GOVERNMENT OF WEST BENGAL

KOLKATA METROPOLITAN DEVELOPMENT AUTHORITY

For A Contract

DESIGN AND BUILD NEW UNDERGROUND SEWERAGE NETWORK OF ABOUT 44 KM. LENGTH INCLUDING SURVEY AND CONSTRUCTION OF 4 NOS. PUMPING STATIONS INCLUDING ALL APPURTENANT STRUCTURES & ALLIED WORKS IN KHARDAH MUNICIPAL TOWN, WEST BENGAL UNDER AMRUT.

NIT No.: KMDA/GAP/SE(N)/NIT-7/16-17 Dated 9/1/17

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CONTENT

INSTRUCTIONS TO BIDDERS

Section 1. Introduction

1.1. Scope of work

i. The bidder's scope of work shall include survey, review the designs, redesign where necessary, new infrastructure components and improvement of sewage collection network, pumping stations, and dovetailing the existing infrastructure with build new underground sewerage network including sewage pumping station(s) of length and capacity and all appurtenant structures and allied works; and successful commissioning and testing of the complete works ("Project") of sewerage network and pumping stations at the Place and State. KMDA shall make available the Right of Way for the Sewerage Network, and the land area allocated for setting up the Sewage Pumping Station(s) and all appurtenant structures

ii. For Sewerage Network:

(a) KMDA shall make available all the designs and drawings pertaining to the proposed Sewerage Network including alignment, peripheral land etc.;

(b) the selected bidder shall conduct field survey, review the available designs, redesign where necessary, the Sewerage Network based on the survey, ensuring that the design standards and the performance standards as specified in the Contract are satisfied along with other conditions as may be applicable as per the law; and

(c) if the selected bidder (Contractor) redesigns where necessary, he shall obtain KMDA's approval of the redesigned component and work shall be carried out as per the revised approved design. Payments will be made for the actual quantities as per rates quoted by the bidder and incorporated in the Contract. Rates for items not found in the original BOQ or variations in quantities from the original BOQ will be regulated as per provisions of the Contract.

1.2. Eligible Bidders

1.2.1 This Invitation for Bids, issued by KMDA is open to all bidders Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this bidding process, if the Bidder:

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

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

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

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

(e) participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which such Bidder is involved.

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

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

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

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

1.2.2 A Bidder shall not be under suspension from bidding by KMDA as the result of the operation of a Bid–Securing Declaration.

1.3. Cost of Bidding

The Bidder shall bear all costs associated with the preparation and submission of its bid, and KMDA will in no case be responsible for these costs, regardless of the conduct or outcome of the bidding process.

Section 2. The Bidding Documents

2.1. Content of Bidding Documents

The nature of the services, the site and the plant that are to be designed, built, operated and maintained by the Bidder, the procedures that are to be followed during the bidding process and the contract terms and technical requirements are prescribed in the Bidding Documents. The Bidding Documents consist of:

1. the Instructions to Bidders (ITB);
2. Annexure A to the Bidding Documents – Forms

a. Bidder's Bid Form
b. Price Schedules
c. Form of Bid Security
d. Form of Performance Security
e. Format of Curriculum Vitae for Proposed Key Staff
f. Form for Clarification Questions
g. Qualification Criteria
h. Information Forms
i. Form of Letter of Intent by JV Partners

j. Form of Power of Attorney for Joint Venture
k. Form of undertaking by JV Partners
3. Annexure B to the Bidding Documents – the contract (the "Draft Contract") consisting of:
i. Form of Contract;
ii. General Conditions of the Contract; and
iii. Schedules attached to the Contract
4. Addenda to the documents if any are issued by KMDA.

The Invitation for Bids issued by the KMDA is not part of the Bidding Documents.

2.1.1. The documents listed in ITB Section 2.1 are collectively the "Bidding Documents".

2.1.2. Each Bidder shall examine all instructions, terms and conditions, forms, specifications and other information contained in the Bidding Documents. If the Bidder fails to provide all documentation and information required by the Bidding Documents; or submits a Bid which is not substantially responsive to the terms and conditions of the Bidding Documents, such action is at the Bidder's risk and KMDA may determine that the Bid is non-responsive to the Bidding Documents and may reject it.

2.2. Clarification of Bidding Documents

a. A prospective Bidder requiring any clarification of the Bidding Documents may notify KMDA in writing by mail, courier, fax or hand delivery at KMDA's mailing address similarly, if a Bidder feels that any important provision in the Bidding Documents will be unacceptable, such an issue must be raised during the clarification stage.

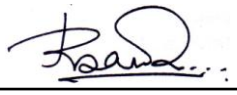
b. All such queries and requests for clarification shall be submitted using the Form for Clarification Questions contained in Annexure A Part f to the Bidding Documents.

c. KMDA will respond in writing to any request for clarification or modification of the Bidding Documents that it receives on the Form for Clarification Questions no later than the date set out in the time table. Written copies of KMDA's response, including an explanation of the query but not identification of its source, (the "Response to Questions Document") will be uploaded on the website or e-procurement platform. If similar or repeated queries are made by Bidders, