Kota / Vitrified	Teak	Al. Glazed Powder Coated					Luster Paint		Luster Paint	
		Toilet for labourers	2 WC, 2 Bathing, 4 Urinals																

18. ROAD WORKS

18.1 GENERAL

Roads shall be 10m wide out of which 7.0 m wide in metalled portion with bituminous carpet and 1.5m berm on either side. The roads should be given suitable camber and longitudinal slopes. The cross section of roads shall be as per attached drawing no 2962/E/M-01.

The tenderer should include preparation of 500mm thick sub-grade to the required level and camber, leveling and dressing of the filling and compaction upto 97% of laboratory dry density as per IS : 2720 (Part 8) by vibro roller. The earth of soaked CBR value not less than 5% required for making the roads i/c embankment for access road will be arranged by the contractor at his own cost if required.

18.2 GRANULAR SUB BASE

18.2.1 Scope: This work shall consist of laying and compacting well-graded material on prepared sub-grade in accordance with the requirements of these specifications. The material shall be laid in one layer as sub-base to a 150mm thickness as necessary according to lines, grades and cross sections shown on the drawings or as directed by the Engineer.

18.2.2 Materials: The material to be used for the work shall be natural sand, murram, gravel, crushed stone or combinations thereof depending upon the grading required. The gradation is specified below.

Table 1: Grading for coarse-graded Granular Sub-base materials

Sieve Designation 75 mm 53 mm	**Percentage passing by weight Grade II** -100
26.5 mm	50-80
9.5 mm	-
4.75 mm 2.36 mm 0.425	15-35
0.075 mm	<10
CBR value	25

18.2.3 Physical requirements: The material shall have a 10 percent fines value of 50 KN or more when tested in compliance with BS: 812 (part 111). The water absorption value of the course aggregate shall be determined as per IS:2386 (part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to the site as per IS: 383 for grading II materials, the soaked CBR shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent and shall not be less than 30%.

Strength of sub-base: It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies requirement of soaked CBR and other physical requirements when compacted and finished.

When directed by the Engineer, this shall be verified by performing CBR tastes in the laboratory as required on specimens re-molded at Field dry density and moisture content and any other tests for the quality of materials, as may be necessary.

18.3 WET MIX MACADAM (WMM)

18.3.1 Scope: This work shall consist of laying and Compacting clean, crushed, graded aggregate and granular material, pre mixed with water, to a dense mass on a prepared sub base in accordance with the requirements of these specifications. The material shall be made in one or more layers as necessary to lines, Grade and cross sections shown on the approved drawings or as directed by the Engineer. Vibrating or other approved types of Compacting equipment shall be used, the compacted depth of single layer of WMM course shall be 150mm.

18.3.2 Materials

18.3.2.1 Aggregates:

Physical requirements: Coarse aggregates shall be crushed stone. If crushed gravel or shingle is used, not less than 90 percent by weight of the gravel or shingle pieces retained on 4.75mm sieve shall have at least two fractured faces. The aggregate shall conform to the physical requirements set forth in table 2.

Table 2: Physical requirements of coarse aggregates for WMM for sub-base or baseCourses

S. No.	Test	Test Method	Requirements
1	Los Angeles Abrasion value	IS: 2386 (part 4)	40 percent (max.) or
	Aggregate		
2	Impact Value	IS: 2386 (part4) or IS: 5640	30 percent (max.)
3	Combined Flakiness and	IS: 2386(part1)	30 percent (max.)
4	Elongation indices (Total)		

If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (part-5).

18.3.2.1 Grading requirements:

The aggregates shall conform to the grading given in Table 3.

Table 3: Grading requirements of aggregates for WMM

Sieve Designation the IS sieve	Percent passing by weight passing
53 mm	100
45 mm	95-100
26.5 mm	-
22.4 mm	60-80
11.2 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600 Microns	8-22
75 Microns	0-8

Materials finer than 425 micron shall have plasticity index (PI) not exceeding 6.

The final gradation approved within these limits shall be graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on adjacent sieve or vice versa.

18.4 DENSE BITUMINOUS MACADAM (DBM)

18.4.1 Scope: This work shall consist of construction, in a single course of 50 mm thick base course to the following specifications on a previously prepared WMM course with prime coat.

18.4.2 Materials

The bitumen shall be a paving bitumen of penetration grade S65 or A65 as per Indian standards specifications for "Paving bitumen" IS: 73. In case of a non-availability of bitumen of this grade, S90 grade bitumen may be used with the approval of Engineer.

18.4.2.1 Coarse aggregates: The coarse aggregates shall consist of crushed stone, crushed gravel or shingle or other stones. They shall be clean, strong, durable, of fairly cubical shaped and free from disintegrated pieces, organic or other deleterious matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity. If hydrophilic aggregates are to be used, the bitumen shall be treated with anti-stripping agents of approved quality in suitable doses. The aggregate should satisfy the physical requirements set forth in table-4 below.

If crushed gravel or shingle is used, not less than 90 percent by weight of gravel or shingle pieces retained on IS 4.75 mm sieve shall have a at least two fractured faces. The plasticity index of the fraction passing through the 425-micron sieve shall not exceed 4.

Table 4: Physical requirements of coarse aggregates for DBM

S.No.	Test	Test Method	Requirements
1	Los Angeles Abrasion value	IS: 2386 (part	40 percent (max.)
2	Aggregate Impact Value	IS: 2386 (part4)	30 percent (max.)
3	Flakiness and Elongation indices	IS: 2386(part1)	30 percent (max.) (Total)
4	Coating and stripping of Bitumen	AASHTO T	Minimum retained coating 95 percent182
5	Soundness		
	i) loss with sodium Sulphate	5 cycles	12 percent maximum
	ii) Loss with magnesium Sulphate	5 cycles	15 percent maximum
6	Water absorption	IS: 2386(part3)	2 percent maximum

18.4.2.2 Fine aggregates: Fine aggregates shall be the fraction passing 2.36 sieve and retained on 75 microns sieve, consisting of crusher-run screening, gravel, sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from any injurious, soft or flaky pieces and organic or other deleterious substances.

Filler: Filler consist of finely divided mineral matter such as rock dust, hydrated lime or cement as approved by the Engineer. the filler shall be graded within the following limits:

Table 5: Grading requirements of aggregates for DBM

Sieve Designation	Percent passing by weight passing the IS sieve
600 Microns	100
300 Microns	95-100
75 Microns	85-100

The filler shall be free from organic impurities and have a plasticity Index not greater than 4. The plasticity Index requirement shall not apply if the filler is cement or lime. When the coarse aggregate is gravel, 2 percent by mass of total aggregate of Portland cement or hydrated lime shall be added and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when the gravel is limestone.

18.4.2.3 Aggregate gradations: The combined course and find aggregates and filler shall produce a mixture to conform to the grading set for a table-6 below.

Table 6: Aggregate gradation for DBM

Sieve Designation	Percent passing by weight
37.5 mm	100
26.5 mm	90-100

13.2 mm	56-80
4.75 mm	29-59
2.36 mm	19-45
300 Micron	5-17
75 Micron	1-7

Preparation of Surface

This work shall consist of preparing of existing WMM surface. The work shall be done on such widths as shown in drawings. The existing surface shall be firm, cleaned with mechanical broom and treated with prime coat (@ 0.9kg /sq.m), 24hrs. in advance of laying of DBM course. The laying shall be done with paver finishers and compacted with road roller.

18.5 PREMIX CARPET

The Dense Bituminous Macadam roads shall be provided with 2cm. Thick premixed bitumen carpet surfacing with 1.8cum of stone aggregate 12.5mm nominal size and 0.90 cum of stone aggregate, 10mm nominal size using 144kg. Of residual petroleum of penetration 80/100 (S-90) of approved quality per 100 sq.m. And 52 kg of hot bitumen per cum of 12.5 mm nominal size stone and 56 kg of hot bitumen per cum of 10mm nominal size including a tack coat with residual petroleum bitumen of penetration 80/100 (S-90) of approved quality @ 0.35 kg/sq.m of road surface including consolidation with road roller etc.

Providing and consolidation with road roller seal coat of premixed stone dust with residual petroleum bitumen of penetration 80/100 (S-90) of approved quality and using 68 kg. Of residual petroleum bitumen of penetration 80/100 (S-90) and 0.6 cum of stone dust per 100 sq.m. of road surface complete. The seal coat is to be provided immediately after laying the bitumen carpet layer.

Pipe culverts with size not less than 300mm dia NP3 S&S pipes S&S Rubber rings joint with necessary 150mm CC/RCC M15 cradle & encasement with C.C. / R.C.C. M 15 with nominal reinforcement as per site requirement shall be provided at road crossings for storm water drainage of the area at the required number of places. Pipe shall be ISI marked.

Adequate / classified road roller of 8/10 MT capacity for the use of work as directed by the Engineer-in-Charge shall only be arranged by the contractor for consolidation. Log books of such road rollers shall be maintained. Maximum quantity of any items to be consolidated by each sprayer or roller / day shall be as under:

i)Prime Coat	3200 sq.m
ii)Consolidation of sub-grade	1860 sq.m
iii)Granular subbase	100 cum.
iv)Wet Mix Macadam	100 cum.
v)Dense Bituminous Macadam	40 cum.
vi)2 cm. Premix carpet	930 sq.m

For less use of rollers recovery for less roller days shall be made @ Rs. 1000 per day.

Aggregate and bitumen will be mixed in a mechanical mixer of approved type, and will be heated to required temperature as directed by Engineer-in-Charge. Bitumen boiler of suitable design avoiding local heating and ensuring continuous supply will be arranged by Contractor. The Contractor shall maintain a thermometer for measuring the temperature at site of work. The contractor shall also make the necessary arrangement for weighting the material at site of work.

Fresh supply of bitumen from Bharat Petroleum / Indian Oil / Hindustan Petroleum as approved by Engineer-in-Charge will be arranged by the Contractor and brought to

the site of work and stored properly. Receipt for purchase in original as proof of purchase will be submitted to the department by the contractor.

No variation in bitumen on lower side shall be allowed. In case bitumen used by contractor is found less than the quantity calculated theoretically, based on the coefficient for bitumen consumption given in CPWD/TNDSS specification 1997 or as decided by the Engineer-in-Charge for the items for which coefficient are not available in CPWD/TNDSS specification 1997. The cost of bitumen not so used shall be recovered from the contractor.

Wherever, necessary RCC pipe / Box culvert shall be provided for crossing of drain pipes and effluent channel etc. For pipe culverts NP3 RCC pipes fully encased in concrete / RCC shall be used. All RCC cover slabs of drains / channels & of culverts subjected to vehicular traffic shall be designed for I.R.C. class AA loading.

18.6 QUALITY CONTROL

For quality control of road works following table 7 and 8 shall be used for frequency of tests :

Tests on Earthwork for Embankment, Sub-grade Construction and Cut Formation

18.6.1 Borrow material: Grid the borrower area at 25 m c/c(or closer, if the variability is high) to full depth of proposed working. These pits should be logged and plotted for proper identification of suitable sources of material. The following test on the representative samples shall be carried out:

(a) **Sand Content [IS: 2720 (Part-4)]:** 2 tests per 3000 cubic meters of soil.

(b) **Plasticity Test [IS: 2720 (Part 5)] :** Each type to be tested, 2 test per 3000 cubic meters of soil.

(c) **Density Test [IS: 2720 (Part-8)] :** Each soil type to be tested, 2 test per 3000 cubic meters of soil.

(d) **Deleterious Content Test [IS: 2720 (Part-27)] :** As and when required by the Engineer.

(e) **Moisture Content Test [IS: 2720 (Part-2)] :** One test for every 250 cubic meters of soil.

(f) **CBR Test on materials to be incorporated in the sub grade on soaked/un-soaked samples [IS: 2720 (Part-16)]:** One CBR test for every 3000 cubic metre at least or closer as and then required by the Engineer.

18.6.2 Compaction control: Control shall be exercised on each in their by taking at least one measurement of density for each 1000 square meters of compacted area, or closer as required to yield the minimum number of test results for evaluating a day's work on statistical basis. The determination of density shall be in accordance with *IS: 2720 (Part- 28).*

Table 7– Control Tests and their minimum frequency for sub-base & base (excluding bitumen bound bases)

Sl.No	Type of Construction	Test	Frequency(min)
1.	Granular	a. Gradation	One test per 200 m3
		b. Atterberg limits	One test per 200 m3
		c. Moisture content prior to compaction	One test per 250 m2
		d. Density of compacted layer	One test per 500 m2
		e. Deleterious constituents	As required
		f. C.B.R	As required

2	Wet Mix Macadam	Aggregate Impact value	One test per 200 m3 of aggregate
		Grading	One test per 100 m3 of aggregate
		Flakiness Index and Elongation Index	One test per 200 m3 of aggregate
		Atterberg limits of portion of aggregate passing 425 micrion sieve	One test per 100 m3 of binding material
		Density of compacted layer	One test per 500 m3

Table 8 – Control Tests and their minimum frequency for bituminous works

S. N.	Type of Construction	Test	Frequency (min.)
1.	Prime Coat / Tack Coat	(i) Quality of binder	Two samples per lot to be subjected to all or some tests as directed by the Engineer
		(ii) Binder temperature for application	At regular close intervals
		(iii) Rate of spread of Binder	Two tests per day
2.	Seal Coat / Surface Dressing	(i) Quality of binder	Two samples per lot Dressing to be subjected to all or some tests as directed by the Engineer
		(ii) Aggregate Impact Value	One test per 50 m^3 of aggregate
		(iii) Flakiness Index and Elongation Index	-do-
		(iv) Stripping value of aggregates	Initially one set of 3 representative specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates.
		(v) Water absorption of aggregates	-do-
		(vi) Grading of aggregates	One test per 25 m^3 of aggregate
		(vii) Stone polishing value	As required
		(viii) Temperature of binder at application	At regular close intervals
		(ix) Rate of spreading of materials	One test per 500 m^2 of work
3.	Dense Bituminous Macadam /	(i) Quality of binder	Two samples per lot to be subjected to all or some tests as directed by the Engineer
		(ii) Aggregate Impact Value	One test per 50 m^3 of aggregate
		(iii) Flakiness Index and Elongation Index	One test per 200 m^3 of aggregate
		(iv) Atterberg limits of portion of aggregate passing 425 micron	One test per100 m^3 of binding material

		(v) Density of compacted layer	One test per 500 m^3

8.6.3 Acceptance Criteria

The acceptance criteria for test shall be subject to the conditions that the mean value is not less than the specified values plus [1.65 – 1.65/(No. Of Samples)$^{0.5}$ times the standard deviation.

19. ILLUMINATION:

All internal and external areas shall be provided with lighting. The illumination levels to be achieved shall be as follows:

AREA	LUX.	
Office and labs	300	Lux
Switchgear Room	200	Lux
Control Room	300	Lux
Pump House	200	Lux
DG set room	200	Lux
Chemical and general store	150	Lux
Chemical Plant room	200	Lux
Other indoor areas	100	Lux
Outdoor plant from and	50	Lux
Building entrance	100	Lux
Indoor Plant Area	200	Lux
Outdoor Plant Area	50	Lux
Transformer Area	100	Lux
Roads	10	Lux

Fluorescent luminaries shall be used primarily for internal lighting. High pressure vapour or metal halide type luminaries shall be used in indoor application where their use is appropriate. If mercury or metal halide is used in indoor then they should be supplemented with fluorescent luminaries to assure that minimum illumination levels are maintained following momentary power dips. All other internal areas shall be lit with fluorescent luminaries. Where specific recommendation of lux level are not covered above, illumination level in such areas shall be finalized in consultation with MMC.

Contractor shall be required to measure levels of illumination after completion of lighting installation work and short fall in illumination level shall be made good by the contractor. Complete set of calculations showing, room, index, copy MF shall be given during detailed engineering.

19.2 Switches / sockets of piano type shall be used in general and in offices of staff, control room, MMI room, decorative modular switches shall be used. Suitable fans shall be provided in rooms/ plant areas as per MMC/CPWD standards. For exhaust fans it must be provided in panel rooms, pump rooms, chemical rooms, stores, toilets and at least 20 air changes per hour must be maintained.

19.3 The following type of lighting fixtures shall be proposed:

a) Decorative type 2x36W fixtures for fluorescent luminaries inside office/ administrative buildings and control rooms.

b) Corrosion resistant fixture with canopy made of FRP for fluorescent luminaries for corrosive areas like chlorine handling or chemical store or area with corrosive smell/gases etc.

c) Industrial type vitreous enameled fixture for fluorescent luminaries inside 415V switchgear, MCC room and pump house.

d) In outdoor process areas, lighting fixtures shall be sodium vapour type subjected to minimum of IP protection class.

e) All outside lights as plant field lights, building outside lights, flood lights etc. which are to be switched on only during night hours should be controlled through photo cell/ clock switch installed at a central place. All lights shall have minimum IP65 protection class.

f) Street lighting wiring shall be through buried underground.

g) All bulb fittings (except fluorescent lamps) will have screw type caps.

h) For outdoor lighting, the lighting feeder shall be operated through a contactor, controlled by photocell/ clock switch and shall also have a manual by pass switch.

19.4 Luminaries shall be installed to permit ease of maintenance i.e. it shall not be necessary to shut down plant in order to carryout maintenance or to access luminaries located over areas of water etc. The contractor shall provide all equipment necessary to carryout maintenance on the lighting installation and demonstrate its operation to the satisfaction of MMC.

19.5 Indoor lighting circuit will be arranged in such a way that 50% lighting can be put off in each room through switches. All lighting circuits will be wired with 2.5sq.mm. Stranded copper wire or through 2.5 sq.mm. armoured cable laid in cable trays. Sub circuit from switch to fixture could be wired with1.5 sq.mm. stranded copper wire in MS conduits or armoured copper cable of similar size provided total voltage drop in any lighting distribution board to last lighting point shall not exceed 2%. All lighting circuits will have separate neutral, separate earth from Lighting Distribution Board.

For illumination of roads, outdoors areas where operation of equipment or units required and sub station area, lighting fixtures of appropriate type (such as street lighting type, flood lighting type, post top lanterns etc.) incorporating high pressure sodium vapour lamps shall be proposed. Street light poles shall not have less than 7500 mm height above the finished road level and the arm shall not project more than 1200 mm along the road width. Poles of bigger heights may also be used if some outdoor areas are to be illuminated. Poles of 4 / 4.5 Mtrs using post top lantern may be used in gate office, walk way or in front of office area. Complete area, streets, lanes, boundary shall be covered with street lighting.

19.6 Receptacles (Lighting & Small Power) :

19.7 a. Decorative and industrial type units of above shall be proposed in all plant areas, offices, stores, workshop, plant room and they shall be located at least two numbers in each room. Distance between two receptacles shall not be more than 8 – 10 mtr. All small 5 amps 5 pin lighting & small power sockets shall be wired by multi stranded copper wire of 2.5 sq. mm laid in rigid MS conduits along with earth wire of1.5 sq.mm flexible copper wire or equivalent size armoured cables. All wiring shall be coded with Red, Yellow, Blue & Black as per the phase used. If required, wiring can be done alternatively through armoured copper cables of similar size laid in MS perforated trays of minimum 2.0 mm thick.

b. Three phase power receptacles (convenience outlets) suitable for operation of 415V,3 Phase 4 wire, 50 Hz power supply shall be proposed. In indoor areas one such unit shall be provided to cover areas of 20 meter radius (or at least one in each room housing plant items) and in outdoors areas on such unit shall be provided at 50 meter

interval. Actual requirement of such units shall be finalized by MMC during detailed engineering. One three phase receptacle shall be provided near entrance of each building for utilities like welding.

c. Single phase 15 Amp 5 Pin / 6 Pin receptacles will be provided in each room and in halls they will be provided in such a way that with 15 meter cord we should reach every place in building. These shall be wired with 4 sq. mm copper earth wire in MS rigid conduits along with 2.5 sq. mm earth wire. Not more than two sockets shall be looped in one circuit. Alternatively they can also be connected through armoured cable of 4 sq. mm running in appropriate cable trays.

19.8 Separate lighting panels and lighting distribution boards shall be installed and they shall not take tapping for power from motor control centers or power distribution boards.

IV. LIQUID RETAINING STRUCTURES

1. General:

All structures shall be designed as liquid retaining RCC structures with minimum M 30 grade concrete.

Minimum cover shall be 25mm

All structures coming in contact with sewage shall be constructed with Sulphate Resistant Cement.

2. Testing for Water Tightness:

2.1 The testing of the liquid retaining structure and other water retaining structures should be done by the contractor at his own cost inclusive of all necessary equipment, water etc., complete. The test for water tightness of the structure as well as materials of construction used shall be conducted in conformity with the standard specification as per IS 3370 (Part-I) – 1965 as amended from time to time.

2.2 If the structure does not satisfy the condition of the test period, the test may be extended for a further period of seven days and if the specified conditions of the test are satisfied the structures shall be considered to be water tight.

In case of unsatisfactory test results, the contractor shall ascertain the cause, make all necessary repairs and repeat the procedure in the preceding clauses until the test has been passed satisfactorily at no extra cost to the Employer.

V. Specification for electromechanical WORK (Sewage treatment plant)

1. General requirements

1.1 Material

All materials incorporated in the Work shall be the most suitable for the service conditions and duty concerned. They shall be new and of reputed make / approved quality, free from imperfections and selected for long life and minimum maintenance. Non–destructive tests, if called for in the Specification, shall be carried out. All submerged moving parts of the Plant, or shafts and spindles or faces etc. in contact with them shall be of corrosion resistant materials. All parts in direct contact with various chemicals, shall be completely resistant to corrosion, or abrasion by these chemicals, and shall maintain their properties without aging due to the passages of time, exposure to light or any other cause. All materials shall conform to the material standards as per BIS or any equivalent standard.

1.2 Workmanship

Workmanship and general finish shall be of first class quality and in accordance with best workshop practice. All welds shall be as per IS, BS, ASME standards. All tolerances and clearances shall be as per good and sound engineering practices. Should the Employer's representative not consider any material acceptable, it shall be replaced.

1.3 Design Features

As far as practicable, all designs shall be as per latest concept and practices. The equipment shall be new, of robust design for a long reliable operating life. These shall be capable of 24 hours per day continuous operation for prolonged period in the climatic and working conditions prevailing at the site and with a minimum of maintenance. Particular attention shall be given to extra temperature and the rating of electrical and mechanical equipment, cooling systems and the choice of lubricants shall be for the temperatures as specified.
Paints used shall be the manufacturers' standard and shall be suitable for duty as described.
The equipment shall be designed to provide easy access to and replacement of component parts which are subject to wear without the need to replace whole units. All parts in contact with water shall have a life from new to replacement for 15 years minimum and new to repair of not less than five years.

Design features shall include the protection of equipment against damage caused by vermin, dirt, dust and dampness and to reduce risk of fire. Equipment shall operate without undue vibration. Noise reduction measures shall be adopted such that levels of 75 dB (A) at 3 meters are not exceeded. Parts shall be designed to withstand the maximum stresses under the most severe conditions of normal service. Materials shall have a high resistance to change in their properties due to the passage f time, exposure to light, temperature and any other cause which may have a detrimental effect upon the performance or life of the Plant.
All rotating elements shall be dynamically and statically balanced.
All equipment shall have name plates specifying the makes, model, rating and other pertinent information.

1.4 Lubrication

The equipment shall be lubricated by long life lubricants such that working life is not less than 3000 operation hours or as recommended by equipment manufacturer.

A complete schedule of recommended oils and other lubricants shall be furnished by the Contractor. The number of different types of lubricants shall be kept to a minimum. The schedule and the name of the supplier of the lubricants shall be submitted to the Employer's representative for approval.

Lubricants shall be oil and grease. The Contractor shall indicate indigenously available equivalent lubricants, with complete specification.

Where the lubricant is grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Preferably, life lubricated grease packed bearings shall be used.

Where more than one special grease is required, a grease gun for each special type shall be supplied and permanently labeled.

1.5 Name Plates

Each equipment of the Plant shall have permanently attached to it a nameplate and rating plate in a conspicuous position, Upon these shall be engraved or stamped, the manufacturers name, type and serial number of the equipment, details of the loading and duty at which the equipment has been designed to operate, and such diagrams as may be required by the Employer's representative. All indicating and operating devices shall have securely attached to them or marked upon them designations as to their functions and proper manner of use.

1.6 Painting

1.6.1 At Manufacturer's Works

The Contractor shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting, as specified, all parts of the Plant/ Equipment at the place of manufacture prior to packing.

Parts may be cleaned but surface defects may not be filled in before testing at the manufacturer's works. Parts subject to hydraulic test shall be tested before any surface treatment. After testing, all surfaces shall be thoroughly cleaned and dried out, if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the specification provides to the contrary, all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.

Steel and cast iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp corners etc. shall be ground to a curve before sand blasting. A primer coat of a zinc rich epoxy resin based coating with at least 75 microns dry film thickness is to be provided. In addition, the parts for wet duty are to be provided with an adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns excluding primer coating.

1.6.2 At Site

Immediately on arrival at the site, all items of Plant shall be examined for damage to the paint coat applied at the manufacturer's works. Any damaged portions shall be cleaned down to the bare metal, all rust removed, and the paint coat made good with similar paint.
After erection, such equipment/ items which are not finish painted shall be done so. Items that have been finish painted at the manufacturer's works shall be touched up for any damaged paint work. For finish painting, two coats of synthetic enamel conforming to IS: 2932 shall be applied. Dry film thickness of each coat shall be at least 25 microns.

The dry paint film thickness shall be measured by Elcometer or other instruments approved by the Employer's representative. In order to obtain the dry film thickness specified, the Contractor shall ensure that the coverage rate given by the paint manufacturer will enable this thickness to be obtained. Strength of adhesion shall be measured with an adhesion tester and this value shall not be less than 10 kg/cm2. Painted fabricated steel work which is to be stored prior to erection shall be kept clear of the ground and shall be laid out or stacked in an orderly manner that will ensure that no water or dirt can accumulate on the surface. Suitable packing shall be laid between the stacked materials. Where cover is provided, it shall be ventilated.

1.7 Galvanising

Wherever galvanizing has been specified the hot dip process shall be used And electro-galvanized parts, equipment shall not be permitted. The galvanized coating shall be of uniform thickness. Weight of zinc coatings for various applications shall not be less than those indicated below:

a) Fabricated steel : 460 gms/sq. m
b) Fasteners : 300 gms/ sq. m

Galvanising shall be carried out, after all drilling, punching, cutting, bending and welding operations have been carried out. Burrs shall be removed before galvanizing. Any site modification of galvanized parts should be covered well by zinc rich primer and aluminum paint.

1.8 Supports for Pipe Work & Valves

All necessary supports, saddles, slings, fixing bolts & foundation bolts shall be provided to support the pipe work. Valve and other equipment mounted in the pipe work shall be supported independently of the pipes to which they connect.
All valves to be installed in straight lines shall be installed between the flanges with a dismantling joint or SS expansion bellow at one side of the valve. The dismantling joint must allow a minimum clearance of 20 mm. The pressure rating of the dismantling joint / expansion below shall be same as that of the valve.

1.9 Mechanical & Manual Coarse Screens & Conveyor

1.9.1 Purpose & Scope:

a. Mechanized screens should be suitable for installation in Sewage pumping stations for removal of floating wastes coming along with sewage. These screens should be capable to screen out most of the medium and large floating material such as plastic bags, floating debris, weeds, paper wastes, clothes and rags etc. which are generally clogging the impellers of the pumps installed downstream of the screens.
b. The operation of the screen shall be automatic. An ultrasonic type differential level controller shall be provided to sense the head loss through the bar and give the signal to the traveling raking mechanism to start its operation. The sensor will signal the raking mechanism to operate continuously till the head loss is reduced to a preset level.
c. A complete electrical control system shall be supplied with each screen and shall be mounted independently near to the screen installation. The system shall provide for total automatic operation of the screen with the feedback from the level controller.

1.9.2 General Material And Equipment Requirements:

a. Fabrication and design features:
(i) Use power grinder to dull and produce smooth edges.
(ii) Use bolted field connections. Field welding will not be allowed.

(iii) Design all components for continuous 24 hours per day service.

b. The screen shall be so constructed so as to mechanically remove the waste from the bottom most portion of the bar portion using a traveling type raking mechanism without shutting the water flow through the screen. The raking mechanism shall then travel up to the top of operating platform and automatically discharge the waste through a discharge chute.

c. The screen shall have protection against overload conditions, which might damage the equipment.

d. All screens shall be constructed and shipped as an integrated product comprising of frame structure and guides, rake and rake arm mechanism, dead plates, cog wheels, sprockets and chains, discharge chute, drive unit and cover apron.

e. The screen shall be supplied factory assembled and duly tested at manufacturer's works before dispatch. This integrated and factory assembled screen shall involve minimum dismantling and assembly at site for erection.

f. Upon receipt at site these shall be installed resting on the channel floor and mechanically or chemically anchored to the parallel sidewalls of the channel (without making grooves in concrete or breaking open the concrete side walls and thereby weakening the civil structure) in a way that there are minimum chances of misalignment.

g. All parts shall be designed to withstand the stresses that will be imposed upon them during handling, shipping, erection and operation.

h. All stainless steel fabricated materials will be pickled and passivated before dispatch to remove ferrous contamination, if any.

1.9.3 Specifications :

1.9.3.1 Material of construction:

All parts of screen including fixed bars, raking mechanism, screen frame and guide rails, dead plate and discharge chute shall be constructed from stainless steel material SS304 for long life in aggressive sewage environment. Suitable measures should be taken to ensure long life of parts like bearing, chains, sprocket and cogwheels etc, which are not made from stainless steel material.

1.9.3.2 Drawings & Documents:

Drawings for the following shall be submitted for approval before taking up manufacturing of Screens:

- General Arrangement drawing of screens.
- Bill of Material (BOM) & Wiring diagram of control panels.
- Quality Assurance Plan.

All drawings shall be submitted in 3 copies of which one will be returned duly commented / approved.

Approval of manufacturer's drawings shall not relieve the manufacturer of his responsibility for supplying equipment confirming to the Technical Specification laid herein for any mistakes, errors or omissions in his drawings.

1.9.3.3Level controller

The level controller shall be of ultrasonic differential type.

1.9.3.4 Electrical motor

The motor shall be of TEFC type with IP 55 protection and suitable for operation on 415V± 10% and frequency of 50 Hz ± 5%.

1.9.3.5 Control Panel

The control panel shall have IP 65 protection, painted with epoxy paint and shall be comprising of

- Mushroom head emergency stop.

- Overload relays for motor protection.
- Circuitry to operate the screen with ultrasonic level sensor.
- Selector switch to operate the screen in Auto, off and JOG mode.
- Provision to run the screen on timer in case of failure of level sensor.

1.9.3.6 Shop Testing

The screen should be completely manufactured and offered for inspection at the plant of the manufacture confirming the above mentioned eligibility criteria. A screen assembled by a vendor and offered for inspection at the plant of a vendor / sub contractor shall not be accepted. The screen shall be subjected to following tests at manufacturer's premises by third party inspection and / or Corporation Employer representative(s):

- **(a) Dimensional Check:** The overall dimension of the screen shall be conforming to the approved drawings.
- **(b) Operational Test:** The complete screen including its carriage, rake, drive system and brake motor shall be mechanically operated and tested to verify interference free movement and satisfactory operation.

1.9.3.7 Miscellaneous:

Any type of work, either supply and or erection of material / equipment which have not been specifically mentioned in this specification, but are necessary to complete the works for trouble free and efficient operation and guaranteed performance of the entire plant system and equipment offered shall be deemed as included with in the scope of this specification and shall be provided by tenderer with out any extra price to purchaser.

1.9.4 Manual Bar screen

The manual bar screen will be of opening not more than 25 mm for coarse screen and inclination about 60^0 with respect to horizontal. Specifications for Manually raked screen shall be as under.

The trash screen shall be rectangular in shape. The screen shall be fabricated out of stainless steel SS 304 of not less than 10mm thick and 75 mm wide in section. The screen shall be rigidly fixed to the frame and provided with 2 sets of cleaning rakes.

1.9.5 Belt Conveyor

The conveyor shall be common to the mechanical and manual screens. The conveyor system shall be a combination of a horizontal conveyor and upward inclined conveyor (if required) and shall have a capacity to transfer the maximum screenings anticipated at the peak flow. The conveyor provided for discharge of screenings shall be inter-locked with all the screenings discharging on to the conveyor so that it operates when the screenings are discharged on to it and stops automatically after a time lag when the screen stops discharging the screenings on top the conveyor.

Conveyor type	Horizontal
Speed	15 m / minute (maximum)
Type	Troughed
Belt	3 ply Z duck, 3 mm top, 1.5 mm bottom, rubber cover CR M –24

1.9.6 Mechanical fine Screens

1. GENERAL :

- Mechanically operated step Screen completely made of Stainless Steel having 6 mm clear spacing between the bars shall be provided in inlet screen channel for screening out floating materials such as plastic pouches, bags, rags, floating debris, weeds, paper wastes and other floating materials from the raw sewage coming from the pumping station / gravity mains.
- The screen shall include discharge chute as required to discharge the screenings on the belt / screw conveyor without employing any external mechanism / rake mechanism.
- The screen shall be factory assembled & movement tested at plant before dispatch to site & shall only be installed at the site in factory assembled condition thereby avoiding chances of misalignments.

1.9.6.1 SCOPE:

Design, Supply, Installation, Testing & Commissioning of screening equipment consisting of following:

(a) Mechanized step screen having 6mm spacing between bars and suitable for installation at an inclination of 40 degrees in channel.
(b) Level sensing instrument connected to control panel for automatic operation of screen mechanism and allied accessories.
(c) Local control panel installed near screen.
(d) Belt/screw conveyor to discharge the screened material of the screen to the waste bin.

1.9.6.2 SPECIFICATION

(a) **Material of construction**:

The fixed as well as movable bars, mechanism, support frame, fixings discharge chute shall be manufactured from stainless steel for long life in the aggressive sewage environment. No component of the screen assembly shall be made of carbon steel or any other material, which can get corroded in sewage environment.

1.9.6.3 Level Controller

The level controller shall be upstream type Ultrasonic level switch.

1.9.6.4 Electrical Motor

The motor shall be TEFC type with IP 55 protection and shall be suitable for operation on 415V $\pm$ 10% and frequency of 50Hz $\pm$ 5%.

1.9.6.5 Control Panel

The Control Panel shall have IP 55 protection, painted with Epoxy paint and shall be comprising of

- Mushroom Head Emergency stop
- Overload relays for motor protection
- MCB's, HRC Fuses and Glass Fuses
- Circuitry to operate the screen with level sensors.
- Selector Switch to operate the screen on JOG mode

1.9.6.6 TESTING

The Fine bar screen shall be Factory assembled and subjected to following tests at the manufacturer's premises.

(a) Dimensional Check: The overall dimensions of the screen shall be conforming to the approved drawings.
(b) Operational Test: The complete screen including its mechanism, Electro-motor/hydraulic operating mechanism level probing system and control panel shall be integrated and mechanically operated to verify free movement and satisfactory working.

1.10 Mechanical grit separator

The grit separator shall be square in size and twin unit construction. A Central drive mechanism of worm reduction type driven through helical gear and motor or by geared motor shall be mounted on the RCC platform spanning the tank. All exposed steel parts shall be sand blasted and painted with epoxy. The walkway shall have RCC posts and handrails of anodized aluminum. All wetted parts shall be in mild steel with epoxy coating. The epoxy coating shall be suitable for corrosion as well as abrasion of the grit. The drive shall be provided with electro-mechanical device, torque indicating arrangement and mechanical trip contacts with electrical overload relays. Flow regulating vanes shall be provided at the inlet side of the collection chamber and shall be of FRP. The vanes shall be adjusted as per the flow requirement. The weirs at the outlet of grit chamber shall be SS 304 with minimum 3-mm thickness .The spacing of anchor bolts of SS 304 for the fixing of the weir shall not be more than 450 mm.

1.11 Classifier Mechanism

The classifier mechanism shall comprise of a screw driven by a suitable motor. The material of construction of the mechanism shall be SS 304 and the diameter shall be minimum 400 mm. The length of screw shall be such that the grit can be elevated up to the discharge end. SS puddle pipe shall be provided in the concrete trough at the discharge point of wet grit.

1.12 Air blowers for Oxygenation

The blowers shall be provided for providing adequate oxygen into the reactor tank for aeration.

The blowers shall be capable of developing the required total pressure at the rated capacity for continuous operation. The blowers shall be Twin lobe type. One number VFD drive shall be provided for each set of Blowers. Directly coupled design shall be preferred.

The blowers shall be provided with suction air filter, silencer, dead weight pressure relief valve and pressure gauge and the air delivered shall be clean, dry and oil free. The blower noise level and velocity of vibration shall be within 90 dB(A) and less than 4.5mm/s at a distance of 1.86 m respectively. The blower shall be driven by squirrel cage induction motor

1.12.1 Material of construction:

Casing : C I conforming to IS: 210 Gr FG 260
Rotor : Alloy steel
Shaft : Carbon steel C40/EN 24/19
Timing gear : Cast alloy steel
Pulley and gear side plates and cover : CI conforming to IS 210 Gr FG 260

Tests

No	Tests	Specs
1	Hydrostatic tests	Twice the maximum working pressure
2	Performance test	As per BS : 1571

3	Strip test	Clearances with tolerance limit
4	Mechanical balancing	ISO 1940 Gr. 6.3 or better
5	Visual Inspection	Before painting

1.13 Diffused Aeration System

This comprises piping to diffusers and the diffusers.

1.13.1 Type of diffuser system

A fine bubble diffused aeration system shall be applied to both the selector zone and aeration tank for oxygenation. The number of diffuser elements can be varied by the bidder depending on the manufacturer selected, subject to the condition that sufficient design calculations are attached along with it and the manufacturer is a standard one having supplied the diffusers to various waste water treatment plants for at lest two years.

1.13.2 Diffuser Elements

The diffuser elements with SS304 shall be membrane type and resistant to such ingredients as hydrocarbons, oil and grease. This shall afford a high oxygen transfer rate coupled with a minimal pressure drop besides permitting simple erection onto the horizontal air manifold. They shall also permit easy retrieval above the liquid surface by lifting the air vertical header feeding the horizontal air manifold.
Suitable mechanical provision for lifting the headers easily above the water level for maintenance without the need for draining the tank shall be provided for each header. Isolating valves of polypropylene shall be provided upstream of the coupling to cut off the flow through the specified header for purposes of attending to the diffuser header and also diffusers.

1.13.3 Air Supply Piping

The air piping from the blower to the basin header (above water) shall be of MS epoxy painted material and pressure rated for the sewage depth plus frictional losses etc. These shall be fixed securely to the concrete surfaces in the horizontal plane and vertical plane so that they are not clamped horizontally onto vertical sides of the walls. The clamping shall be so designed as to permit “in-situ” screw driven fittings. Breaking open concrete surfaces shall not be permitted. However the air piping submerged in sewage has to be in SS304 conforming to I.S specification.

Two spare drop pipes with diffuser elements shall be supplied by the Contractor one for each compartment. This will be used to replace the choked diffusers drop pipe or on preventive basis on rotation. The choked one will be attended to and used as spare drop pipe.

1.13.4 Specifications for Epoxy Painting

Zinc rich epoxy primer and epoxy paint of approved quality shall be used for external and internal painting for all exposed and immersed surfaces of all R.C.C components of STP units conforming to relevant I.S specification. No primer shall be applied without prior approval from the Employer’s Representative. The max of zinc rich epoxy primer shall be prepared at work site not earlier then 15 minutes before applying the same on pipes and special surfaces. One coat of zinc rich epoxy primer of DFT 75 micron shall be applied along with two coats of epoxy paint DFT 40 micron and DFT 30 micron respectively. No thinner shall be added to ready mix paint without previous approval of the Employers’ representative

and the finishing coats on top of the primer coat shall only be applied after allowing the film to cure for at-least 48hrs.

After application of zinc rich epoxy primer the surface should be cleaned by duster and inspected. If during inspection any portion is found rusting the same shall be removed by emery paper and coated with zinc rich epoxy primer.

Mixed paint should be used within 3 to 4 hrs of mixing and fresh mixing shall be done for every new application. Every successive coat of paint shall be given only after 48 hrs of previous coat. Before applying the next coat the surface should be properly cleaned by duster.

1.14 SPECIFICATIONS FOR DECANTING DRIVE for CYCLIC ACTIVATED SLUDGE PROCESS only

- The decanting device shall be rotating moving arm devices of Stainless Steel with top mounted gear box, drive, scum guard, down comers, collection pipe, bearings. The following type of decanter assemblies are not acceptable,
    - § Rope driven decanters.
    - § Floating decanters.
    - § GRP products.
    - § Valve-arrangement.
- The maximum design travel rate shall be 60 mm/min. with proven hydraulic discharge capacity of the decanter proportional to the selected basin area. Bidders to provide sample graphs of executed projects with such decanting speeds with decanters of min. same size (length)
- There should be Maximum 1 decanter per basin
- The hydraulic design based on design flow rates as given above shall not exceed flow speeds of 1.3 m/s
- Flexible rubber hose kind of decanter sealing is not acceptable.
- Each Decanter mechanism shall be inclusive of local control boxes with manual operation selection and function buttons, communication to main PLC by DH485 or Ethernet

1.15 Submersible Pumps for Raw sewage, return and excess sludge

Raw sewage pumps shall pump sewage from wet well at sewage pumping station to inlet chamber of STP. Return sludge pumps shall pump the return sludge from the sump to the aeration tank. Pumps shall be submersible type of non –clog design. They shall be suitable for pumping soft solids of size 80 mm. Only pumps with maximum 960 rpm shall be provided. In addition to this, the pumps shall be fitted with a special tearing system on the suction side for tearing soft solid material. The impeller shall be of a non-clog design with smooth passage and solid handling capability of 80-mm size. Maintenance-free anti- friction bearing, deep grooved permanently greased filled ball bearings shall be provided to take care of all the axial and radial forces at any point of operation. The pump installation design shall be such as to facilitate automatic installation and removal of the pumps without having to enter into the sewage pit. The motor shall be squirrel cage type, suitable for three phase supply continuous duty with class ‘F’ insulation. Motor shall have integral cable parts and the cable entries shall be sealed. The cables must be leak tight with respect to liquids and firmly attached to the terminal block. The motor shall be designed for non-overloading characteristics. There shall be thermal protection against overheating of the motor winding. The pump design shall ensure that seal does not come directly in contact with the liquid being pumped as well as cooling / lubrication by oil is provided. The moisture sensor of the tripping unit shall be located inside the oil chamber.

The pump unit shall be supplied along with the special duck foot bend, flanged elbow, lifting chain with shackles, enough guide wire / pipe, sufficient tough rubber sheeted water proof cable, as well as stainless steel foundation bolts and nuts. Alternatively pump unit can be with SS wire rope guiding system and pedestal cart integrated with the discharge head.

1.15.1 Reverse Rotation

The pump shall be designed to operate safely in the reverse direction of rotation, due to wastewater returning through the pump.

1.15.2 Pump Construction

The pump casings shall be of cast iron and conform to IS: 210 Gr FG 260. The internal surfaces shall be free of rough spots. The casing shall have centre line discharge.

The material of impellers shall be as specified and they shall be of the single vane type. They shall be dynamically balanced. The leading edge of the vanes shall be rounded and cut back to prevent rags, stringy material etc. from impinging on the impeller vanes.

1.15.3 Pump Shaft

The pump shaft shall be hard chrome plated alloy steel or stainless steel. The shaft shall be of one-piece construction.

1.15.4 Pump Bearings

Pump bearings shall be of the antifriction type. The bearings shall be able to take normal axial thrust loads due to unbalanced hydraulic loads on the impellers plus the weight of all rotating parts of the pumps. Pump bearings shall be designed with a minimum life of 40,000 hours. The bearings shall be grease lubricated for life and shall be maintenance free

1.15.5 Guide Arrangement

The assembly may have C.I. pedestal, bracket, delivery bend, SS 316, guide rail pipe, upper guide rail holder, etc complete. The pedestal and bracket may provide automatic coupling between pump delivery and discharge bend. Alternatively, the guiding system can be with S.S. wire rope and the pedestal cast integrated with the discharge bend.

1.15.6 Mechanical Seals:

A double mechanical seal of approved type shall be provided to prevent pumped liquid entering into the motor winding. The seals shall be running in oil bath. The oil bath shall have moisture sensors to sense water leakage. The sensors shall be used for tripping the pump and also for alarm.

1.15.7 Pump Balance:

All rotating parts shall be accurately machined and shall be in rotational balance. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case the amplitude of vibration as measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of Indian Standards. At the operating speed, the ratio of relative speed to the critical speed of the unit or its components shall be less than 0.8 or more than 1.3.

1.15.8 Lifting chain

Each pump shall be provided with galvanized steel lifting chain of suitable capacity. One end of the chain shall be attached to the pump and the other end fixed near the upper bracket for guide rail / wire rope assembly, by means of GI D shackle. The chain shall have GI rings fixed at an interval of about 1 meter for engaging the hook of the chain pulley block.

1.15.9 Submersible Cable

Each pump shall be provided with submersible cables of equal length for power and control so that the pump positions can be interchanged with each other. The cable shall be terminated in a common weatherproof junction box.

1.15.10 Moisture Sensor

The moisture sensor shall be provided in the oil chamber to detect the failure of the mechanical seal.

1.15.11 Motor

The motor shall be integral part of the pump. The enclosure for motor shall be IP-68. Each phase of the motors shall be provided with thermistor. The motor winding shall be suitable for star delta/soft starter. The motor shall be designed for minimum 10 starts/stops per hour, irrespective of whether it is DOL start or otherwise. For other requirements refer subsection VI. The motor shall operate satisfactorily at all operating levels in wet well.

(a) Materials of construction:

Pump casing	: CI IS: 210 Gr FG 260
Discharge casing	: CI IS: 210 Gr FG 260
Impeller	: CF 8m or SS316
Shaft	: SS AISI 431
Mechanical Seal	: Silicon Carbide
Fasteners	: SS AISI 304.

(b)Protective Coating:

The pumps shall be epoxy painted.

1.16 Air blowers for sludge mixing

The blowers shall be provided for providing air mixing through Coarse bubble aeration in the Sludge Sump.

The blowers shall be capable of developing the required total pressure at the rated capacity for continuous operation. The blowers shall be Twin lobe type.

The blowers shall be provided with suction air filter, silencer, dead weight pressure relief valve and pressure gauge and the air delivered shall be clean, dry and oil free. The blower noise level and velocity of vibration shall be within 90 dB(A) and less than 4.5mm/s at a distance of 1.86 m respectively. The blower shall be driven by squirrel cage induction motor

1.16.1 Material of construction:

Casing	: C I conforming to IS: 210 Gr FG 260
Rotor	: Alloy steel
Shaft	: Carbon steel C40/EN 24/19

Timing gear : Cast alloy steel
Pulley and gear side plates and cover : CI conforming to IS 210 Gr FG 260

Tests

No	Tests	Specs
1	Hydrostatic tests	Twice the maximum working pressure
2	Performance test	As per BS : 1571
3	Strip test	Clearances with tolerance limit
4	Mechanical balancing	ISO 1940 Gr. 6.3 or better
5	Visual Inspection	Before painting

1.17 Sludge feed pumps to centrifuge

These pumps shall be used for pumping sludge to centrifuge. The pumps shall be designed to operate satisfactorily without detrimental surges, vibration, noise, or dynamic imbalance. Over the required head range, the head-capacity curve of the pump shall have a continuously rising head characteristic with decreasing capacity over the whole range of total head. The pump shall have the maximum efficiency at the specified duty point. The unit shall be designed to operate safely at the maximum speed attainable in the reverse direction of rotation due to sewage returning thro the pump at times when power supply of the motor is interrupted. The first critical speed of the pump set shall be at least 30% above the operating speed.

The pumps shall run smooth without undue noise and vibration. The velocity of vibration shall be within 4.5 mm/sec. The noise level shall be limited to 85 DBA at a distance of 1.86m.

All rotating parts shall be statically and dynamically balanced as per ISO standards.

A stationary coupling guard shall be provided for the coupling conforming to all relevant safety codes and regulations. Guards shall be designed for easy installation and removal. They shall be complete with necessary support accessories and fastener.

The pumping unit shall be provided with a common base plate. The base plate shall be of sufficient size and rigidity to maintain the pump and motor in proper alignment and position.

The pump design shall be as per IS 6595 and pump performance shall be as per IS 9137
The power rating of the pump motor shall be the larger of following

(i) 115 % of power required by the pump at the duty point
(ii) 110 % of maximum power required by the pump from zero discharge to the runoff point total head

1.17.1 Material of Construction

Type Screw
MOC Alloy Steel
Base plate CI / MS Epoxy painted
Fastener SS AISI 304.

1.17.2Parameters of Pump

Capacity	As per bidder
Head	To pump to Centrifuge
Efficiency	Minimum 30 %
Pump speed	960 rpm (maximum)
Ball passing size	25 mm minimum
Applicable code	
Design	IS 6595
Performance	IS 9137

1.17.3
Testing

Material test certificate	Casing, Impeller, Shaft
Hydrostatic test	1.5 times shutoff head or twice the rated discharge head whichever is greater
Performance test	IS 5120 and IS 9137 at full speed
Mechanical balancing	As per ISO 1940, Gr. 6.3 or better
Visual inspection	Pump shall be offered for visual inspection before shipment. The pump components shall not be painted before inspection
Field Tests	Field performance tests required for satisfactory operation

Note:- The type, capacity & duties of return and excess sludge pumps shall be as proposed by the bidder. However, minimum 50% standby capacity shall be provided and the same set of pumps may be used for the pumping of excess sludge and return sludge

1.18 Recycle pumps to recycle supernatant and centrate

The specifications shall be the same as that of raw sewage pumps.

1.19 Polyelectrolyte tank & agitators

The equipment shall include drive motor, direct coupling, impeller assembly, and such other fittings, devices or appurtenances necessary for a complete operating installation.

The drive motor shall not exceed rpm of 1,500 and directly coupled with the gearbox. It shall be wired for 415 volts, 50 cycles, and three-phase service and shall be totally enclosed, fan cooled, rated for severe chemical duty with a minimum service factor of 1: 1.5.

The rotary speed of the impeller shall not exceed 100 rpm.

The drive motor output shaft and the impeller rotary shaft shall be connected by a direct coupling using such couplings as “Lovejoy” type to avoid cumbersome erections and de-erections. The drive assembly for each agitator shall consist of a suitable drive motor, directly coupled to a helical gearbox. The Gear reducer shall be of heavy duty, high efficiency type with a rugged housing. It shall have a minimum service factor of 2.0 and suitable for 24 hours continuous service. The gear reducer shall have oil bath lubrication and dry well construction on the vertical out put shaft to prevent leakage of the lubricant. The casing of the gear reducer shall be of CI. The gears shall be hardened and ground for precision.

Each impeller shaft shall be solid SS304 shaft of suitable diameter designed to resist the applied radial and axial thrust loads. All fasteners and anchor bolts shall be of such metallurgy that they are compatible with the stipulated duty conditions shall be used.

1.20 Polyelectrolyte Dosing Pumps

The Polyelectrolyte solution from the preparation tanks shall be pumped by the use of Polyelectrolyte solution dosing pumps to the Centrifuges. The pipe and the pipe fittings shall be HDPE and valves shall be Polypropylene.

1.20.1 Parameters

Standby	minimum 50%
Capacity of each pump	to suit each centrifuge requirement
Material of construction of wetted parts	AISI SS 304

1.21 Centrifuges

Minimum 2 Nos of Centrifuge capable of handling sludge and de watering the sludge into cake for safe disposal shall be provided. The dewatered cake shall be based on minimum consistency of 20% by weight dry solids. The centrifuge and its accessories shall be mounted on a common base frame so that entire assembly can be installed on an elevated structure.

The wetted parts of Centrifuge shall be stainless steel, 304. The base frame shall be in epoxy painted steel construction and provided with anti-vibration pads. All steps necessary to prevent transmission of structure borne noise shall be taken. The noise level shall be 88 dB (A) measured at 1m distance under dry run. The vibration level shall be below 50 micron measured at pillow blocks under dry run condition. Adequate sound proof shall be carried out for the housing the centrifuges to ensure that the noise level at 5 m distance from the enclosure is less than 75 dB (A).

A hoist shall be provided above centrifuge for maintenance purpose. The hoist shall be such that it shall be possible to erect or de-erect the centrifuge while one centrifuge is in operation

1.21.1 Parameters

Type	Solid Bowl
Mixing arrangement of Polyelectrolyte and sludge:	online-mixing

1.22 Disinfection system

Chlorination System:

1.22.1 General

(a) Chlorine diffusers shall be supplied and installed at the dosing point.

(b) Treated sewage shall be dosed with chlorine gas at suitable concentrations so that effluent from the chlorine contact tank shall not have more than 0.2 mg /l residual chlorine.

1.22.2 Chlorinators

(a) Vacuum type chlorinators shall be supplied with one duty and one stand by unit.

(b) Mal-operation of the duty chlorination system shall be indicated in the Central Control room.

1.22.3 Dosing Pumps

(a) Dosing pumps (1 working + 1 standby) shall be installed.
(b) The dosing pumps shall draw their supply from treated sewage line.
(c) The pumps shall be placed inside the chlorination room and shall be made from material resistant to corrosion by chlorine.

1.22.4 Injectors

Two injectors shall be provided, each serving a duty /standby pair of chlorinators. The injectors shall be located in the chlorination room.

1.22.5 Chlorine

Chlorine shall be supplied as liquid from nominal 1 tonne chlorine toner.

1.23 The Toner Room

(a) Storage shall be provided for chlorine toners sufficient for at least one month's usage at normal rate of withdrawal.
(b) The system shall be designed to prevent freezing of the liquid chlorine at the maximum rate of withdrawal.
(c) Tonners on line, tonners on standby and full and empty tonners shall be stored separately in the tonner room.
(d) Four sets of tonner rollers shall be provided. Tonners not in use shall be stored on concrete cradles.
(e) A 2 tonner overhead single girder electric traveling crane shall be provided in the chlorine tonner room for the following functions:
    i) Offloading (and reloading) of tonner from trucks;
    ii) handling of tonners within the storage area.
(f) The system shall serve the tonner store width over the entire length including the loading/unloading area.
(g) The hoist and traverse speeds shall be as follows;

    (i) Long traverse speed : 5m/min
    (ii) Cross traverse speed: not more than 5m/min
    (iii) Slow lifting speed : 1m/min
    (iv) High lifting speed : 5m/min

(h) The container lifting beam shall be specifically designed for handling chlorine containers and equipped with necessary shackles and hooks.
(i) Operation of crane system shall be from the floor level using independent push button pendent controls operating at a 230 volt 50Hz AC supply.
(j) Two lifting beams shall be provided (a duty and a spare) and a one tonner weighed to be suspended from the crane hoist.
(l) A pit and alkali absorption systems shall be provided to contain and neutralize chlorine in the event of leak. The system shall comprise a pit located in the tonner storage room and accessible by the overhead crane system. The pit shall be surrounded with removable guard railing. The pit shall be kept full with a neutralizing solution of lime. The pit shall be capable of holding side by side two chlorine tonners. A provision shall be made to drain the pit.
(m) Special consideration shall be given to any floor drainage system in the tonner building; adequate shall be provided to ensure that chlorine gas cannot escape. All

leader tubes carrying cables or pipes out of the building shall be sealed at either end to prevent any chlorine gas leaking out.

1.24 Chlorination Room

a) The chlorination room shall be constructed adjacent to the tonner room but no interconnecting door or other form of access.
b) Gas lines from the tonner room into the chlorination room shall run in ducts to be sealed after installation and prior to commissioning.

1.25 Chlorine Leak Detectors

(a) Not less than three chlorine gas leak detectors shall be provided each, with a single detector cell. At least two sensors shall be located in the chlorine tonner storage room and at least one sensor in the chlorination room.
(b) The chlorine leak detectors in the tonner room shall be mounted at each end of the tonner room.
(c) The chlorine leak detectors shall have two adjustable alarm levels sensitive to chlorine concentrations above 1mg/m3.The range of adjustment of alarm levels shall facilitate selection of the following alarms:
  (i) Low level 2mg/m^3
  (ii) High level 4mg/m^3
(d) The low level alarm shall initiate a local audible and visual alarm;
(e) Statutory warning notices relating to the storage and handling of chlorine shall be provided. The signs shall be pictorial and provided in Tamil and English.

1.26 Ventilation System

Each area where chlorine is stored or used as gas or liquid shall be provided with a good ventilation and exhaust system.

1.27 Chlorine Residual Test Kit

Chlorine residual test Kit shall be provided for monitoring of the residual free chlorine at plant outlet.

1.28 Safety Equipments

Materials and equipment necessary to ensure the safety of personnel operating the chlorination plant and others shall be provided.

1.29 Chlorination Power and Control

(a) A combined MCC and control panel shall be provided and located in a suitable location protected from the weather and effects of the process. The c0ntrol panel shall provide facilities for :
  (i) Duty Pump selection
  (ii) annunciate alarms associated with the chlorination systems;

(b) The chlorination system s shall operate using a fixed manually set dose rate. The quantity of chlorine dosed will therefore be adjusted in direct proportion to the process flow at the dosing point.

1.30 Sluice Valves

The gate face rings shall be securely pegged over their full circumference. Valves of 450 mm and above shall be provided with a thrust bearing arrangement for ease of operation. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5mm. Alternatively, valve of diameter 450mm and above may be provided with a gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and gearing shall be such as to permit manual operation in a reasonable time and not to exceed a required rim pull of 80 N. All hand wheels shall be arranged to turn in a clockwise direction for opening and counter clockwise for closing. These directions shall be indicated on the hand wheels. All valves shall be rated for not less than PN 1.0.

All valve doors when fully closed will ensure door faces are riding on body seat ring by at least 50% of width of seat ring providing sufficient allowance for wear. Valves of diameter 450 mm and above shall be provided with a drain and air plug.

1.30.1 Material of Construction

Body, Bonnet, Wedge	: CI conforming to IS 210 Gr FG 260
Spindle	
Drain and Air Plug	: IS 318 Gr LTBZ
Seat Ring, Wedge Ring	: SS ASTM A743 CF8
Back seat Bush	: Bronze IS: 318 Gr LTB 2
Gland Packing	: Graphide Asbestos

1.30.2 Parameters

Type	: Rising spindle
Nominal pressure	: 2 times working pressure in pipeline
Nature of operation	: Horizontal / vertical
Applicable code	: IS 14846
Tests:	Acceptance tests as per IS 14846

1.31 Knife Gate Valves

Knife gate valves shall be suitable for use at suction and delivery side of pumps in a sewage pumping station. The valve should be provided with gate made of stainless steel and the gate should have beveled knife edge at the bottom to cut through and easily enter in the solids settled in the bottom and ensure positive shut-off / closure in sewage environment. The valve should be bonnet-less and suitable for face to face flange connections in between pipelines. It should be suitable for uni-directional application.

The valve body should be of Cast Iron Gr. FG 260. The body shall be designed to withstand 6 bar pressure.

The valve shall be provided with replaceable type flexible sealing seals to offer drop tight shut off. The seals should be made of EPDM rubber and should be held in place by an easily removable type seal retainer ring. The seal retainer ring should be designed in a manner so that the flow of the fluid should be away from the sealing perimeter and towards the center of the valve.

The valve housing should have integral as cast tapered lugs provided for pushing the gate towards the flexible rubber seal only at the verge of closure with a view to avoid

seal wear and achieve drop tight shut off. The surface of the gate coming in contact with the seal should be polished & buffed.

The valve shall be provided with sufficient ply of stuffing seals in the in built stuffing box to seal the rear opening. The stuffing box should have internal tappers for pushing the seals on to the gate. The seals should be of non-asbestos PTFE to reduce the friction and offer higher life. Provision shall be made to enable tighten the stuffing seals by means of a pusher arrangement to minimize the leakage through the back of the valve. Replacement of stuffing seals should be done in installed condition of the valve.

The spindle should be double start threaded and non-rising type for compact & safe operation. The gate movement area should be covered by protection shields. Gate opening indicating arrangement should be provided to find out the extent of gate opening /closing.

Flange drilling suitable to mount between flanges as per IS 1538 -1993.

- Body: Cast Iron FG 260 as per IS 210
- Knife gate: AISI:304 Gr. ASTM A240
- Retainer ring: SS:304 ASTM A351 Gr. CF:8
- Inlet Seal: EPDM
- Spindle: AISI:410 Gr. ASTM A276
- Spindle Nut: Cast Iron Gr. FG 200 as per IS 210
- Stuffing plate: Cast Steel ASTM A216 Gr. WCB
- Stuffing seal: Synthetic yarn with PTFE

1.31.1 Factory Tests:

Body test: The valves shall be hydrostatically pressure tested at specified pressure without any visible leakage.

Seat test: The valve shall be hydrostatically pressure tested for seat leakage at 2.8 bar for no visible leakage.

1.32. Reflux Valves

Reflux valve shall possess high speed closing characteristics and be designed for minimum slam conditions while closing. External counterweights are not acceptable. Dual plate check valves shall conform to API 594 and API 598. They shall have metal to metal sealing. The spring action shall optimize the equal closing rates of each plate, especially when the friction coefficients are uneven due to one plate resting upon another. The plates shall not drag on the seat while opening. The plates shall not vibrate under full or partial flow condition. The pressure drop in the valve at design flow shall be limited to 0.4 mWC.

1.32.1 Material of construction

Body	CI conforming IS 210 Gr FG 220
Plate	SS AISI 316
Spring	SS AISI 316
Seal	SS AISI 304

1.32.2 Parameters

Type	Dual Plate.
Nominal pressure	Twice the pressure in pipeline

Nature of operation	Automatic
Closure characteristic	Non slamming
Applicable code	API 594
Tests	Acceptance tests as per API 598

1.33 Pipe Work

The Piping within the pumping stations shall be CI. All other sewage pipes inside the plant premises shall be made of DI internally lined with SFRC lining. The treated and chlorinated sewage should be disposed off to the disposal site by closed RCC pipe or DI pipe.

In general, the colour code for piping shall be blue for potable water, white for air, red for gas and as received colour from manufacturer for all other sewage pipes. The pipe works for the plant involves procuring, supply, laying and jointing of suitable size electrically welded steel, cast iron, ductile iron, u PVC, RCC and PSCC pipes along with matching specials etc. as required. All yard piping inside the plant shall be cast iron or ductile iron. All pipe work and fittings shall be a class rating in excess of the maximum pressure attained in service including any surge pressure. The pipe work installation shall be so arranged to offer ease of dismantling and removal of pumps or major items of equipment. CI/DI Piping above ground level shall be only flange jointed and adequately provided with structural/ masonry supports. Stainless steel AISI 304 expansion bellows which can take radial and axial misalignment of minimum one percent of the valve nominal size and tie bolts shall be provided. All pipe work shall be adequately supported with purpose-made fittings. When passing through walls, pipe work shall incorporate a puddle flange. Flange adapters and union shall be fitted in pipe work runs, wherever necessary, to permit the simple disconnection of flanges, valves and equipment. The Contractor shall be responsible for ensuring that the internal surfaces of all pipe work are thoroughly cleaned before and during erection and commissioning. Cleaning shall include removal of dirt, rust, scale and welding slag due to site welding. Before dispatch from manufacturer's works, the ends of the pipe, branch pipes etc., shall be suitably removed until immediately prior to connections adjacent pipes, valves or pumps. All small-bore pipes shall be blown through with compressed air before connection is made to instruments and other equipment. No point of passage of pipes through floors or walls shall be used as a point of support, except with the approval of Employer's representative. All underground-buried mild steel piping unless found otherwise necessary, shall be protected by the application of hot coal tar enamel and fiberglass wrapping. The coating shall consist of one coal` tar primer one coat, wrapping of fiber glass one more coat of enamel and the final wrap of enamel impregnated fiber glass. However, all water supply plumbing pipelines shall be of UPVC class 4 thick-walled inside the premises in concealed piping. They shall be GI class B in external locations and either anchored externally with SS AISI fasteners or appropriately buried below the ground with a sand cushion of 20 cm all round. All sanitary piping shall be of UPVC class 4 suitably buried below the ground with a sand cushion of 20 cm all round. Changes in direction on the ground shall be achieved with inspection chambers of 45 cm x 45 cm and heavy-duty CI/Steel reinforced fiberglass chamber covers.

1.34 Galvanized Iron pipe

The procurement, supplying, laying, jointing and testing at works and site of Galvanized Iron (G.I.) pipes and fittings shall be in accordance with IS 1239 (Part I and II) and its latest revisions. The general requirements relating to the supply of mild steel tubes shall conform to IS 1387. The sulphur and phosphorus requirements in steel shall not exceed 0.05 percent each. The galvanizing of the pipes shall be as specified in IS 4736. The zinc coating shall be uniform adherent, reasonably smooth and free from imperfections. The pipes shall be galvanized before screwing. All screwed pipes and sockets shall have pipe threads conforming to the requirements of IS 554. Gauging in accordance with IS 8999 shall be considered as an adequate test for conformity of threads of IS 554. Screwed tubes shall

have taper threads while the sockets shall have parallel threads. The specifications for G.I. pipes shall be generally in accordance with Clause 15.4 of standard specifications. The tolerances on the length of pipes shall follow clause 11.0 of IS 1239 (Part I). The fittings for G.I. pipes shall be of mild steel tubular or wrought steel fittings conforming to I.S. 1239 (Part II). The laying of G.I. pipes and fittings shall follow the relevant I S code of practice. These pipes shall be used for drinking water supply for the office and laboratory buildings. The pipes shall be painted with two coats of anticorrosive bit mastic paint.

1.34.1 Testing of G.I. pipes

Hydrostatic test shall be carried out at works at a pressure of 5 M Pa, maintained for at least 3 sec and shall not show any leakage in the pipe. The tensile strength of length or strip cut from selected tubes, when tested in accordance with IS 1894 shall be at least 320 N / mm2. The elongation percentage shall be as per clause 14.1.1 of IS 1239 (Part I). The bend test shall also be carried out as per clause 14.2 of IS 1239. The G.I. pipes and fittings shall be tested at site, after they are laid and jointed as per clause 15.4.11 of standard specifications.

1.35 Unplasticized Poly Vinyl Chloride (uPVC) Pipes

The latest versions of Indian standards and codes of practice shall be adhered to for the design, manufacturing, inspection, factory testing, packing, handling, and transportation, laying, and jointing of the uPVC pipes. The rubber rings shall be vulcanized from Ethylene Propylene (EPDM) confirming to IS 5382. The uPVC pipes shall be of minimum 4 kg / sqcm and as per IS 4985 and the pipes for plumbing works in office building shall be SWR (Type B) as per IS 13592, with electrometric sealing rubber ring joints. The method of sampling of rubber rings should be in accordance with IS 5382. The material from which the pipes are made shall consist substantially of unplasticized polyvinyl chloride conforming to IS 10151, to which only those additives shall be added that are absolutely needed to facilitate the manufacture of the polymer and the production of sound, durable pipes of good surface finish, mechanical strength and opacity. The total quantity of additives like plasticizers, stabilizers, lubricants and fillers shall not exceed more than 7.0%. The bulk density of UPVC pipes shall be 1.39 to 1.44 g/cm3. The PVC resin of suspension grade K-66/K-67 shall be used for extrusion of UPVC pipe. The uPVC fittings shall be fabricated from Class 4 uPVC as per IS 4985.

1.35.1Tests on Material:

Following in house tests shall be carried out on the raw material:

(i) Grade (K-value)
(ii) Particle size distribution
(iii) Bulk density of resin
(iv) Bulk density of compound

1.35.2Acceptance Test on Pipes:

The acceptance test shall be conducted in accordance with IS 4985 and in presence of the Engineer's representative–

(i) Visual and dimensional check
(ii) Reversion test
(iii) Vicat softening test
(iv) Ash Content
(v) Bulk density
(vi) Resistance to external blows

(vii) Internal hydrostatic pressure test for pipes and joints
(viii) Opacity

1.35.3 Marking on Pipe:

Each pipe shall be clearly marked as indicated below:
(i) Manufacturer's name and trade mark
(ii) Outside diameter (OD) in mm
(iii) Class of pipe and pressure rating
(iv) Month and year of manufacturing
(v) Length of pipe
(vi) Marking of insert depth of spigot

1.35.4 Marking on rubber ring:

Each sealing ring shall be permanently marked with
(i) The manufacturer's name or trade mark.
(ii) The month and year of manufacture
(iii) Diameter of pipe for which the ring is suitable.
(iv) Type of rubber material

1.35.5 Tests on rubber ring:

Following tests shall be conducted on rubber rings conformity:
(i) Hardness
(ii) Tensile strength
(iii) Elongation at break
(iv) Compression set
(v) Accelerated ageing
(vi) Water Absorption
(vii) Stress relaxation

1.36 Ductile Iron Pipes

The DI pipes shall be centrifugally cast (spun) for Water and Sewage and confirming to IS 8329-2000. The pipes used shall be both gasket joints and flanged joints. The minimum class of pipe to be used shall be class K-9 conforming to IS 8329. In general, pipes inside the buildings and below the structures shall be jointed as double-flanged pipes and those outside the building can be either EPDM gasket in accordance with IS 5382 and manufactured by the pipe manufacturer only. The pipes shall be supplied in standard lengths of 5.5m and 6.00m length with suitably rounded chamfered ends. Any change in the stipulated lengths will be approved by the Engineer's representative. The flanged joints shall confirm to the Clause 6.2 of IS 8329. The pipe supply will also include one rubber gasket for each flange.

1.36.1 Inspection and Testing:

The pipes shall be subjected to following tests for acceptance:
(i) Visual and dimensional check as per clause 13 and 15 of IS 8329.
(ii) Mechanical tests as per clause 10 of IS 8329.
(iii) Hydrostatic test as per clause 11 of IS 8329.
(iv) The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5382 and in accordance to clause 3.8

The sampling shall be as per the provisions of the IS 8329.

1.36.2 Markings

All pipes shall be marked as per clause 18 of IS 8329 and shown as below:
(i) Manufacturer name / stamp
(ii) Nominal diameter
(iii) Class reference
(iv) A white ring line showing length of insertion at spigot end.

1.36.3 Packing and Transport

The pipes should be preferably transported by road from the factory and stored as per the manufacturer's specifications to protect them from damage.

1.36.4 Specials for DI Pipes

The DI specials shall be manufactured and tested in accordance with IS 9523 or BS 4772. The mechanical test and hydrostatic test shall confirm to clause 9 and clause 10 respectively of IS 9523. The tolerances on dimensions shall be as per IS 9523. The manufacturer of the pipes shall supply the fittings.

1.36.5 Supply

All the DI fittings shall be supplied with rubber rings for each socket. The rubber ring 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.

1.37 Sluice Gates

The construction of sluice gates shall be in accordance with the specification and generally as per AWWA C 501 or IS 13349. The sluice gates shall be capable of performing the duties set in the specification without undue wear or deterioration. They shall be constructed so that maintenance is kept to a minimum. All parts of sluice gate, including mechanism components shall be designed for the heads specified with a minimum safety factor of five. All sluice gates shall be of the raising spindle type.

All sluice gates shall be manually operated. Motorised gates, if provided by the Contractor, the actuator specs be got approved from the Employer's representative.

1.37.1 Constructional features

The sluice gates shall be standard design of manufacturer's and of robust construction. The special features shall be as follows

1.37.2 Frame:

The frames shall be of ample section and cast in one piece. All surface forming joints and bearings shall be machined. The frame shall be of the flange back type and shall be machined on the rear face to bolt directly to the machined face of the wall thimble.

1.37.3 Guide:

The guide shall be bolted to the frame or cast integrally with it and shall be machined on all bearing and contact faces. The length of the guide shall be such that it should support the gate upon the horizontal line of stem nut pocket. Arrangements shall be such that it should support the gate upon the horizontal line of stem nut pocket. Arrangements shall be made to prevent lateral movement of bolted on guides. They shall be capable of taking the entire

thrust produced by water pressure and wedging action. Wedges or wedge facings shall be attached to the guides at point where, in the closed position, they will make full contact with the wedging surface on the slides.

1.37.4 Seating Faces

The seating faces shall be of full width, solid section. They shall be secured firmly by means of counter sunk fixings in finished grooves in the frame and slide faces in such a way as to ensure that they will remain permanently in place as well as free from distortion and loosening during the life of the sluice gates.

1.37.5 Wedging devices

Sluice gates shall be equipped with adjustable side, top and bottom wedging devices required providing contact between the slide and frame facing when the gate is closed position. All faces shall be machined accurately to give maximum contact and wedging action. Wedges shall be fully adjustable with suitable adjusting screws and lock nuts and so designed that they will remain in the fixed position after adjustment.

1.37.6 Gate slides

The slide shall be with strengthening ribs where required and reinforced section to receive the seating faces. The slide shall have tongues on each side extending its full length and tongues shall be machined accurately on contact surfaces. Surfaces of the slide that in come in contact with the seat facing and wedges shall be machined accurately. The maximum allowable clearances between the slide and slide gate shall be 1.6 mm. An integrally cast stem nut pocket with reinforced ribs shall be provided above the central line of the slide.

1.37.7 Stem nut and Lift nut

A gate shall be provided with lower fixed stem nuts for connecting the stem to the slide and revolving lift nut located in the lifting mechanism in the head stock. They shall be of ample design to endure the thrust developed during gate operating under maximum gate operating condition loads in opening and closing direction. The stem nut and slide shall be constructed to prevent turning of the stem nut in the pocket in the slide. The stem nut shall be threaded and keyed or threaded and pinned to the stem.

Stem

The operating stem shall be designed for a tensile strength to withstand 90 kg effort on the crank and for a critical buckling compressive load assuming a 36 kg effort on the crank. The threads of the stem be machine cut or rolled and of the square or acme type. The number of threads per inch shall be such as to work most effectively with the lift mechanism used. The top of the stem be provided with a stop collar. Stem shall be provided with polycarbonate cover fixed to the headstock.

1.37.8 Stem coupling

The coupling shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem

1.37.9 Stem guide

Stem guides shall be cast, with bushings and mounted on cast brackets. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they shall hold the stem in alignment. The number of stem guides shall be such that the unsupported length of stem shall not exceed one hundred times its diameter.

1.37.10 Lifting Mechanism

Sluice gates shall be operated through a suitable lifting mechanism, which shall incorporate gearing if required. The lifting mechanism shall be suitable for operation by one man under all conditions. The lifting mechanism shall incorporate a strong locking device suitable for use with a padlock or padlock and chain. The manual operation shall be of the hand wheel crank operated type and shall have a lift nut threaded to fit the operating stem. The crank shall be removable. Ball or roller thrust bearings shall be provided above and below flange on the lift nut to take the load developed in opening and closing the gate with torque of 14 kg-m on the crank. Fittings shall be provided to lubricate gears and bearing. The design of the lift mechanism of the hand operated gates shall be such that the slide can be operated with torque is not more than 7 kg-m on the operator after the slide is unseated from wedges based on the operating head. The maximum crank radius shall be 380 mm.

1.37.11 Gears and bearings

All gears and bearings shall be enclosed in cast iron housing with labyrinth seals. The lifting mechanism shall be of cast iron pedestal, machined and drilled to receive the gear housing and suitable for bolting to the operating floor. The gates shall close with clockwise rotation of the crank. The direction of rotation to close the gates shall be indicated on the lift mechanism. A suitable means shall be provided for lubricating the stem threads directly adjacent to the lift nut. An inspection cover shall be provided to access the lift nut and gearing.

1.37.12 Fasteners

All anchor bolts, assembly bolts, screw, nuts etc., shall be of ample section to safely withstand the forces created by the operation of the gate.

1.37.13 Wall thimbles

The wall thimbles shall be made of cast iron and shall be supplied along with the gate. The wall thimbles shall provide a rigid mounting and designed to prevent warping of the gate frame during installation. The cross section of the thimble shall have the shape of the letter ‘F’. The front, or mounting flange, shall be machined and shall be attached to the thimble with bolts and studs. The depth of the wall thimbles shall not be less than 300mm. To permit entrapped air to escape as the thimbles are being encased in the concrete, holes not less than 35 mm diameter at not more than 600 mm span, shall be cast or drilled in each entrapment zone formed by the reinforcing ribs or flange and water stop.

a) Material of Construction

Frame, Guide, Thimble, Stem Guide Bracket, Wedges,	C I conforming to IS 210 Gr 260
Door Sealing faces	Bronze conforming to IS 318 Gr LTB 2
Spindle	SS AISI 431
Flush bottom resilient seal	Natural or synthetic rubber conforming to IS: 1855
Anchor bolts	SS conforming to IS 6603
Hand wheel	Cast iron
Stem cover	Polycarbonate transparent tube.

b) Parameters

Type	Rectangular rising spindle
Size	As per requirement
Applicable code	IS 13349
Class	1
Maximum seating head	As per contractors design
Unseating head	As per contractors design
Maximum distances between gates centre line and operating platform	As per contractors design.
Tests	Seat clearance check, moving tests, leakage tests and Hydrostatic tests as per IS 13349/ AWWA C 501 shall be conducted at Manufacturer's works in accordance with the Inspection category.

1.38 Open channel Gates

The manufacture of open channel gates shall be in accordance with the manufacturer's standard.

All open channel gates shall be of the rising spindle type.

All open channel gates shall be manually operated.

Open channel gates shall be tested as per manufacturer's standard.

The open channel gates for pumping stations shall be CI sluice gates. All other gates shall be aluminum gates.
The material of construction shall be as follows.

Components	**Material**	**Specification**	**Grades**
Gate frame, shutter, Headstock, Flush bottom seal support bar, Stop nut.	Cast Iron	IS: 210 – 1993	FG: 260
Sealing faces/ Seat facings	Stainless Steel	ASTM A276	AISI: 304, 316
Resilient rubber seal	Natural Rubber EPDM Rubber Neoprene Rubber		
Seal retainer bar	Stainless Steel	ASTM A276	AISI: 304, 316
Stem / Spindle	Stainless Steel	ASTM A276	AISI: 304, 316
Operating Nut/ Stem Nut	Leaded Tin Bronze	IS: 318 – 1981	LTB 1, LTB 2
Fasteners	Stainless Steel	ASTM A276	AISI: 304, 316
Anchor Bolts	Stainless Steel	ASTM A276	AISI: 304, 316
Yoke	Mild Steel	IS: 2062 – 1992	Grade A

1.39 Fire Extinguishers

The Contractor shall provide 3 Kg CO2 fire extinguishers of suitable capacity and numbers for the treatment plant at the following locations after consultation with the Employer's representative. These shall be provided as adhoc at the start itself and replaced fully up to

date before handing over of the work. However for providing fire extinguishers in sub station, PMCC/MCC and control rooms, please refer to sub-section VI

- Laboratory - 1
- Blower room - 2

These shall be installed in a fashion such that their use is facilitated in case of fire emergency.

1.40 First Aid kits

The first aid kit shall consists of all materials, medicines necessary for treatment of cuts, wounds, burns etc., These shall be provided in addition to requirement mentioned in sub-section VI as adhoc at the start itself and replaced fully up to date before handing over of the work

- Laboratory
- Rest room

1.41 Emergency Lamps

The Contractor shall provide for lamps with autonomy of 5 hours continuous service. The units shall be DC 6V and shall be rechargeable from any 5A plugs. They shall be continuously chargeable without damage to the battery at the following locations

- Laboratory
- Administrative Building
- Toilets

1.42 Exhaust fans

The fans shall be as per IS 2312 and the blades shall of mild steel dynamically balanced to avoid noise and vibration. The blade and its carriers shall be securely fastened to avoid loosening in operation and shall have a SS AISI guard as a grill inside and a 10 sq mm mesh screen to safeguard birds from getting sucked in. The duty of the fans shall be calculated to ensure 3 to 10 air changes per hour in the command area depending on requirement. These shall be provided at the following locations

- Laboratory
- Toilets

1.42.1 Materials of Construction

Casing	M S as per IS 2062
Impeller	Cast Aluminium
Test	As per IS 2312

1.43 Chain Pulley Blocks

Geared Chain Pulley Blocks shall be adopted. The monorail and trolley and the chain pulley block shall be provided for lifting the blowers and submersible pumps. The trolley and chain pulley block shall be hand driven. The capacity of the trolley and the chain pulley block shall be for the maximum weight to be lifted during erection and maintenance of the equipment but should not be less than 1 tonner. The traveling trolley shall run on the lower flange of the rolled steel joist. The trolley shall have two wheels on both sides of the joist web. The trolley wheels shall be single flanged with treads machined to match the flange of the beam. The wheels shall be of carbon steel casting conforming to IS 1030. The trolley shall have an arrangement for the fixing chain pulley block and sling. Pushing the load shall move the trolley. Suitable arrangement shall be provided on the joist to prevent over traveling. The chain pulley block shall have frame housing gears load sheave, brake unit, hand chain

wheel and load chain wheel shall have hooks on both sides, one fixed with traveling and other for the load. The frame shall be of welded construction.

The gears shall be of spur type incorporating high grade hardened carbon steel pinion and heat treated carbon steel wheels. The width of the gear shall be adequately sized for long life. The driving pinion shall be integrated with the driving shaft. The load hook (bottom hook) shall rotate on the ball bearing. The chain shall be electrically welded, accurately calibrated, pitched and polished. The length of the load chain shall be sufficient for taking out the blower/pumps from their location. The hand chain wheel shall be provided with roller type guarding to prevent slipping the chain. The hand chain wheel shall hang to cleat of the hook. The braking shall be automatic, the screw and friction disc type and shall offer no resistance. The load shall be sustained in any position of lift when effort for hoisting or lowering is removed. Each chain pulley block shall be supplied with one set of 1 tonner sling with galvanized D- shackles and clamps. The slings shall be about 3 m long. The monorail shall be 'I' section. The exposed mild steel surfaces shall be enamel painted. The fasteners shall be GI or Cadmium plated. The chain pulley block shall be tested for 150% overload through a length of lift which will be ensure that every part of the block mechanism and every teeth of gears come under load.

1.44 Valve Actuators (Wherever required)

1.44.1 General

All actuators shall be motorized type and local controls shall be protected by a lockable cover.

Each actuator shall be adequately sized to suit the application and be continuously rated to suit the modulating control required. The gearbox shall be oil or grease filled, and capable of installation in any position. All operating spindles, gears and head stocks shall be provided with adequate points for lubrication.

The valve actuator shall be capable of producing not less than 1½ times the required valve torque considering valve spindle jamming and shall be suitable for at least 5 continuous operation.

The actuator starters shall be integrally housed with the actuator in robustly constructed and totally enclosed weatherproof housing. The motor starter shall be capable of starting the motor under the most severe conditions. The entire electrical system shall be tropicalised.

The starter housing shall be fitted with contacts and terminals for power supply, remote control and remote positional indication, and shall also be fitted with internal heaters so as to provide protection against damage due to condensation. Heaters shall be suitable for single phase operation. The heaters shall be switched "ON" when the starters are "OFF" and shall be switched "OFF" when the starters are "ON".

Each actuator shall be equipped as follows:

(a) AC electric motor with engage/disengage clutch mechanism of the dry type.
(b) Reduction gear unit (with thrust bearing if required)
(c) Torque switch mechanism
(d) Limit switch mechanism
(e) Geared hand wheel for manual operation of valve.
(f) Valve position indicator – open/closed
(g) Auto-Manual lever with suitable locking arrangement
(h) Valve position transmitter
(i) Reversing contactor starter complete with overload relays of suitable range and adequately rated control fuses

(j) Actuator with integral starter shall have selection between local/remote operation
(k) Local control switch/push buttons
(l) 415 V/110 V AC control transformer
(m) A white lamp for supervision of main supply to be provided locally.
(n) A potential free contact shall be provided to annunciate over-load trip/main supply failure on remote panel
(o) Provision for local as well as remote operation

1.44.2 Special Features

(a) Two (2) nos. interposing relays for matching the control voltage of remote commands.
(b) The motor shall be specially designed for valve operation, combining low inertia with a high torque and with linear characteristics.
(c) All motor actuators shall be provided with visible local valve position indicators mounted on the actuator assembly itself.
(d) The torque switch shall function to stop the motor on closing or opening of the valve, on actuation by the torque when the valve disc is restricted in its attempt to open or close. A minimum of two (2) torque switches, one for closing direction and one for opening direction shall be provided.
(e) The non-adjustable limit switches shall stop the motor and give indication when the disc has attained the fully open or close position. Provision shall be made for indication of stuck or jammed valve.
(f) All wiring connections from the various switches shall be brought out on to separate terminal box mounted on the valve, having liberal space for wiring and making connection.
(g) The terminal box shall be suitable for outdoor use and shall be weather-proof and dust tight.

1.45 Laboratory Equipment

Laboratory equipments shall be provided as mentioned below:

	Description	*Quantity*
1	PH Meter	1 no.
2	Conductivity Meter	1 no.
3	D.O. Meter	1 no.
4	Distillation Apparatus	2 nos.
5	B.O.D. Incubator	1 no.
6	C.O.D. Apparatus	1 nos.
7	Hot Air Oven	2 nos.
8	Incubator	2 nos.
9	Refrigerator	1 no.
10	Water Bath	1 no.
11	Dessicator	3 nos.
12	Hot Plate	2 nos.
13	Auto Clave	1 no.
14	Thermometers	4 nos.

	Description	*Quantity*
15	Electronic Balance (Single Pan)	1 no.
16	Automatic Burettes	4 nos.
17	Fixed Vol. Pipettes	6 nos.
18	Laminar Flow	1 no.
19	Centrifuge	1 no.
20	Magnetic Stirrer	1 no.
21	Filtration Assembly	1 no.
22	Vaccume pump	1 no.
23	Aeration Pump	1 no.
24	Microscope	1 no.
25	Physical Balance	1 no.
26	Muffle Furnace	1 no.
27	Fish aquarium	1 no.
28	TOC analyzer	1 no.

In addition to these, contractor shall also provide necessary chemicals, glassware and reagents required for testing in the laboratory.

VI. ELECTRICAL WORKS

A ELECTRICAL

1 General

Following clauses specify General Electrical requirements and standard of workmanship for the equipment and installations. General specification classes shall apply where appropriate except where particularly redefined in the Special Specification Clauses.

2 Standards

The equipment offered shall comply with the relevant Indian Standards. The equipment conforming to any other approved International Standards which is considered equivalent or superior shall be acceptable. The tenderer however, shall have to substantiate equivalence or superiority.

3 Requirement of Statutory Authorities

The electrical equipment/installations shall comply with the requirements of Rules/Regulation as amended up-to-date, required by Statutory Acts or Authorities.

- The Indian Electricity Rules, 1956
- The Indian Electricity Act.
- The Indian Electricity (Supply) Act, 1948
- The requirements of Chief Electrical Inspector to the Government of Tamil Nadu.
- The requirement of Tamil Nadu State Electricity Board.
- Fire advisory Committee Insurance Act.
- The contractor shall get the drawings, layouts of HT sub station etc. approved from TNEB and chief Electrical Inspector to the Govt. of Tamil Nadu, wherever necessary. The contractor also shall arrange to get the installation inspected by CEIG and carryout modifications/rectifications as required by CEIG, prior to commissioning of sub station/electrical equipments.

4 H-Frame Steel Structure

H-frame galvanized steel self supporting structure shall generally have the following equipments.

- Lightning Arresters
- Gang Operated A.B Switch
- DO Fuses
- String Insulators
- Pin Insulators
- ACSR conductors of appropriate sizes to connect all the equipments

4.1 Lightning Arrester

Lightning arresters shall be provided on each 11KV line before the termination on the 11KV isolators in the switch yard. Lightning Arresters shall be suitably mounted on H pole structure or 4 pole structure for receiving 11kv supply as per IS 3070 Part I.

4.2 Gang Operated AB Switch

The Switches shall be provided with horizontal connecting bar, for gang operation, G.I pipe as down rod lever coupling and operating handle with padlock and other components necessary for complete assembly.

4.3 11KV Drop-Out Fuses

The IIKV drop-out fit off fuses shall offer protection against short circuit and suitable for use in conjunction with 11KV system having fault level of 500 MVA as per relevant ISS.

A suitable insulated operating rod shall be provided with each fuse assembly. Two pairs of rubber hand gloves for working on 11KV shall be provided.

4.4 Insulators

The disc, pin and post type insulators used shall be of high quality glazed porcelain. The electrical and mechanical characteristics shall conform to IS:731 and IS:254. The insulators shall have following characteristics suitable for use in an effectively earthed system.

- System voltage : 11kv
- Dry wet one- minute power Frequency to withstand Voltage : 22 kv
- 1.2/50 micro second impulse Withstand voltage : 75KV
- Power frequency puncture Withstand test voltage on Units : 1.3 times of the dry flash over voltage of the unit.
- Visible discharge voltage : 9 KV
- Total minimum creep age distance for post and disc insulator : 320 mm for post insulation
  320 mm for disc insulation

5 HT Sub Station

5.1 In general HT sub station shall be out door type. The transformer shall be suitable for out door type and installed on cement concrete platform, having capping level well above the flood level of that area. The size of the platform shall be decided by the contractor, depending on the capacity number of transfer to be installed. In case of indoor sub station, the transformer shall be suitable of indoor type. The transformer HT/MV panel rooms shall be decided to suit requirement. The transformer may be erected on the structure also with suitable provision made in the H pole structure. Fencing shall be provided as per relevant IE rules.

6 Power Transformers

6.1 General

TRANSFORMER SHALL BE 11KV /0. 433KV

Type: Outdoor in general. In case of indoor, sub station shall be indoor type, mineral oil filed natural cooled ONAN as per standard IS 2026 with of circuit tap changer of + 5 to - 10% in steps of 2.5%. Adequate number of radiator elements made of low carbon sheet steel should be provided for cooling.

Technical Particulars:
No. of Winding : 2
No. of Phase : 3
Winding connection: primary - Delta
Secondary - Star
Connection Symbol: DYN 11
Rated frequency: 50 Hz
Rated kVA: 400
Rated primary voltage: 11kV
Short circuit level: 26.2kA
Method of system earthing : Solidly earthed
Rated Secondary voltage: 433 V
Impedance voltage: 4%
The temperature rise at reference ambient as per IS: 2026
Top oil 45^{o}C by thermometer method
Winding 55^{o}C by resistance method
Primary and secondary side cable box for cable termination.
All standard fittings and accessories as per IS
Acceptable makesCGL, EMCO, Bharat Bijlee, WSON

6.2 Insulating Oil

The transformer shall be supplied with insulating oil duly filled. The insulating oil shall conform to IS: 335 10% excess oil shall also be supplied to account for loss.

6.3 Transformer Accessories

The transformers shall have the following Accessories

- Off Circuit manual tap changing switch externally operated as specified and positioned on side of transformers accessible from the ground level;
- Conservator with drain plug, filling as specified.
- Explosion vent with diaphragm
- Air-relief vents;
- Inspection cover on the tank covers for all transformers;
- Filtering connections with required valves
- Following valves shall be provided

  Oil sampling valve - One No

Oil Drain valve - One No
Filtering valves - Two Nos

- Grounding terminals, two for the transformers tank for clamping to purchaser's grounding grid connection;

- Lifting lugs or eyes for the over top part of tanks, cores and coils, and for the complete transformers

- Pulling eyes, for pulling the transformers parallel to and at right angles to the axis of bushings.

- Diagram and rating plate for transformers,

- Rollers

- Thermometer pockets with dial type thermometers for top oil temperature indication. The thermometer shall be clearly visible from ground level as specified.

- Weather proof control cabinet

- Buchholz relay

Transformer shall be tested as per IS 2026.

LT Panel Board

Panel board shall be either cubicle type floor mounted or wall mounted. The board shall be Vermei and dust proof powder coated made of 14 SWG MS sheet and MS angle, iron frame work with copper/Aluminum bus bar 4 nos enclosed with insulated sleeves of approved colour and required current carrying capacity as per IE rules. The bus bars shall be mounted on a suitable insulating support. The panel board shall be complete with all internal wiring including twin copper earthing.

8 Air Circuit Breakers

The Air Circuit Breakers shall conform to IEC/Indian standards. The ACBs shall be manually draw out type in open execution with over current trip device adjustable 64% to 110% time setting for overload adjustable current setting for short circuit protection and adjustable current and time setting for earth fault protection.

No. of poles	- 4 or 3
Rated insulation voltage	– 1000
Rated short circuit breaking	- 50 KA – (AC – 415V)
Rated making capacity AC	– 105KA
Rated short time withstand current	– 50KA
Total making time	– 30 millisecond
Total Breaking time	– 38 ms.
Motorised mechanism	– 220/240V
Under voltage released AC	– 150/(66)VA
Opening line delay	– 20 – 30 MS

System protection	– overload, short circuit, Earthfault
Overload protection	– adjustable current settings ariation 50% to 100%
Short circuit protection	– adjustable pickup level
Earth fault protection	– relay shall have sensitivity of adjustable Between 10% to 30% of ACB rating

Air circuit Breaker shall be fitted with following

- Heavy duty switch having not less than 4 No. + 4 N C - contacts
- Built in resin cast current Transformer
- Auxiliary contacts
- Shunt and under voltage tripping device
- Neutral CT for earth fault protection
- ACB shall be suitable for locking the breaker in various positions. Provision of door locking with requisite end termination lug and sockets. Terminal bars for connecting more than one terminal.

9. Moulded case circuit breakers

The Moulded case circuit Breakers shall have overload, and Short-circuit protective elements. The contact system shall be designed to have minimum wear and also energy loss. Arc extinguishing device shall be provided. The MCCB shall have 'ON' – 'OFF' or 'Trip' indicators. The interrupting capacity of the breaker shall be 35KA – 50 KA at 415V. The MCCB shall be tested as per IS 2516.

The container shall be of non-conducting materials and withstand high temperature, and flame retardant.

10. Miniature Circuit Breakers

Miniature circuit breaker working on residual current device having 6000A short circuit breaking capacity and 30 milli amp. sensitivity and 30 millisecond tripping time conforming to IS 12640 trip free mechanism operating for rated leakage at nominal 10 Volts. Earth leakage circuit breaker also may be provided wherever necessary instead of MCB.

11 **Fuse Switch Units.**

The fuse switch unit shall be suitable for 415/430V operation and conform to IS 13947 (Part 3) and IEC 947-3.

The switch shall conform to following Technical specification

Rated operational voltage	- 415V
Rated insulation voltage	- 660V
Rated Thermal current	- 125A/160A/250/400A
Number of Poles	- Three (TPN) isolate
Rated operational current	- as required
Rated making capacity	- 10 times the rated current
Rated fuse short circuit making capacity at 415V	- 176 KA

Rated fuse short circuit withstand

Capacity - 80 KA

12. **Indicating Instruments**

All electrical indicating instruments shall be digital square type of size suitable to the panel. These shall be suitable for flush mounting with only flanges projecting on vertical panel. Instrument dial shall be white with black numerical lettering.

Instrument shall conform to IS 1248 and shall have accuracy class 1.00 or better. The current coil and potential coil of Ammeters and Voltmeters respectively, shall withstand 120% of rated current and voltage, without loss of accuracy.

The meters shall have external zero adjustments. The ammeters fitted in the motor circuits shall have suppressed scale to indicate the maximum starting current. The instrument shall be provided with glass cover to avoid the possibility of measurements due to static charge.

The three phase three wire trivector meter shall comprise of KWH meter and KVAH meter mounted together with KVAH meter in one case with special summator mounted between them to register correct KVAH at all power factors.

All the factors shall have respective maximum demand indicators to record the average power over a period of half an hour. The tri-vector meter shall conform to relevant IS.

13. Under Voltage Relays.

The induction disc type, single pole under voltage relay shall have inverse time voltage characteristics on all taps. The relay shall be designed to develop maximum torque at supply frequency and shall be insensitive to the voltage at harmonic frequencies.

The operating time shall be adjustable by time setting multiplier. Selection of the required voltage setting shall be possible by means of a plug setting bridge having an insulated plug. The relay shall conform to IS-3231.

14. Protective Relays

Relays shall be rectangular in shape, flush mounting type, having dust tight covers, removable from front, and shall be equipped with externally reset, positive action operations indicators. The relay shall have auxiliary units of either series connected or shunt connected type. All auxiliary relays shall be non-draw out type and protection relays shall be draught type with test facilities.

Test plug shall be supplied loose. All relays shall conform to the requirements of IS - 323 or relevant IEC in general and IS - 3231 in specific.

Relays shall be provided with adequate number of potential free self reset/hand reset output contacts as required. Provision shall be made for easy isolation of trip circuits of each relays for the purpose of testing and maintenance. Current transformer short circuiting arrangement shall be provided in case of draught type relays.

Voltage relays shall have sufficient thermal capacity for continuous energisation using external resistance, if necessary.

No control relay, which will trip a circuit breaker when relay is de-energized, shall be used.

15. CABLES

15.1 1100V/660V Grade cables shall be PVC insulated, PVC sheathed, G1 strip armoured, Aluminum conductor.

The control cables and cables for lighting system shall be with PVC insulated, multi stranded copper conductors. Cables in general shall conform to IS 694, IS 1554 part I & II, and cross section 25,16, 10, 6, 4, 2.5 and 1.5 sq.mm.

15.2 Laying of cables

Cables shall be laid directly buried on earth, in conduits along walls, ceiling etc. The cable installation shall conform to relevant ISS.

- Cable inside the Sub-station/Building shall be laid in the prepared trench. If any hole or breaking of wall is required for cable laying work, it shall be done by the contractor and the wall shall be closed after completion of the work as original.

- The cable trench dimensions inside the Sub-station and the route shall be indicated to the civil contractor well in advance while Sub-station civil work is in progress, depending upon the cable entry, and location of different equipments, transformers, panels, etc.

- Laying of underground cables outside the building shall be done by excavating a trench covered by brick and sand of 0.75 metre depth for HT and LT cable and protecting each run of cable by sand and earth filling.

- The HT and LT cables shall be taken through the cable duct provided on the ground floor roof as shown in the sketch, by properly clamping.

- Fixing of cable on the wall by clamping the cable, using suitable GI clamps with wooden saddles. The distance between two clamps shall not be more than 750mm. The cables shall also be taken through PVC pipes on the wall. The cable route on the walls shall be decided with the Engineer in site. The cables shall be covered with GI plates, trays or wooden covering. Sharp bending, twisting and Kinking of cables shall be avoided. Suitable cable duct shall be provided in the wall connecting all switch rooms of Railways and Commercial Complex.

16. Distribution Boards

All the switch Boards, Panels shall be neatly wired using 1100/660V PVC insulated stranded copper cable of minimum 2.5 sq.mm. Copper Bus Bars also may be provided to suit the requirements.

Each wire shall be identified at both ends with cable marker.

Distribution Boards shall be housed in metal clad case or board conforming IS 4237. The Sub-distribution Boards shall be equipped with rigidly fixed miniature circuit breaker complying IS8828 in the phase leads with over load and short circuit protection. The MCBs shall have adequately sized terminals for the outgoing leads. The distribution boards shall have adequately rated phase and neutral bus bars of

high conductivity copper. Earth the bus bar with the necessary number of terminals for connecting the earth continuity conductors.

Each SDB shall have circuit schedule pasted or permanently fixed inside the cover stating the details of circuit controller and rating of MCB. Non-flammable insulating shields shall be provided to prevent fire hazards during operation of MCBs.
The Sub-Distribution Boards shall not be mounted at a height exceeding 180CM from ground level.

Main Distribution Boards shall be surface mounted. Main Distribution Boards shall be erected in each switching room, and sub-distribution boards shall be located according to the distribution of load and the equipments to be connected and its location.

17. Lighting System

17.1 Point Wiring

Point wiring shall include all work necessary to complete wiring from switch circuit of any length from the tapping point on the distribution circuit switchboard to the following:

- Ceiling rose for fans, lighting etc.
- Socket outlet (in the case of socket outlet points)
- Lamp holder (in the case of wall brackets, batten points, bulk head and similar fittings).
- Call bell buzzer (in the case of the works “via the ceiling rose/socket outlet or bell push where no ceiling rose/socket outlet is provided”).

17.2 Circuit wiring

Circuit wiring shall mean the length of wiring from the distribution board upto the tapping point of the nearest first points of that circuit, viz., upto the nearest first switchboard measured along the run of wiring. Such wiring shall be measured on linear basis.

18 Electric Motor

Type : Squirrel case induction motor suitable for continuous duty.
Standards : Performance - IS 325, IEC 34
Dimensions - IS 1231, IEC 71
Site condition : Ref. Ambient -45? C
Max humidity - 100%

Cast iron body with integral feet and frame. The stator core shall be that of high grade carlite insulated low loss silicon steel lamination stacked together and fully tightened. The rotor shaft made of high grade forged/rolled steel. A spacious terminal box is to be provided to accommodate aluminum conductor cables.

Technical Particulars : Rated voltage: 415V$\pm$110%

Frequency : 50Hz±3%
Temperature rise of 75°C over ambient of 45°C
Enclosure: IP 55
Type of cooling: Totally enclosed fan cooled
Acceptable makes: Siemens, NGEF, CGL, KEC

18.1 Auto transformer starter

Automatic auto transformer starter shall be assembled in 14 SWG sheet steel, floor mounted with following accessories

- Oil immersed auto transformer with 50%, 65% and 80% tapping including first filled oil.
- Bimetallic overload relay
- Timer on delay and off delay.
- Ammeter with CTS and selector switch.
- Voltage with selector switch.
- No voltage release
- Indicating lamp, Power On, Trip

(Single phasing current sensing preventor with protection CTS)

- Thermo stat for oil temperature.(Optional)

19 Earthing

- Earthing in general shall comply with C.P.(Code of Practice) 3043 of Indian Standards.

- Earth electrode either in the form of pipe electrode or plate electrode should be provided at all premises for providing earthing system.

- As far as possible, all earth connection shall be visible for inspection and shall be carefully made.

- Except for equipment provided with double installation all the non-circuit carrying metal parts of electrical installation are to be earthed properly. All metal conduit trunking cases. Sheets, switch gears, distribution fuse boards, lighting fittings and all other parts made of metal shall be connected to an effective earth electrode.

- The main earth electrode should be a G.I perforated pipe driven into the soil as per standard practice. continuous looped earthing should be provided with adequate size G.I. wire /feat. Earthing work should conform to I.E. Rules.

- The electrodes shall be situated at a distance not less than 3.0 m from the building fencing structure and equipment foundations. The earth pit shall conform to IS: 3043 and GI earth electrodes of not less than 100 mm external dia shall be driven to a depth of at least 3 ma in the ground below the ground level. The surrounding the electrodes, soil shall be treated up with salt, coke and charcoal.

- Earth electrodes shall be installed near the main supply point and shall comprise a copper/GI earth of appropriate diameter and driven to depth of 3 metres below ground level,. or to a greater depth, if so required to obtain a sufficiently low earth resistance value. Alternatively copper plate mach be used as the main

earth electrode conforming to IS: 3043. The electrodes shall be driven at least 3 m away from the building or any other earth station.

Minimum requirement of earth pits as per I.E. rules are as under:

- Two numbers independent for transformer body
- Two numbers independent for transformer neutral
- Two numbers independent for four pole structure
- One number for lightning arrestors.
- Two numbers of L.T. panel at sub-station and at pump house.

The main earth electrodes after being driven into the ground shall be protected at the top by constructing a concrete or block masonry chamber of size 300 mm x 300 mm x height 300 mm. and shall be provided with CI cover. The resistance of any point in the earth continuity system of the installation to the main earth electrode shall not exceed 1.0 ohm. The remaining space in the borehole shall be filled with bentonite. The bentonite will hold the earth rod in position. The neutral conductor shall be insulated throughout and shall not be connected at any point to the consumers earthing system.

- An earth continuity conductors shall run continuously from the farthest part of installation to the main earth electrode and shall be connected by branch conductor to all metal casing and sheathing housing electrical apparatus and/or wires and cables. all branch shall be connected to earthing. The earth continuity conductors shall have a cross-sectional area at least half to the size of the phase conductor and in no case less than 1.5 sq.mm of copper/GS.
- All earth wires and earth continuity conductor shall be galvanized M.S flats of appropriate size. Interconnections of earth continuity main conductors and branch wires shall be brazed properly, ensuring reliable, permanent and good electrical connections. The earth lead run on structures must be securely bolted. Neutral earth leads shall be run on separate supports without touching the body of the transformers. Earth wires shall be protected against mechanical damage and possibility of corrosion particularly at the junction points of earth electrodes and earth wire interconnections. Earth electrodes shall be connected to the earth conductors using proper clamps and bolt links.
- It shall not be allowed to use the armour of the incoming feeder cables to the sub-distribution board as the only earthing system.
- Sheathed lugs of ample capacities and size shall be used for all underground conductors for sizes above 3 mm^2 whenever they are to be fitted on equipment of flat copper conductor.
- The lugs shall be fitted on equipment body to be grounded or flat copper only after the portion on which it is to be fixed is scrubbed, cleaned of paint or any oily substance on a subsequently tinned.
- No strands shall be allowed to be cut in case of stranded ground round conductors. G.I embedded conduits shall be made eclectically continues means

of good continuity fixing and also be rounding copper wires and approved copper clamps.

19.1 Earthing of Lighting Poles

All external poles are to be looped together with continuous 8 SWG GI earth wire clamped at dollies provided on every fuse box of poles and looped onwards to the other pole. Every fifth pole shall be connected to earth through an earth electrode.

19.2 Earthing for Lighting Installation

This shall be common grid system, the main grounding conductor laid and embedded in concrete being grounded at earth pits outside the buildings at approved locations or other places. The earthing of L.T. panels shall be connected to two main grounding conductors each of which along with main cables shall run with cables to distribution boards in which floor. This shall run along with the cable and at the top floor be connected same section completing the grid.

19.3 Sizes of Earthing Conductors

S. No	System	Earthing conductor size and Material
		Buried in ground/ Above ground concrete
-	Main earthing grid	40 X 10 mm MS
	11 kV outdoor sub-station and 11 kV switchgear	40 X 10 mm MS 50 X 6 mm GS
-	415 V switchgear,	Suitable to its rating.
	transformer, DG set, Capacitor Control Panel	
-	Battery charger	25 X 3 mm GS
-	415 VLT Motors	
-	Valve motors	10 SWG GS wire
-	0 - 15 HP	8 SWG GS wire
-	15 - 40 HP	4 SWG GS wire
-	40 - 50HP	25 X3 mm GS flat
-	50 HP and above	25 X6 mm GS flat
-	Lighting distribution Board, 30 V DC Tripping Unit.	25 X 3 mm GS flat
-	Local Push Button stations, Junction Boxes.	14 SWG GS wire
-	Lighting and receptacle system	12 SWG GS wire
-	Earth Electrode	50 mm dia.3000mm long heavy duty

GI Pipe electrode

- Street lighting Poles 8 SWG GS wire

Notes: 1. Conductors above ground shall be galvanized steel to prevent atmospheric corrosion.
2. Conductors buried in ground or embedded in concrete shall be mile steel.

1. Drawings; The typical earthing details are shown on drawing.

19.4 Battery, Battery Charger & DC Distribution Board

- The charger and DC distribution board shall be enclosed on a common sheet steel enclosure with necessary compartment for each incoming and outgoing feeder.

- Complete information regarding battery layout, space requirement for locating battery, wall painting of battery room floor, ventilation, method of lighting etc. shall be supplied by the Contractor. The battery room shall preferably be located inside MCC room as shown,. The battery room shall have acid proof tiles as flooring and upto 4 ft. level. Also there shall be an exhaust fan of appropriate capacity to extract vapours from the room.

19.5 Tests

Batteries and battery chargers shall be routine tested before despatch, in accordance with Indian Standards. Capacity test shall be carried out on the batteries at site after installation.

20. Street Light

Street Light fixtures shall be complete with integral semi-cut off lantern with glass cover complete with internal wiring, control gear, mounting accessories, street light bracket for HPSV 150W made from 60mm dia (B Class G I Pipe) 2 m in length and welded to the pole cap of size 100mm and 30 cm long duly welded.

21. Street Light Poles

The street light mast shall be 65m/75 diameter G.I pipe of 7.5 meter long with 300mm x 300mm x 6mm of M.S base plate, duly welded at the bottom. A suitable MS box to have 5A control switch, 16A fuse unit with suitable frame work shall be fitted in the street light mast with door and locking arrangements.

A terminal box with fuse shall be fixed in all the poles.

22. Capacitor

To improve the power factor capacitor shall be provided in the LT bus bar in the sub station.

- The capacitor shall be as per ISS 2834 and IS 2544.

- The capacitor shall be all polypropylene film capacitors. The film shall be oriented bi-axially.

- The oil used for impregnation under vacuum shall highly purified non-toxic.

- Low loss discharge resistance, to reduce the residual voltage to 50V or less within one minute after the capacitor is disconnected.

- The capacitor container shall be painted with epoxy-based paint, to prevent corrosion/rusting.

- 4 stage switching ON/OFF shall be provided to match with the load.

- Automatic Power Factor Correction Unit shall be provided if necessary.

23. Safety

The following minimum safety equipments shall be supplied and installed in the Sub-Station switch rooms and Diesel Generating rooms.

- Portable chemical fire extinguishers conforming to IS 935 or its latest version shall be supplied and installed at the Sub-Station, Switch rooms and Diesel Generating Stations.

- Fire buckets with M.S. angle stand each consisting of 4 Nos. round bottom fire buckets painted with red and marked fire and filled with clear dry river sand shall be supplied and installed at a convenient locations at the proposed Sub-Station.

- First-Aid boxes equipped fully with required materials, shall be supplied and kept at a convenient place in the Switchgear room so that the same is easily accessible.

- Shock Treatment chart.

- Rubber matting of not less than 25 mm. thick and 600 mm width and standard lengths, shall be provided in from of all the switch gear panel, Transformer, Control cubicles, etc.

- Rubber gloves tested for 15 KV about 4 sets shall be supplied.

24. Diesel Generating Equipment

24.1 General

- Electrical power supply for each pumping arrangement will be availed from nearby TNEB supply point. According to the load requirement HT at 11KV/22KV or LT at 415V - 3 Phase will be availed from TNEB.
- One Diesel driven alternator set of required capacity as specified shall be provided to permit operation of all the units in the plant including lighting units in the event of failure of the TNEB electricity supply, complete with all equipments like. The equipment shall conform to the latest relevant ISS or BS.

- Control gear, circuit breakers, cabling, synchronizing equipment etc.

- The engine alternator sets shall be designed such that the starting power peak shall not exceed 10 per cent of the continuous engine rating and the voltage dip shall not exceed 15 per cent whilst starting the connected load under the worst conditions.

- The Drawings shall show the building, floors and other details as they will be constructed and the space allocated for the generating plant, control gear and circuit breakers.

- Tenderers attention is specifically drawn to the operating conditions where by generator sets could be running at little or no load due to the intermittent and differing flow rates and pump capacities.

- A system using dummy loads to maintain a safe minimum working level is envisaged and the Tenderer is required to comment upon this or any other proposed system at the time of Tender submission together with supporting documentation and calculations.

25 Statutory Approval

The Contractor shall be totally responsible for obtaining statutory approval from the electrical inspector or any other statutory authority for the entire installation carried out by him unless otherwise specified and agreed. Necessary test reports shall be submitted by him to electrical inspector. This will be an integral part of the contract and shall not be paid for separately. However fees payable to statutory authorities shall be borne by the employer.

26 Acceptance of Installation

On completion of the work the Engineer, together with the Contractor, will carry out an inspection of the installations. The Engineer will issue a completed copy of the Employer's Acceptance of Electrical Installation to the Contractor as confirmation that the work has been accepted, subject to any matters noted on the form being attended to.

VII OPERATION AND MAINTENANCE OF SEWAGE TREATMENT PLANT

1. SCOPE OF WORK

The contractor shall operate and maintain the Sewage Treatment Plant, and all other allied works under this contract, for a period of 5 years. Salient features of works are:

1) To Operate and maintain the sewage treatment plant, all instruments and mechanical, electrical equipments in accordance with the aim and purpose of treatment. The plant & equipments covered under the above contract will be totally attended to, by the contractor including any "Troubleshooting" to ensure smooth and trouble free operation.

2) The contractor will monitor the performance of the sewage treatment plant; conduct the analysis of the inlet sewage and water quality after treatment. Contractor shall initiate and take adequate actions to ensure smooth and satisfactory performance / running of the plants on a 24 hours / round the clock basis.

3) The contractor shall prepare and implement an effective plant maintenance programme in consultation with the Employer. It is an absolutely contractor's responsibility to look after all sorts of maintenance whether preventive, Minor, Major, or break-down

4) The contractor will determine operating parameters, select settling (Chemical doses etc.) and generally optimize the process, and working of the treatment plant. Excessive chemical dozing i.e. dose more than normal should be avoided otherwise penalty shall be levied and recovered from the contractor.

5) The contractor should plan & procure all spares, Polyelectrolyte and all consumables including chemicals, grease, lubricating oil, cleaning agents, laboratory reagents etc. Further the contractor will plan about the requirement well in advance (At least 4 months) and procure the material from the market.

6) The contractor will be responsible for keeping up-to-date record of documents including History Card for equipments and maintaining every day log book relating to various analysis performed.

The contractor shall maintain and update logbook, in which details of operational parameters are recorded in every shift and at regular interval say hourly or as decided mutually.

7) The contractor will prepare and submit a daily report of plant performance and will assist the Employer in preparing the necessary documents for their purpose and records.

8) The contractor will be responsible to carry out day to day periodic maintenance, necessary to ensure to smooth and efficient performance / running of all equipments / instruments comprising the sewage treatment plant and maintaining the record of the same.

9) The contractor shall have to issue identity cards with photographs to all the staff employed for Operation and Maintenance. The list of the same shall be submitted to the Employer mentioning qualification & experience.

10) The contractor will also be responsible to carry out day to day Maintenance of the rising main inside the STP premises.

11) The contractor will employ minimum staff for operation and maintenance of the Plant as per the list mentioned in the detailed scope of work.

The above staff shall be distributed in three shifts as per mutual agreement between Contractor and Employer As per agreement the number of staff in each shift should always remain present otherwise penalty towards absence of any staff shall be recovered from the Contractor as per Volume-I GCC . The contractor shall make the arrangement of reliever for weekly off/holiday etc. Absence on any ground like weekly off or holiday shall not be considered. The presence of staff in each shift should be marked in muster to be maintained at office of shift in charge at Sewage Treatment Plant that shall be considered as final. The Contractor's staff must mark their presence in this muster.

The Contractor may maintain a separate register for his own purpose.

12) The staff of contractor will always remain in contact with the Junior Engineer, Assistance Engineer/Electrical Supervisor, in charge of the Plant deployed by the Employer and follow their instruction.

13) Unsatisfactory and inefficient running of the plant and unnecessary and excessive usage of spare, consumable, etc. supported by the reasons which are under control of contractor will be highly objected. In such cases Engineer-in-charge's decision will be final and binding to the contractor.

14) It is required that at least once in every one months a technical expert other than the Monthly Staff of the contractor will visit the plant and will suggest if required, to improve the efficiency and working of the plant etc. No separate payment will be made for such visits. The visit must be recorded and out come of the visit/minutes of the meeting should be got signed by Employer authorities without which the visit shall not be considered.

15) Contractor will comply with all safety rules and regulations and all inter disciplinary as followed by the Employer.

16) The Employer will not be responsible for any accident /injury to the staff of the contractor. Further the Employer will not provide any insurance or medical facility to the staff of contractor. The responsibility lies with the contractor.

17) All Central/State Government / Semi-Government / Local Body's Rules and Regulations pertaining to this contract shall be followed and observed by the contractor without any extra cost to the Employer.

18) No accommodation / guesthouse / transportation facility will be provided by the to the contractor. Operation & maintenance staff will not be allowed any accommodation facility inside the plant premises.

19) The duration of the O&M shall be 60 months from the date of successful commissioning of the STP. The same can be extended for the further period if the Employer so desires.

20) The contractor should employ all the staff within two days of successful commissioning.

21) The contractor will provide the necessary tools and tackles required for day-to-day maintenance.

22) The scope of work also includes cleaning of complete plant area including floor, toilet block railing, door, windows, light fixtures and ceiling etc. The entire premises of the plant area shall also be cleaned and maintain by the contractor regularly.

23) This work is inclusive of but not limited to operation, maintenance, house keeping, cleaning, removing sludge by its own carrier arrangement & dispose it off as per Employer's instructions. Preparing data recording, correspondence work to EMPLOYER and Government Departments, etc. All this work should be done as per standard practices and by following labour, factory, electrical, TNPCB, and all other old and new law and order, Indian standards etc. as applied of Local, State and Central Government of India.

24) The contractor will employ no offense, guilty person or indiscipline man.

25) Right is reserved by EMPLOYER of suspension, dismiss ion, termination of any officer / staff employed by contractor. He shall have taken prior permission to employ or to terminate his personals.

26) No watch and ward, safety insurance, security, storage, housing accommodation etc. will be provided by EMPLOYER. This will be responsibility of contractor.

27) Consumable items like rubber bush, graphite packing, rubber sheet, nut-bolts, material require for cleaning and house keeping etc. are to be brought by the contractor.

28) Electricity charges including diesel in case of power failure required for operation & maintenances of the plant will be provided by EMPLOYER. The contractor should provide all other consumables like polyelectrolyte, oil & grease etc. except chlorine, which will be provided by the Employer. All the formalities to all Government authorities for factory, Electrical, TNPCB etc. for having NOC, water consent, Hazard waste concern, approval etc. shall be done by the contractor.

29) Monitoring should be done as per guideline given by Engineer-in-charge. Contractor has to maintain all the parameter of effluent within stipulated limit or he will be penalized for not maintaining the parameters given by TNPCB and EMPLOYER. All expenditure incurred for the same like, suite fee, court fee, case fee, or the penalty as decided by Engineer of EMPLOYER and penalty charged by TNPCB will be charged to contractor and deducted from his bills, S.D etc.

30) Contractor shall have to test the effluent / influent at his own cost at the plant lab on daily basis. The same be verified by and checked by EMPLOYER whenever required. The contractor shall also have to test the effluent / influent at TNPCB lab for different parameter on weekly basis at his own cost.

31) No equipment shall remain ideal or un-attended or damaged for the period of 3 days. If any equipment is not repaired, rectified and or replaced within 3 days, the contractor will be penalized with no limit at the rate of Rs. 2000/- per day delay per each individual equipment of the plant.

32) The payment of O & M charges will be made as per the tender conditions. The other terms and condition described in these complete tender documents, wherever applicable shall remain unchanged. In case of any discrepancy the decision of Engineer-In-Charge will remain final & binding on the contractor.

32) During Operation & Maintenance period, contractor has to supply all the spares, at his cost during preventive, major-minor breakdown, replacement and maintenance work. No extra payment will be made for such maintenance on any ground. The payment for the same will be made strictly as per tender document irrespective of the number of break down / minor, major repairs replacements. During the O & M contractor will have to enter annual maintenance agreement with Manufacturers of all major Mechanical Equipments like Centrifuge, Air Blowers, Screens, Decanters etc.

33) Contractor will have to maintain required Power Factor as per TNEB rules and regulations. Incase penalty is levied by TNEB for not maintaining the Power Factor the same will be recovered from the contractor.

34) Maintenance of Garden, Lawns, Plants, Bushes, Plantation of new Plants, Lawns etc. and feeding, gardening, cleaning etc. is in the scope of the contractor. No separate payment will be made for the same.

35) The Contractor during his O&M period will have to follow all the guidelines set by TNPCB for Operation & Maintenance of STP.

36) Operation and maintenance of all General facilities and utility services including all other components of work done under this contract.

37) Operation and maintenance PLC based automation system and all instruments installed in the STP. All repairs, replacements towards the entire instrumentation works during the O & M period shall be in the scope of contractor.

38) Any other services required for smooth running of the scheme.

39) The contractor shall also dispose off the sludge, screenings, grit and any other material, as per specifications and to the satisfaction of the Engineer-in-Charge. It is to be noted that all costs during the O&M period, excluding the cost of power and chlorine are to be borne by the contractor. Within his quoted cost, the contractor is to ensure that the following guarantees are maintained during the operation & maintenance period:

? for quality of treated effluent
? for consumption of chemicals
? for automation

44) The contractor shall provide on job training to the Local body staff as per specifications.

45) At the end of every 2(1/2) year of operation & maintenance period, an assessment of the condition of the plant has to be done by the contractor through third party inspection at his own cost and based on that assessment the contractor shall, at no extra cost to the EMPLOYER, repair and re-condition all the mechanical equipments in the concluding year of the O&M contract to a condition so that they are in running condition with regular preventive and recommended maintenance as per manufacturer's recommendations or as per CPHEEO manual.

46) **Variability of Throughput**: If the quantity of treated sewage from the Facility can be increased in the existing system without impacting the annual fixed costs to the Contractor, the Contractor shall comply with such requirements

For a sustained requirement of higher throughout from the Facility, the Contractor may be required to frame and submit a proposal that shall be implemented if mutually acceptable.

OUTPUT AND OPERATIONAL GUARANTEES

The contractor is fully responsible for treating all the Sewage reaching at the Receiving chamber. The performance of the contractor shall be treated as unsatisfactory if he fails to treat the complete sewage or does not maintain the guarantees listed in this clause excepting in force majeure condition or fails to fulfill other conditions of the contract.

2.1 Treated Effluent Quality

The contractor shall operate the Sewage Treatment Plant in such a way that the treated effluent quality attains the following parameters as given Appendix-I of Page of Volume I. Effluent characteristics **shall not exceed** the following values.

BOD_5 at 20^0C	10 mg/L
Suspended solid	10 mg/L
pH	6.5 to 8.5
COD	100 mg/l
Faecal coliform	200 MPN/100 mL.
Oil & Grease	5 mg/L

2.2 Treated Sludge Disposal

The contractor shall operate the Sewage Treatment Plant such that the sludge produced is of a spade-able consistency and the volume of sludge produced after necessary process, is minimum. The sludge generated from the STP shall be disposed off through proper approved means of transport to the Compost yard site as designated by the Employer

2.4 Chemical Requirements

All chemicals consumed to operate the Sewage Treatment Plant and other facilities under this contract will be borne by the contractor.

3. **Adverse Operating Condition**

During which the raw sewage quality deteriorates beyond the

Specifications in Volume I, the following provisions will be applicable

a) If the raw sewage can still be treated to meet the Output Standards, the Contractor shall comply with such specifications.

b) In the event it is not possible to meet the Output Standards, the Contractor shall immediately inform the Employer.

c) In the event it is possible to meet the Output Standards, but an increase in fixed and variable costs is unavoidable, the Contractor shall, as soon as practically possible, inform the Employer.

3.1 Alternate Output Standards;'

The treated effluent output BOD, shall be 10% of the influent BOD, the period of

adverse condition is 30 days.

4. TESTS TO BE CARRIED OUT DURING O&M PERIOD

The sampling and testing to be carried out twice a day and at least at the points given below. This schedule shall also be maintained during the O&M period.

- Inlet chamber at sewage treatment plant for flow, BOD, pH, SS, temp., COD and oil & grease, TDS.
- Outlet of the sedimentation units for BOD, suspended solids. PH, COD and oil & grease, TDS.
- Inlet of the reactor unit for MLSS, Dissolved Oxygen & pH.
- Outlet of the reactor unit for Dissolved Oxygen, Sludge volume Index & pH.
- Outlet of the secondary treatment units for BOD, Suspended solids, pH, COD and oil & grease
- Outlet of the chlorination units for BOD, Suspended solids, pH
- Excess sludge for Volatile suspended solids, total solids, specific gravity
- Various parameters to be tested by online monitoring system at these locations as per specific requirements of Instrumentation.
- Residual Free Chlorine after Chlorination.**REPORT FORMAT FOR DAILY TESTING SCHEDULE**

FOR VARIOUS PARAMETERS
TIME: (1000 & 1600 HOURS)

Test/ Parameter	Inlet To Receiving chamber	Inlet To Secondary Treatment unit	Outlet from STP.

5. Laboratory Chemicals & Tamil Nadu Pollution Control Board Testing Charges:

Contractor should run the laboratory (both chemical &Biological) by expertise hand to evaluate the results &different parameters stated above and for that he should supply required chemicals, reagents filters& glass wares etc complete.

He should analyze the treated & untreated sewage samples for Fecal Coliform Count once in a week for that also contractor should support & supply necessary chemicals.

The Contractor should submit the weekly test reports to EMPLOYER . The list of minimum Chemicals to be procured monthly by the contractor is as follows.

LABORATORY CHEMICALS FOR ONE MONTH O & M

S. No.	Particular	Qty	Unit	Make
1	PH Tablets - 40	1.00	No	
	PH Tablets - 7.5	1.00	No	
	PH Tablets - 9.2	1.00	No	
2	Whatman filter paper	1.00	Box	
3	Manganese Sulphate	500.00	gm	
4	Sodium Hydroxide	500.00	gm	
5	Sodium Azide	100.00	gm	
6	Sodium Iodide	100.00	gm	
7	Starch	500.00	gm	
8	Sodium Thiosulphate	500.00	gm	
9	Disodium Hydrogen Phopspate	500.00	gm	
10	Ammonium Chloride	500.00	gm	
11	Magnesium Sulphate	500.00	gm	
12	Ferric Chloride	500.00	gm	
13	Calcium Cloride	500.00	gm	
14	Sulphuric Acid	1500.00	ml	
15	Petroleum Ether	1000.00	ml	
16	Ammonium Ferrous Sulphate	500.00	gm	
17	Potassium Dichromate	500.00	gm	
18	Ferron Indicator	100.00	ml	
19	Beakers- 500 ml	2.00	No.	
	Beakers- 200 ml	2.00	No.	
	Beakers- 50 ml	2.00	No.	
20	Distil Water Coil	1.00	No.	
21	Water Bath Coil	1.00	No.	

Contractor shall also procure the other chemicals required to carry out the different tests as per EMPLOYER requirements, TNPCB & Other governing authorities. The TNPCB guidelines for Operation &maintenance of ETP should also be followed for performing different laboratory tests, record keeping, as well for Operation & Maintenance of the entire plant.

Tamil Nadu Pollution Control Board Testing Charges:
The contractor should get analysed / checked the untreated as well as treated sewage samples every week from TNPCB for parameters like BOD, COD, TSS, SS, PH, etc. The necessary TNPCB testing charges are to be borne by the Contractor. The TNPCB Vigilance testing charges for samples directly collected by TNPCB are also to be borne by the Contractor.

6. STAFFING

The minimum personnel required for O & M iis as given below. Non-employment of the personnel during O&M as per the Bid will lead to imposition of penalty as mentioned in Volume I Section IV. Contract Data. However the Contractor shall mention the personnel required for O&M in his bid.

6.1 **MINIMUM STAFF REQUIREMENT**

Sewage Treatment Plant

Plant Operator	2
Lab Chemist	1
Lab Assistant	1
Watchman / helper	2
Gardener / Farm Assistant.	2

The work shall be carried out on a 24 hr basis, without intermission and the staff deployed by the contractor shall be in accordance with this contract.

The contractor shall give or provide all necessary superintendence during the O&M and as long thereafter as the Engineer-in-charge may consider necessary. Such superintendence shall be given by a competent person having adequate knowledge of the operation and Maintenance to be carried out (including the methods and techniques required), the hazards likely to be encountered and methods of preventing accident) as may be required for the satisfactory working of the entire plant.

No labour below the age to 18 years shall be employed on the work.

List of staff is to be given by the agency to the Engineer-in-charge and advance intimation to be given before deputing/removing any staff from site during the period of contract. 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 replacements shall be got approved from EMPLOYER in advance.

Engineer-in-charge shall be authorized to direct the contracting agency to remove any or all staff employed on O&M of the plant if in his opinion continued presence of such staff is detrimental to safety or proper O&M of the plant. The contractor shall comply with such directions & post suitable substitute(s) thereof. Whenever the Engineer 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 employed again on it.

7.0 SAFETY/SECURITY

The contractor shall take all safety precautions under various Acts/Rules under central/State Govt. from time to time and he shall be responsible for safety of its staff and the consequences thereof. The contractor shall deploy round the clock security personnel at entrance of plant’s premises and in the compound for the safety of the plant and premises for the safety of the plant, equipment and personnel during this period.

7.1 Responsibility for damages

The care of the whole of the permanent works shall remain with the contractor who shall be responsible for all accidents or damages from whatever cause arising and chargeable for any thing that may be stolen, removed destroyed or damaged to whomsoever belonging and also for making good all defects and damages to the said works or to any property adjoining or any cause whatever, whether such damage or defects were occasioned by the negligence of the contractor or not or may be or might have been discovered during the progress to be known after the completion

whereof or whether payment may wholly or partially have been made or the works approved as supposed to have been properly done and no certificate of approval of any works by any officers or members of the Board shall affect or prejudice the right of the TNPCB against the contractor or be considered or held as at all conclusive as to the sufficiency of any work materials.

Adequate safety precautions against fire, flooding, lightening, electrical shocks, accident due to moving/non-moving heavy/light equipments shall be strictly observed by the contractor at his own cost. Suitable safety measures like gumboots, gloves, safety belts, ladders, safety lamps, gas masks, Oxygen apparatus, insulated tools, alarms etc. shall be provided by the contractor. Necessary medical first aid kit shall be made available all the time. In absence of observance of above safety precautions, the contractor shall be responsible for any unforeseen loss of the equipments or persons dealing with it. Special care shall be taken by the contractor while carrying out the work in sewage gas zone. Any incidence of human life or accident will be totally contractor's responsibility.

The contractor shall ensure that the staff employed takes all necessary precautions while carrying out the work either in shift duties or any general shift as per Indian Electricity Rules/Factory Act/CPHEEO Manual, or manufacturer's special instruction for safety / gas handling. The staff should use Gas masks, Oxygen apparatus, Gum Boots, Safety Belts and Safety Lamps, etc. while carrying out the work in Bar Screens, sumps etc.

The contractor will make arrangement for all necessary safety equipments for persons working at STP as per Factory Act/Safety Rules. In the event of any accident on or off site, in which the contractor or his personnel are involved, in which an injury occurs to any person whether directly concerned with the project or a third party, the contractor shall inform EMPLOYER within 24 hrs. of the occurrence of the event. The plant will be open to local/state/central agencies for verification of safety/emission/acts compliance.

During night hours, the main gate should be locked. However, shift duty staff should be alert and open the gate during surprise checking of EMPLOYER staff or any other Government Authorities or his nominee without any wait. Only bona-fide persons be allowed in the plant premises being a prohibited area. Smoking and drinking are prohibited in the plant. The staff engaged shall wear common uniform with name plate indicating name and designation during duty hours.

8.0 REPORTING

The Contractor will prepare daily and monthly reports (in EMPLOYER format) of pumping/treatment and project performance and submit to the Engineer-in-Charge and will assist the department in preparing the necessary documents for their purpose and record as per proforma given from time to time. The reports shall contain, inter-alia, the following:

- Raw Sewage quantity and quality and effluent quality as per the on-line monitoring programme and other tests as specified in Clause 3.0 of this section and print outs of online monitoring shall be submitted to Engineer-in charge.

- A description of the maintenance work carried out in the reporting period.

- A report on major failures, if any, their causes and remedial actions taken.

- Sludge quality and quantity (daily basis) in the reporting period.

- Power and chemicals consumed in the reporting period.
  An inventory of the chemicals and spare parts available at the end of the reporting period.

- O&M staff deployed by the contractor during the reporting period.
  Any major repair works, if any.

- Contractor is required to maintain separate register/computerized records at all sites of following information:
  Pumping register
  Quantity of sewage treatment and performance register
  Working hours register
  Electric break down register
  Maintenance register
  Staff attendance register
- Equipment breakdown, repair record and extent of repair
- Chlorination equipment and chlorine toner operating and using register

9. Site Order Book

Site order Book shall be kept by the Engineer -in-charge at the plant site. Orders entered in this Book by the Engineer-in-Charge or his authorised representative shall be held to have been formally communicated to the contractor. The Engineer-in-Charge or his authorised representative shall sign each order as it is entered and will hand over the duplicate to the contractor or his agent, who shall sign the original in acknowledgment of having received the order.

10. Record Keeping

Running Records are required to be kept for various operating machines such as Mechanical Screens, Mechanical Grit Removers, Pumps, Motors, Scrapers, Air Blowers, Chemical consumption, Chlorine consumption etc. as maintained by the operators and kept at Control Room or duty room of the operators that is closer to the location of the machines.

The records of effluent quality and other laboratory tests are kept in the laboratory as per daily sample collection and testing schedules.

The record with respect to flow shall be maintained by operators as per Table below. The operator passes the daily log sheet to the plant Manager on the subsequent day duly signed in the first shift. All operators shall be responsible to fill up their part of observations and calculations. The plant Manager shall verify the daily record as well as the calculations and shall be responsible to generate further data using these.

It is pertinent to mention that there shall be a requirement of drawing site-specific procedures and formats / forms for keeping records. This shall be the responsibility of the plant manager.

11. Hourly record of Flow as measured / recorded through the Notch / Weir / Flow meter:

Date/ Time	Head Over The Notch / Weir / Meter	Rate Of Flow	Average Rate Of Flow In Past Hour	Flow Quantity
/ /	METERS	CUM./HOUR	CUM./HOUR	CUM
0800				
0900				
1000				
1100				
1200				
1300				
1400				
1500				
1600				

12.0 OPERATION

In case, the motor or any other equipment is burnt or damage due to negligence of the contractor or due to faulty operation it shall be sole responsibility of the

Contractor to rewind/replace/repair it as per standards of the equipment free of cost. In case of any fault in operation and performance of the plant, contractor or his staff at duty will immediately report to the Engineer-in-charge about it.

The Contractor shall run the plant unit after ensuring proper voltage. He shall also record all the power failures and voltage in daily log sheet. He will bring into the notice of power supply agency as well as control room and Departmental Engineer about the break down/power failure. He will also get the electricity restored simultaneously.

Any dispute with the workmen shall be contractor's responsibility as per Labour Laws/Govt. Rules and Regulations. In no way the department shall be responsible for the disputes between them.

The contractor shall follow the rules and regulations as per Factory Act as it is applicable.

The contractor shall arrange all necessary required tools, tackles and instruments in advance for proper operation and maintenance of the entire plant.

The contractor shall operate and maintain all (E&M) equipment as per the recommendations of the respective equipment manufacturer. He shall further maintain and operate the plant, as per CPHEEO manual to obtain the treated effluent results as per approved norms specified in this document elsewhere along with the Technical Bid. The contractor shall be free to follow manufactures manual in this regard. However in case of any doubt, the Employer. shall refer to best of the above standards and the contractor shall be bound to carry out the works accordingly.

The floating material/scum should be collected in bins and dispose the same in open pits away from the plant, machinery which should be dried and disposed off regularly at a location outside the plant and approved by statutory authority. During rainy season, this should be buried after using lime.

The treated effluent after the chlorination unit, should be disposed off to the adjacent B'Canal. The conveyance of treated and chlorinated sewage should be by means of closed conduit made by RCC Pipe/ channel.

The screened material, grit and the dried sludge cake from the centrifuge should be collected in trailers, trucks or tractor and the same should be disposed off at Municipal Compost yard. away from the plant on his own.

The Tenderers shall know all Central/State Government/ Semi-Government/Local Bodies rules regulations to this contract without any excuse. Gas coming out of sewage is hazardous containing Methane, CO, CO_2 and H_2s etc. Therefore, necessary precaution and measures are to be taken in regard to human life and installations.

13. MAINTENANCE

Every part of the works and all the materials to be used therein shall be subjected to such tests from time to time during the execution of the work as the Engineer-in-charge may direct and the whole of such tests shall in all cases be made at the contractor's sole expense.

The work shall be carried on and completed under the exclusive control direction and supervision and to the satisfaction of the Engineer-in-charge. The Engineer-in-charge shall likewise have full power to reject or condemn any work or material that he may deem unsuitable. In case of any work or material being rejected by the Engineer in-charge, the contractor shall immediately remove and replace the same to the

satisfaction of the Engineer-in-charge or the Engineer- in-charge shall have full powers to get the same removed and replaced and deduct the expenditure incurred in the process from any amount due or that may become due to the contractor.

The contractor shall use only the original and genuine spares of the original equipment as per recommendations given in the maintenance booklet of the manufactures/as per directions of the Engineer- -in-charge. Adequate stock of such spares is to be maintained by the contractor. Test certificate of manufacturer is required for bearings along with supplies. Test certificate of all major equipment will be submitted from the manufacturer.

If any material brought upon the site of works or to the places where any Operations have been or are being carried out in connection with or for the purpose of the works, be in the judgment of the Engineer, of an inferior or improper description or improper be used in the works, the said materials or workmanship shall where required by the said officer be removed or amended by the contractor forthwith or within such period for every breach by the contractor in this clause, the Engineer is hereby authorized to remove or cause to be removed the materials and workmanship so objected to or any part thereof and replace the same with such other materials and workmanship as shall be satisfactory to him and there upon the contractor shall on demand repay to the Board the expenses incurred there by or to which the board may be put or be liable in connection therewith, the amount thereof to be certified by the Engineer whose certificate shall be final.

He shall be responsible for civil maintenance of buildings and roads changing of broken glasses, white washing and painting every two years and watering of lawns/plants within the plant premises.

The contractor shall also be responsible to maintain cleanliness in around the plant including machineries, disposal of floatings removed from the Bar Screens/reactors, etc. Grit and other unwanted material.

All the steel structures and machines installed in open areas should be painted after every monsoon period after cleaning the surface as per the instructions of the Engineer- in-charge.

Entire plant including all civil structures, mechanical equipments, HT panel and Transformers etc. shall be repainted after every 2(1/2) years as per original painting specifications.
Surface drains shall be cleaned every year before start of monsoon.

All leakages should be attended promptly to avoid any nuisance etc. Chokages should be removed at once. All the valves/gates which are not used regularly should be operated at least once a week and make sure that they are properly lubricated /greased.

All safety valves should be checked daily and ensure that they are working properly. In case of any fault the same should be attended immediately without any wait. The maintenance of the plant shall be as per maintenance manuals of the manufacturer for all equipments. Contractor shall keep all the safety devices in working order.

The contractor should make sure that no unwanted material should float/grow in and around different units. In case it is found the same shall be removed /cleaned immediately. He shall also be responsible for cleaning/sweeping the plant buildings inside and outside, roads, foot path etc.

Launders/Weirs etc. of reactors etc to be maintained clean round the clock. During preventive/ breakdown maintenance, the contractor has to visit the unit/units as and when needed. The pumping units or other machineries required if any shall have to be arranged by the contractor at his own costs for completing the work. In case of

battery operated auto system panels and also system alarm etc., batteries are required to be maintained and replaced as and when needed by the contractor.

The contractor has to make sure that proper fire extinguishers are used to cover any kind of fire during any miss-happening within the total boundary area including plant machineries. The expiry period of refills of various fire extinguishers should be watched and maintained during the period of contract.

The contractor has to maintain all the toilets for proper use of the staff etc. In no case, in-sanitation conditions are developed. The contractor has to maintain minor repair in Civil structures, including replacement of sanitary items, glass pans etc. as and when needed.

The Contractor shall maintain the PLC system in working condition for the 5 year O&M period.

The contractor shall not remove/shift any equipments/machinery even temporarily without written permission of the Engineer-in-charge or authorized representative.

Though the contractor has to operate and maintain all the equipments/machineries, lighting (plant area, boundary walls, gate lightening etc.) but the machine of the equipment under warranty should not be dismantled without prior permission of the Engineer-in-charge. The list of such equipments (Under warranty), if any, will be given by the contractor.

POL (petrol/Diesel Oil & Lubricants) has to be arranged by the contractor as and when needed as per manufactures recommendations for periodical maintenance of entire plant. The Department will not provide such items.

The contractor shall have to carry out periodical testing of the installations/equipments as per CPHEEO manual and I.E. Rules as amended up to date and shall have to maintain complete record in the maintenance register. The contractor has to provide necessary protection systems wherever necessary including alarms and fire extinguishers.
The Employer will be at liberty to post its staff for surveillance/ inspection at the plant along with access to all units, control room and records, log books, MIS (Management Information system), data etc. round the clock as required. The logbooks and attested by the staff from authorized EMPLOYER Officials and this record shall be open for further inspection/checking by EMPLOYER and all other Government Agencies CPCB/TNPCB etc. for further action/improvements/rectifications. The staff in each shift shall mark their attendance on the log sheet individually. The plant and equipments covered under the above contract shall be totally attended by the contractor including any 'Trouble Shooting' to ensure smooth and trouble free operation.

In case of major repair due to normal wear and tear/break down, the contractor should bring the same to the notice of the Engineer-in-charge immediately and necessary measures for its repair should be taken simultaneously. Breakdown, all repairs of any kind are to be attended by the contractor. Any unit/equipment being irreparable in the opinion of the Engineer-in-charge will be replaced by the contractor at no cost to EMPLOYER. During 5 years O & M period, the machinery/media to be replaced from time to time as per manufacturer's recommendations/CPHEEO manual.

All relays and HT equipments shall be calibrated and tested atleast once a year and the report shall be submitted to the Engineer-in-Charge.

The contractor shall give his telephone no., contact addresses, etc. to the EMPLOYER as well as shift duty shift to contact him during emergency/odd hours etc.

The contractor will be responsible to carry day to day as well as periodic maintenance, necessary to ensure smooth and efficient performance/running of all equipments instruments installed at the Sewage Treatment Plant.

He shall be responsible for maintenance/replacement of street light poles and light etc. also. All the plant, building land, Sewage treated/untreated/sludge, etc. shall remain the property of EMPLOYER.

14. Oil & Grease Schedule

Routine & preventive maintenance of electrical /Mechanical/ hydraulic/ machines & equipments is to be carried out as per the operation & maintenance manual. Minimum oil & grease requirement for one year Operation & maintenance of the Plant to be procured by the Contractor well in advance.

15. Routine, Preventive, Minor & Major maintenance of all Civil, Electrical, Mechanical, hydraulic machines &equipments of the plant.

The contractor should prepare schedule of daily maintenance & preventive maintenance of all the equipments & machineries operated & run by him in the premises of the plant. The schedule should be as per the guidelines mentioned in the tender &as per the O& M manual.

The scope covers Routine, Preventive, Minor & Major maintenance of all major minor equipments, and machines in the Plant like Submersible pumps, Coarse &Fine screens Grit Removal Mechanism, Channel gates, Decanters, Sludge pumps, Centrifuge feed pumps, Centrifuges, All dosing systems including Chlorine Dosing equipment, etc.

The scope also covers Routine, Preventive, Minor & Major maintenance of all the instrumentation system installed like PLC, Actuators, Flow meters level indicators etc.

The Contractor should also carry out Routine, Preventive, Minor & Major maintenance of all major minor electrical equipments like Electrical Panels, Switch Gears, Power Cables, Control cables, Changeover switches DG set etc so as to ensure uninterrupted round the clock operation of the Plant.

The Contractor should maintain all civil structures including Administrative building, Store room, Storm Drains, fencing etc in a neat manner. He should maintain all civil structures of the plant sturdy to complete the natural/designed lifetime.

The contractor should carry out the safety audit of the plant &obtain necessary certificate from the competent authorities.

This item includes all types of Routine, Preventive, Minor & Major maintenance of all Civil, Electrical, Mechanical, hydraulic machines &equipments of the plant covering supply erection test &trial run of the part/machine to be repaired/replaced with material &labour expenses, necessary hardware's, sundry materials, lubricant oils, power oils, grease other materials plus machining charges etc.

The contractor should procure all the spares required for all types of maintenances in advance. The part/equipment/machine to be repaired /replaced should be as per the EMPLOYER approved list & as per the O& M manual or as per the existing manufacturer's brand.

16 RELEASE OF HAZARDOUS SUBSTANCES OR HAZARDOUS WASTE

The Contractor, after first notifying the TNPCB shall be responsible for fulfilling all requirements associated with any release of any substance into the environment (form the facility or the site) as required by Applicable law or by any Legal Entitlement including but not limit to the notification or reporting of releases / Hazardous

substances or Hazardous Waste. The Contractor shall prepare a memorandum evidence such notification or reporting and provide copies thereof to the Board, along with any documents provided to the relevant regulatory agency regarding such release.

The contractor shall process and obtain the clearance of all such agencies as required for the purpose, including all clearances during 5 years O&M period. He shall be fully responsible to comply with all requirements of Laws including hazardous substances, emission standards for air, discharge standards for effluent oil, sub-soil pollution.

The contracting agency shall not release any hazardous/toxic materials inside the premises.

17. Technical Audit

The Employer has the right to conduct a technical audit of the Facility and to perform any analysis or inspection he deems necessary. The Contractor shall at his cost provide all assistance the Employer required to complete these inspections. Such audits may cover all or any of the obligations of the Contractor, including without limitation,

a) Verification of the system capacity and save for normal wear and tear during the O&M Period

b) Verification of the performance standards and useful life of the individual assets of the Facility, save for normal wear and tear during the O&M Period

c) Verification of the capacity of the Facility to meet Output Standards during the residual life of the Facility and save for normal deterioration expected during such residual life

d) Sampling, testing and verification of the Output Standards for treated sewage, sewage losses

18.0 FACILITY VISITS

(i) At any time or at the end of each twelve month period, or at the initiative of the TNPCB, a visit shall be organized so that both parties can check the condition of the installations at the facility.

(ii) A report shall be drawn up to record the opinions of the both parties. The TNPCB reserves the right to call the equipment manufacturers or specialized technicians for these visits. All expenses are to be borne by the contractor for the purpose.

19.0 OPERATION AND MAINTENANCE MANUAL

a) The contractor shall prepare a detailed program (referred to as O&M Manual) covering the operation and maintenance of the treatment plants as a whole. This program shall include the work and activities described in this Chapter, as relevant to the specific items and technology. Notwithstanding the program submitted and approved, the Contractor is deemed to have tendered for and covered in his price, the responsibility for operating and maintaining the treatment plant for the full period of the contract, thereafter handing it over as specified.

b) The contractor shall provide 6 copies of draft O&M Manual to the EMPLOYER, at the time of the commissioning of the project and on approval of draft, 10 copies of operation &maintenance manual shall be supplied by the contractor.

c) The O&M Manual shall include the daily, weekly, monthly, quarterly, half yearly and annual checks and remedies if necessary to be performed for

effective operation of the plant, elaborate detail, all operating and maintenance procedures and policies which are required, advisable and / or necessary for the Facility to achieve full compliance with the operational guarantees and to achieve maintenance and repair standard for the Facility which will ensure compliance with the maintenance specifications. The O&M manual shall include interalia full explanation of all plant procedures and processes.

d) Without limiting the generality of the foregoing the O&M Manual shall include descriptions, procedures and shall comply with the requirements, set forth in the provisions of the Bid Documents.

e) The draft of the O&M Manual shall be subject to the review and approval of EMPLOYER, which shall have the right to make any changes and revisions to the O&M Manual as it may deem appropriate. The Contractor shall revise such draft O&M Manual prior to the commencement of the O&M period.

f) At the end of the construction period, the contractor shall revise the draft O&M Manual to reflect any updates, changes or revisions it deems appropriate, inter-alia based on its experience and as necessary to reflect any modifications or adjustments to the plant.
Without limiting the above, the contractor shall annually fully review, revise, update and modify the draft O&M Manual as may be necessary or appropriate. Any revision to the draft O&M Manual shall be subject to the review and approval of EMPLOYER.

g) EMPLOYER shall have the right to require revisions to the draft O&M Manual as it may deem appropriate. The contractor shall prepare and submit to EMPLOYER, for its review andapproval, 30 days prior to the proposed date of commencement of O&M, a revised draft O&M Manual which reflects all changes, revisions and modifications. The contractor shall prepare the O&M Manual, as approved by the Employer, prior to the start of O&M.

f) During the term of this Agreement, the contractor shall promptly notify EMPLOYER of any revisions, additions or modifications which he, in his professional opinion, believes should be made to the O&M Manual, whether as a result of additional experience in operating and maintaining the Facility, changes in influent quality or volume, changes or modifications to any equipment, part, component or structure incorporated in the Facility. Such notification shall set forth the reason for the proposed revision. Any proposed revision shall be subject to the approval of the Employer. In addition, during the term of this Agreement, EMPLOYER shall have the right to require

relevant changes, revisions, or additions to the O&M Manual as it, shall deem appropriate to ensure full compliance with the O&M Standards.

g) The contractor shall submit 10 copies of the final O & M manual along with a soft copy in Microsoft Word Format.

20.0 TAKING OVER

The plant will be taken over by EMPLOYER on satisfactory completion of the Operation & Maintenance of the plant provided that

- The plant /equipment are in good, smooth running condition.
- The result of the treated wastewater quality for last three months of operation of the plant is within the limits specified.
- In case of major repairs /replacement of equipment, the performance guarantee for such unit/equipment is extended by six months from the date of putting back in to satisfactory operation of such unit/equipment .In case such putting back is at the end of completion of operation & maintenance period.
- All records of operation & maintenance are handed over to EMPLOYER in proper condition.
- The Third Party Inspection of the plant viz: Civil units, Mechanical units/equipments, Electrical units/equipments, instruments, &all other Major & minor units/machines has to be carried out & the defects unsatisfactory working performances of the equipments/ machines are to be corrected by the contractor at his own cost. The necessary Third Party inspection agency shall be appointed and charges paid by the Employer.
- The Contractor should repaint the plant including all civil structures, mechanical, electrical equipments/ units /structures as per the tender specifications

In case taking over is delayed on account of contractor's failure, the operation & maintenance period will be extended further till it meets the requirement without any extra cost to EMPLOYER. The contractor will also be penalized for such delays.

VIII. Reference to specifications/ code of practice

Description	BIS No.
Ordinary Portland Cement (33 Grade)	269-1976
43 Grade Ordinary Portland Cement	8112-1989
53 Grade Ordinary Portland Cement specification	12269 - 1987
Sulphate resisting Portland cement	12330 – 2001
Hydrophobic Portland Cement	8043-1978
Rapid Hardening portland Cement	8041-1990
Low Heat Portland Cement	12600-1989
Standards for testing of cement	650-1966
Methods of Test for Pozzolonic Materials	1727-1967
Methods of sampling and test for water & waste water (Physical & chemical)	3025-1984 (Part 1 to 37)
Methods of Sampling hydraulic Cement	3535-1986
Methods of Physical tests for hydraulic cement	4031-1988 (1 to 14)
Methods of chemical analysis of hydraulic cement	4032-1985
Aggregates coarse & Fine from Natural resources For concrete.	383-1970 4082/1977
Sand for Masonry Mortar	2116-1965 1542/1977
Methods of tests for aggregates for concrete	2386-1963 (Part 1 to 8)
Part I- Particle size and shape	2386-1963 (Part-I)
Part II- Estimation of deleterious Materials & Organic impurities	2386-1963 (Part-II)
Part III- Soundness	2386-1963 (Part-III)
Methods for sampling of aggregates for concrete	2430-1986
Specifications for test sieves Part-I-Wire cloth test Sieves	460-1978 (Part-I)
Common Burnt clay building bricks	1077-1976
Mild Steel and Medium tensile steel bars and hard Drawn steel wire, concrete reinforcement. Part-I-Mild Steel & Medium tensile steel Bars Part –II- Hard drawn steel wire	432-1982
High Strength deformed steel bars and wires for Concrete reinforcement	1786-1985
High Tensile Steel for PSC Pipes	1784-1986 (Part-I)
Bending and flexing of bars for concrete reinforcement	2502-1969
Recommendations for detailing of reinforcement In reinforced concrete works	5525-1969
Method for tensile testing of steel wire	1521-1972

Method of test for determining modulus of elasticity	2854-1964
Glossary of terms relating to cement concrete	6461-1972 (Part 1 to 12)
Methods of test for strength of concrete	516-1959
Methods of sampling and analysis of concrete	1990-1959
Methods of testing bond in reinforced concrete Pull out test	2770-1967
Methods of test for permeability of cement Mortar and concrete	3085-1965
Methods of test for splitting tensile strength Of concrete cylinders	5816-1970
Methods of tests for determining setting time of Concrete by penetration resistance	8142-1976
Code of practice for construction of Pile foundations (concrete piles) Driven cast-in-situ concrete piles Bored cast -in-situ piles Driven pre-cast concrete piles Bored pre-cast concrete piles	2911 (Part I) Sec-1-1979 Sec-2-1979 Sec-3-1979 Sec-4-1984
Code of practice for construction of raft foundation	2950-1981
Design Aids for reinforced concrete	SP 16-1980
Explanatory Hand Book on codes for earthwork Engineering	SP 22-1982
Explanatory Hand Book on IS Code 456-2000	SP 24-1983
Hand Book on causes and prevention of cracks In buildings	SP 25-1984
Hand Book on concrete reinforcement & detailing	SP 34-1987
Brick Masonry	2212-1962
Construction of Stone Masonry	1957-1967
Concrete pipes with and without reinforcement	458-1988
P..S.C. Pipes (including fittings)	784-1978
Methods of tests for concrete pipes	458-1988 3597-1985
Materials for M.S.Specials	226-1976 & 2062-1980
Specifications for M.S.Specials for P.S.C.Pipes.	
Specifications for Steel cylinders reinforced Concrete pipes.	1916-1989
Specials for steel cylinders reinforced concrete pipes	3597-1985
Methods of test for asbestos cement products	5913-1989
Centrifugally Cast (Spun) Iron pressure pipes for Water, gas and sewage lncluding fittings.	1536-1989
Specifications for Centrifugally Cast (Spun) D.I. Pipes for Water, Gas and Sewage.	8329-1990
D.I.Fittings for pipes for water, gas & seweage	9523-1980
Dimensional requirements of rubber gaskets for Mechanical joints and push on joints for the use With C.I.D.I.Pipes.	12820-1986
C.I. Specials for Mechanical and push on flexible joints for pressure pipe lines for water, gas & sewage	13382-1992
Horizontally cast iron double flanged pipes for water, Gas and sewage	7181-1986

Cast iron fittings for pressure pipes for water, gas And sewage	1538-1976 (Part 1 to 24)
Rubber rings for jointing C.I.Pipes, R.C.C. Pipes & AC. Pipes	5382-1969
Rubber rings for jointing P.S.C. pipes	5382-1985
Hemp yarn	6587-1966
Rubber Insertion to be used in jointing CIDF pipes	638-1979
Bolts & Nuts to be used in jointing CIDF Pipes	1363-1967
Unplasticized PVC Pipes for potable water supplies	4985-1988
Injection moulded PVC socket fittings with Solvent cement joints for water supplies.	7834-1987 (Part 1 to 8)
Fabricated PVC fittings for potable water supplies	10124-1988 (Part 1 to 13)
Methods of test for unplasticized PVC pipes for potable water supplies	12235-1986 (Part 1 to 11)
Sluice valves for water works purposes (50 to 300 mm Dia size)	780-1984
Sluice valves for water works purposes (300 to 1200 mm Dia size)	2906-1984
Surface boxes for sluice valves	3950-1979
Manhole covers for sluice valves	1726-1974
Laying of Concrete pipes.	783-1985
Laying of Cast-Iron Pipes	3114-1985
Laying of PSC Pipes	126 of APSS & 783-1985
Laying of C I Pipes	12288-1987
Laying and jointing of Unplasticized PVC pipes	7634-1975 (Part 3)
Stoneware pipes	IS:651-1992
Code of Practice for Ancillary Stonewares in sewerage system	IS:4111-1986 Part I & II
Precast Manhole covers and frames	IS:12592-1998 Part I & II
Code of Practice for plain and reinforcement concrete	IS:456:2000
Batch type concrete mixer	1791-1968
Sheep foot roller	4616-1968
Safety code for excavation works	3764-1966
Safety code for scaffolds and ladders Part-I Scaffolds Part II- Ladders	3696-1966 (Part I) 3696-1966 (Part-II)
Safety code for piling and other deep foundations	5121-1969
Safety code for working with construction machinery	7293-1974
Tamil Nadu Building Practice	Volume – I Volume – II
Government of India Manual on Water Supply and Treatment	May 1999 (Revised)

Gravel for packing	4091 –1967
Hard drawn Steel Wire	1785 – 1983 (Part I and II)
Structural Steel	226 – 1975
Hard rolled mils steel for concrete	1139 – 1966
Hard drawn Steel Wire	1566 – 1982
American Society for Testing of Materials	
British Standard	2494 – 1955 Part I
Welding Electrodes	814 – 1970
Steel Sheets	225 – 1975
Guniting	7322 – 1994
Welded Joints	3589 – 1966 and 2041 – 1962
Tensile Test	223 – 1950
Mechanical and Electrical Works	
Earthing	3043 – 1966
Transformer	1180 – 1964

IX. MINIMUM ENVIRONMENTAL MANAGEMENT MEASURES

The EIA and EMP is to be adhered during construction and Operation and maintenance period by the Contractor

Environmental Assessment

1. Objectives and Need

Objectives of this assignment are to:

(i) establish the environmental baseline in the study area;
(ii) identify and assess the adverse environmental impacts; and provide requisite measures to address these impacts;
(iii) identify the opportunities for environmental enhancements in the project area and provide requisite guidance/plans in this regard;
(iv) wherever relevant integrate the measures (mitigation and enhancement related) in the project planning and design; and
(v) develop appropriate management plans and codes of practices for implementing, monitoring and reporting of the environmental mitigation and enhancement measures suggested.

The EA shall be carried out in line with the Government of India (GoI)'s regulations (EIA Notification), the World Bank's EA guidelines and TNUDF's ESF.

The EA comprises: Environmental Screening, Project EA and the Environmental Management Plans (EMPs). The EA shall be carried out in a consultative manner through "Stakeholder Consultations", at various stages, with the affected communities, NGOs, selected government agencies and other stakeholders.

2. Scope of Work

The following are the tasks to be performed by the contractor while conducting Environmental Assessment for the STP including nature, scale and magnitude of impacts that the project is likely to cause on environment.

Task 1 Description of Project

A succinct description of the proposed project shall be provided.

Task 2 Review of Earlier Studies

The contractor shall review various earlier studies such as feasibility and detailed project reports, etc., of the project and understand the project and various aspects associated with the same. This shall provide a base to formulate the environmental surveys necessary for the project and assessing impacts of the same.

Task 3 Legislative and Regulatory Considerations

A review of the legal and regulatory provisions applicable for the project shall be carried out in this task. The objective of the review is to bring out the legal and policy issues to be addressed in the project at various stages of project development such as design, execution and operation. Also the contractor should review the environmental laws such as EP Act, Water Act, Air Act, as well as the applicable operational policies / directives of The World Bank. Besides, the contractor shall also provide a complete list of regulatory formalities required for the project and various clearances required from different regulatory agencies.

Task 4 Preparation of Environmental Profile

An environmental profile of the project influence area shall be prepared, based on appropriate primary & secondary surveys and field investigations. The objective of this profile is to establish existing environmental conditions of the project area, in terms of air, water (surface & ground), noise, soil and other environmental parameters, which should form the basis for prediction of impacts due to proposed project activities. As part of this, the environmentally sensitive land uses (protected natural areas, areas of ecological value, sensitive receptors like schools, hospitals etc.) would also be identified and plotted on a map to scale.

The extent and duration of surveys shall be judiciously decided by the contractor as per requirements of the environmental regulations applicable in India and guidelines of international funding agencies. The profile prepared shall be adequate enough to predict impacts of the project and shall cater to the requirements of obtaining necessary environmental clearances from the authorities.

The profile shall essentially include all physical, ecological and socio-economic components of the project environment and bring out the salient and sensitive features of the same. Important aspects such as reserve forests, national parks, major water bodies, structures of archaeological / historic importance, and other environmental resources (if any) shall be identified and salient features of the same shall be presented.

Task 5 Determination of Potential Impacts

Based on the environmental profile of the project area prepared above and the proposed project activities discussed under task 1, the contractor shall carry out environmental screening to determine the nature of impacts and level of Environmental Assessment to be carried out (refer Section 3 for the details to be carried out under Environmental Screening).

- In case of low or insignificant level of environmental impacts, where an EMP will suffice, the contractor shall review the recent versions of generic EMPs available with TNUDF and carry out necessary changes to suit the project requirements.

- As part of screening, if medium to high impacts, requiring a detailed EA and stand alone EMP is required, the contractor shall carry out detailed impact analysis. The contractor shall predict environmental impacts of the project components, activities and sub-activities on various environmental attributes (bio, geo and physical) through appropriate analytical tools and techniques such as modelling techniques, over lays, etc. Significant or insignificant, permanent or temporary, reversible or irreversible, negative or positive impacts shall be categorised separately and presented for each phase of project development.

All identified impacts shall be summarised in an easily understandable format and the magnitude and significance of each impact shall be explained in detail.

An analysis of various project alternatives, including the ‘Project’ and ‘No Project’ scenario shall be analysed and impacts shall be analysed for each scenario. Based on the above analysis the best alternative that causes minimum or no impact shall be recommended for implementation.

Task 6 Social Assessment

Magnitude of social impacts due to loss of land, structures, income, livelihood etc shall be assessed ,Significant findings of census and social economic survey of PAPs along with

a brief account of proposed mitigation measures using the ESF guidelines, budget shall be brought out in the report. Institutional arrangements with resettlement implementation plan shall be provided where required.

Task 7 Stakeholder Consultations

The contractor shall carry out consultations with Experts, NGOs, forest department officials (if applicable) and other selected Government Agencies and other stakeholders to (a) collect baseline information, (b) obtain a better understanding of the potential impacts and (c) appreciate the perspectives/concerns of the stakeholders, and (d) secure their active involvement during subsequent stages of the project as appropriate .

Consultations shall be preceded by a systematic stakeholder analysis, which would (a) identify the individual or stakeholder groups relevant to the project and to environmental issues, (b) include expert opinion and inputs, (c) determine the nature and scope of consultation with each type of stakeholders, and (d) determine the tools to be used in contacting and consulting each type of stakeholders. A systematic consultation plan with attendant schedules will be prepared for subsequent stages of project preparation as well as implementation and operation, as required. Where community consensus is required in respect of proposed mitigation measures for impacts on community assets including water bodies, places of worships etc., specific plan for modification/relocation etc have to be disclosed and consensus obtained.

Task 8 Environmental Management Plan

The contractor using outputs of the above tasks shall prepare an implementable Environmental Management Plan (EMP) for the project. Preparation of Environmental Management Plan is detailed under Section 4 below.

3. Environmental Management Plan

The EMP should suggest ways / options for mitigating negative impacts of the project, the preventive measures necessary. Where required, EMP shall include community consensus for the mitigation measures proposed. The EMP shall identify the means / agency responsible for implementation of the same and recommend suitable monitoring mechanism for the EMP. The EMP shall be implemented fully by the Contractor.
The above referred activity shall be applicable for Generic EMPs as well as specific EMPs developed as an outcome of detailed EAs

The contractor shall prepare a detailed EMP covering the measures to mitigate and/or minimize the negative impacts, including the implementation arrangement and a monitoring plan for the same with site specific requirements. EMP shall cover the following details:

(a) Mitigatory measures: For each of the significant negative impact the contractor should recommend measures to eliminate or mitigate the impact. In case any impact is non-mitigable, the cost of damage shall be estimated. The cost (capital and recurring) of all the mitigation measures and the responsible parties for implementation should be clearly identified. The mitigatory measures should necessarily contain conceptual designs wherever necessary. The contractor should also specify neighbourhood committees to supervise effective implementation of the proposed mitigatory measures.
(b) Landscape plan: Wherever necessary (especially STP sites), the Landscaping plan should be prepared considering the project area as a whole and shall meet project specific requirements. Considering the nature of the project area, the EA

should provide a conceptual landscape plan for all the project components while considering the special environmental and social needs.

(c) Monitoring Plan: The contractor should specify the types of monitoring needed for potential environmental impacts during construction and operation. As in the case of the mitigation plan, requirements should be specific as to what is to be monitored, how and by whom along with reporting formats and recommendations if any Cost estimates are necessary and where monitoring reports are to be prepared, the recipient responsible for review and any corrective action should be identified. The monitoring plan should be supplemented with a detailed schedule of implementation of EMP measures.

(d) Institutional Arrangement to Manage Environment Impacts Effectively: The contractor shall identify institutional/organizational needs to implement the recommendations of the project EA and to propose steps to strengthen or expand, if required. This may extend to new agency functions, inter-sectoral arrangements, management procedures and training, staffing, operation and maintenance, training and budgeting.

4.0 Public Disclosure

The contractor is to provide support and assistance to the Client in meeting the disclosure requirements, which at the minimum shall meet the World Bank's policy on public disclosure. The contractor will prepare a plan for in-country disclosure, specifying the timing and locations; translate the key documents, such as the EA Summary in local language; draft the newspaper announcements for disclosure; and help the client to place all the EA reports in the client's website.

The contractor shall prepare a non-technical EA Summary Report for public disclosure.

5.0 Review Committee

The review committee comprising of representatives from CMWSSB, TNPCB, CMA and TNUIFSL will review and clear the EIA report. Payment will be made after approval of the EIA by the review committee.

6.0 Pre Construction Phase Impacts

`	**Potential Negative Impacts**	**Mitigation Measures**	**Time frame**	**Responsible agencies**
	PRE-CONSTRUCTION STAGE			
1	Clearances	All clearance required for Environmental aspects during construction shall be ensured and made available before start of work.	Before construction	CMWSSB Concerned Departments & agency / Contractor
2	Tree Cutting	i) Try to save the trees by adjusting the plant layout or the alignment of sewage intake structures, sewer mains, pumping stations, etc ii) Provide adequate protection to the trees to be retained with tree guards (e.g. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with	Pre-construction & construction phase	Contractor / CMWSSB

		Bars) as required. ii) Identify the number of trees that will be affected with girth size & species type along the sewer mains, pumping / lifting station sites and sewerage treatment plant site. The details to be indicated on map to scale and/or a a strip map as may be appropriate. Prepare tree cutting schedule to facilitate clearance requirements iii) Trees identified for cutting shall be removed from the construction sites before commencement of construction with prior permission from the concerned department. iv) Undertake tree plantation (not less than three rows inside and along the boundary of STP, and compensatory plantation as per the tree cutting clearances). v) Compensatory plantation by way of Re-plantation of at least twice the number of trees cut should be carried out in the project area.		
3	Utility Relocation	i) Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc ii) Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts. iii) provide advance notice (not less than 10 working days) to affected parties. The advance notice shall be in the form of written notice and a grievance redressal cell shall be established for timely addressing of grievances	Pre-construction & construction phase	CMWSSB / Concerned departments
4	Baseline parameters	Adequate measures shall be taken and checked to control the Baseline parameters of Air, Water and Noise pollution. Base line parameters shall be recorded and ensured conformance till the completion of the project. The monitoring requirements, at minimum shall comply with consent conditions by the pollution control board	Pre-construction, construction and post-construction phase	Prospective contractor / CMWSSB

5	Planning of temporary Traffic arrangements	i) Temporary diversion will be provided with the approval of the engineer. Detailed traffic control plans will be prepared and submitted to the engineers for approval, at least two weeks prior to commencement of works. ii) The traffic control plans shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of wok each day, SIGNAGES, safety measures for transport of hazardous materials and arrangement of flagmen. iii) Any accidents and/or risk of inconveniences caused to the community shall be borne by the contractor	Pre-construction & construction phase	Prospective contractor / CMWSSB
6	Disposal of treated waste water.	i) The construction activities at STP shall be initiated only after consent to establish certificate is secured from the TNPCB ii) STP operations shall take place only after Consent to Operate certificate is accorded by the TNPCB and the treated water quality shall comply with the consent conditions stipulated by TNPCB or at minimum shall meet the discharge standards depending on the type of receiving waterbody (stream / nullah /open land /irrigation purposes, etc.) iii) performance standards shall always be maintained, Ensuring efficient working condition of treatment plant.	Pre-construction & construction phase	CMWSSB
7	Storage of materials	The contractor shall identify the site for temporary use of land for construction sites /storage of construction materials, etc. These sites shall be operated only after prior approval of the engineer.	Pre-construction & construction phase	Prospective contractor / CMWSSB
8	Construction of labour camps	Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp.	During the construction	Prospective contractor

		The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. The construction will commence only upon the written approval of the Engineer. The contractor shall maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be planned. Adequate health care is to be provided for the work force. The layout of the construction camp and details of the facilities provided should be prepared and shall be approved by the engineer. The construction camp shall not be located within 1000m from the nearest water stream, residential areas and/or any sensitive land uses like schools, hospitals, etc.		

3.	**CONSTRUCTION STAGE**			
	Construction of Sewerage Treatment Plant			
3.1	Compensatory plantation of trees	Compensatory plantation of atleast twice the number of trees felled should be done in line with competent authority guidelines.	Pre-construction and Construction	Prospective contractor / CMWSSB
3.2	Protection of top soil & Environmental enhancing	The top soil to be protected and compacted after completion of work. Top soil from the STP area should be stored in stock piles and that can be used for gardening purposes at WTP site which will be an environmental enhancing measure.	During construction	Prospective contractor / CMWSSB
3.3	Disposal of construction debris and excavated materials.	A suitable site should be identified for safe disposal, in relatively low lying areas, away from the water bodies, residential and agricultural fields etc., and got approved by the Engineer. Care should be taken that	During construction	Prospective contractor / CMWSSB

		dumped material does not affect natural drainage system.		
3.4	Pollution from Fuel and Lubricants	i) The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. ii) All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and will be approved by the Engineer. iii) Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. iv) Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines. v) Engineer will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.	Construction and operation.	Prospective contractor / CMWSSB
3.5	Contamination of ground water quality	i) Groundwater quality may get contaminated due to leaching of waste water. So, the treated water quality shall comply with the standards laid down by the PCB for disposal onto land, water body or for irrigation use. ii) Regular monitoring is required for the treated sewage quality and also the ground water quality in the near by areas and ensures compliance with PCB standards.	During construction and operation	Prospective contractor / CMWSSB
3.6	Water Pollution from Construction Wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water	During Construction	Prospective contractor / CMWSSB

		bodies or the irrigation system. All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer.		
3.7	Impact of surrounding areas	To avoid the problems of foul smell polluted air, insects, noise pollution and other problems buffer zones to be provided in the form of green belt around the STP site, this has to be strictly ensured.	During Construction	Perspective contractor / CMWSSB
3.8	Informatory Signs and Hoardings	The contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Engineer.	During construction	Prospective contractor / CMWSSB
3.9	Risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - i) No material shall be stacked or placed as to cause danger or inconvenience to any person or the public. ii) All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.	During construction	Prospective contractor
3.10	Disposal of treated waste water.	i) The treated water quality shall comply with the standards of TNPCB before let out into the stream / nullah /open land /irrigation purposes, and necessary permission to be obtained from the concerned department. ii) Ensure efficient working condition of treatment plant. iii) Prevent the pollution of stream water and other water bodies receiving STP discharge.	Pre-construction / construction and operation stage.	CMWSSB/ Prospective contractor

3.11	Disposal of sludge	A suitable site should be identified for the safe disposal of sludge generated at the STP site and got approved by the Engineer. Prepare a sludge disposal plan and adheres to the same.	Pre-construction, construction and operation.	Prospective contractor/ CMWSSB
3.12	Labour camp & facilities	Setting up of labour camps needs to be done as per the procedures. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws shall be ensured. The contractor shall also guarantee the following: i) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. ii) The construction will commence only upon the written approval of the Engineer. iii) The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. iv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. v) The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is to be provided in all toilets and urinals.	During Pre-construction and construction	Perspective contractor / CMWSSB
3.13	Safety Aspects	i) Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall confirm to the relevant Indian standards Code and shall be regularly inspected by the PIA. ii) Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil.	During construction	Prospective contractor

		iii) Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. iii) Welder's protective eye-shields shall be provided to workers who are engaged in welding works. iv) Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. v) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.		
3.14	First Aid	The contractor shall arrange for : i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During construction	Prospective contractor

4.0	**Environmental enhancement and special issues**		**Implementing Agency**	**Location**
4.1	Flora and Chance found	The contractor will take reasonable precaution to prevent his workmen or	Project area	Prospective contractor

	Fauna	any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same. The Engineer will report to the near by forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.		
4.2	Chance Found Archae-ological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped. The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Project area	Prospective contractor
4.3	Monito-ring of environ-ment parameters	The contractor shall undertake seasonal monitoring of air, water, noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of monitoring plan shall be prepared	Project area	Prospective contractor
4.4	Sensitive Areas	The sensitive areas like Schools, hospitals to be provided with suitable noise barriers and safety measures, prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement during	Project area	Prospective contractor

		construction and their effectiveness to be checked during operation phase .		
4.5	Clearing of construction of camps and restoration	Contractor to prepare site restoration plans for approval by the engineer. The plan is to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	Corridor of Impact	Prospective contractor
4.6	Tree Protec-tion, Tree Planting,	• Giving due protection to the trees that fall in the shoulders /corridor of impact shall be the prime focus during Construction/post construction • Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered where necessary • Re-plantation of at least twice the number of trees cut should be carried out along the project road. Since the major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure. • Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years .Survival status shall be reported on monthly basis to Engineer incharge.	Corridor of Impact	Prospective contractor

7. Environmental Monitoring Plan

To monitor the extent of environmental impact of the proposed project, the contractor has to periodically monitor the ambient environmental quality along the proposed project area. The monitoring requirement for the different environmental components is presented in table below

Air Quality Monitoring	
Project stage	Pre Construction , Construction & operation period (as agreed)
Parameter	SPM, RPM, SO_2, NO_x, CO and Pb
Sampling Method	Use method specified by CPCB for analysis

Standards	Air (Prevention and Control of Pollution) Rules, CPCB, 1994
Frequency	Once before start of work & once every season of the year during construction period & upto 18 months (operation Period)
Duration	Continuous 24 hours / or for 1 full working day
Location	Sensitive locations along the pipe laying work, pumping / lifting station locations, STP site.
Measures	Wherever air pollution parameters increase above specified standards, additional measures as decided by the engineer shall be adopted
Implementation	Contractor through approved monitoring agencies
Supervision	Implementing agency
Water quality Monitoring	
Project stage	Pre Construction & Construction
Parameter	• pH, BOD, COD, DO, TDS, Pb, Oil & Grease and Detergents for Surface water. • Water pH, TDS, Total hardness, Sulphate, Fluorides, Chloride, Fe, Pb for groundwater.
Sampling Method	Grab sample collected from source and analysis as per Standard Methods for Examination of water and Waste water
Standards	Indian standards for Inland Surface Water (IS; 2296, 1982) and for Drinking water (IS; 10500,1991)
Frequency	Twice a year (pre monsoon and post monsoon seasons) during the construction period
Duration	Grab sampling
Location	• Locations to represent residential, agricultural, surface water quality and vicinity of the construction site.
Measures	At locations of increased in water pollution, all inflow channels shall be checked for pollution loads and channel delivering higher pollution loads and channel delivering higher pollution load shall be terminated from disposal into the water source and other methods of disposal shall be adopted
Implementation	Contractor through approved monitoring agencies
Supervision	Implementing agency

Noise Level Monitoring	
Project stage	Pre Construction , Construction & operation period (as agreed)
Parameter	Noise level on dB (A) scale noise levels on dB (A) scale
Special guidance	• Free field at 1 m from the equipments whose noise level are being determined. • Equivalent noise levels using an integrated noise level meter kept at a distance of 15m from edge of pavement
Standards	MoEF Noise Rulers, 2000
Frequency	Once every seasons (except monsoon) for each year of construction
Duration	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged
Location	• Wherever the contractor decides to locate the equipment yard. • At sensitive location such as school, hospitals etc

Measures	Incase of noise levels causing disturbance to the sensitive receptors, management measures as suggested in the EMP shall be carried out.
Implementation	Contractor through approved monitoring agencies
Supervision	Implementing agency
Soil Quality Monitoring	
Project stage	Pre Construction & Construction
Parameter	Monitoring of Pb, SAR and Oil & Grease
Sampling Method	• Sample of soil collected to be acidified and analysed using absorption spectrophotometer
Standards	Threshold for each contaminated set by IRIS database of USEPA until national standards are promulgated
Frequency	• During the pre monsoon post monsoon seasons each year for the entire construction period
Duration	Grab sampling
Location	• At productive agriculture lands abutting traffic detours, pumping / lifting station locations and STP site.
Measures	At location of increased in pollution levels, source shall be identified and shall be diverted from future disposal
Implementation	Contractor through approved monitoring agencies
Supervision	Implementing agency

Apart form the above mentioned monitoring requirements, any major accidents /spillage during bulk transport of hazardous materials. Depending on the type of spillages / accidents the parameters to be monitored will be decided by the engineer and should be carried out by the contractor through approved monitoring agencies and supervised by the Implementing agency at their own cost.

8. FORMATS FOR REPORTING:

Formats for reporting / monitoring the progress / parameters achieved will be finalized in consultation with the successful bidder.

9. Environmental Compliance Report

The contractor shall submit a monthly progress report as per the reporting format approved by the engineer, on the status of the implementation of the EMP, and get it duly approved by the engineer for its compliance and for proceeding with the work. The Engineer and the Environmental and Social Safeguard (ESS) Manager, who will have access and authority to monitor the status based on the same and for which necessary facilities shall be made by the contractor**.**

10. Environmental Protection Work

10.1 The Contractor shall have to take following measures during construction and commissioning of works for protection of environment as under to avoid environmental impacts on air, water and land.

10.2 Site Clearance

The site clearance shall be done with minimum damage to existing structures flora and fauna, electricity and telephone lines and other infrastructure service.

10.3 Earth Work and Excavation

The Contractor shall inform the local authorities / government if any fossils, coins artifacts of value or antiquity, structures and other remains of geological or archaeological interests and excavation shall be stopped until identification of cultural relics by the authorised institution is completed.

The Contractor shall dispose off surplus / waste material at identified sites approved by the Engineer. The Contractor shall ensure that there is minimum hindrance to normal activities and business. The Contractor shall avoid damage to permanent structures and shall avoid loss of standing crops along the road.

10.4 Replantation

The Contractor shall carry out Replantation on areas / on the periphery of construction sites to minimize visual impact and soil erosion. The Contractor shall pay special attention to the type of trees to be replanted to prevent fouling of water through falling leaves and bird droppings. A list showing the type of trees to be replanted will be got approved before replanting any trees.

10.5 Soil Erosion and Water Quality

The Contractor shall ensure that earth and stone do not silt up existing irrigation /drainage systems.

The Contractor shall take suitable measures to prevent direct discharge of polluted waters form construction activity into lakes/rivers/irrigation channels.

The Contractor shall minimize exposure of soil types susceptible to wind and water erosion.

The Contractor shall control run-off and erosion through proper drainage channels and structures.

10.6 Soil Compaction

The Contractor shall restrict traffic movements and use low ground pressure machines.
The Contractor shall preserve topsoil to be replaced after completion of construction activity.

The Contractor shall avoid wet soils.

10.7 Social Disruption

The Contractor shall minimize interruptions to utility services through proper planning and scheduling of activities.

The Contractor shall provide temporary roads and diversions as may be necessary for smooth flow of traffic.

The Contractor shall preferably use local labour / Skilled persons during construction.

10.8 Dust / Air Pollution

The Contractor shall provide effective dust control through sprinkling / washing of construction sites and access roads.

The Contractor shall cover / water stockpiles and storage areas to prevent dust pollution.

The Contractor shall cover trucks transporting construction materials to minimize spills.

The Contractor shall have a preventive maintenance program for construction equipment and vehicles to meet emission standards.

10.9 Noise Pollution

The Contractor shall normally undertake construction work during daytime only (between 7.30 to 18.00 hrs) and when authorized to work beyond these hours adopt suitable noise control methods during such works.

The Contractor shall maintain machines and trucks to keep them with low noise.

The Contractor shall install sound barriers and plant tree as appropriate during construction.

10.10 Construction Camps

The Contractor shall take adequate measures such as provision of septic tank/pit latrines at construction site / camps.

The Contractor shall provide crèches to working women labour.

The Contractor shall provide drinking water conforming to IS: 10500

The Contractor shall provide garbage cans at suitable fixed place and have the garbage disposed off regularly.

10.11 Aesthetic Improvement

The Contractor shall through proper house keeping enhance aesthetic appearance of construction sites.

The Contractor shall dispose-off construction wastes at approved disposal sites.

The Contractor shall repair pavements immediately following construction pipeline and appurtenant structures.

The Contractor shall remove after completion of construction, all temporary structures and restore the project and surrounding areas nearest possible to the pre construction condition.

10.12 Conservation of Ecological Resources

The Contractor shall not use farmland and forest belts as materials borrow sites.

The Contractor shall not select arable land as material borrows site. In case excavation in arable land is unavoidable, topsoil layer (30 cms. depth) shall be saved and returned after construction work is completed so as to minimize impacts on ecosystem, agriculture and animal husbandry.

The Contractor shall educate construction workers to protect natural resources, wild plants and animals.

10.13 Risk of Accidents

The Contractor shall provide efficient lighting equipment and safety signs on temporary roads during construction and shall adopt and implement adequate traffic regulation.

The Contractor shall take effective safety and warning measures to reduce accidents.

The Contractor shall provide suitable temporary crossings to facilitate normal life and business.

10.14 Responsibility For Accidents, Damages Etc.

The care of the whole of the permanent work until their completion and the whole of the temporary work until their removal shall remain with the Contractor who shall be responsible for all accidents or damages from whatever cause arising and chargeable for anything that may be stolen, removed, destroyed or damaged to whomsoever belonging and also for making good all defects and damages to the said Works or to any property adjoining or any cause whatever, whether such damage or defects where occasioned by the negligence of the Contractor or not or may be or might have been discovered during the progress of the works or in consequence thereof, or shall appear to be known after the completion whereof or whether payment may wholly or partially have been made or the Works approved as supposed to have been properly done, and no certificate or approval of any works by any officers or members of the Employer shall effect

10.15 Noise Monitoring

a. Monitoring Frequency:

a) During construction period: 12 times a year each time including day and night.

b) During Commissioning period: 4 times ad hoc monitoring will be taken.

c.) During construction period: Near construction sites, factory sites and Sensitive areas.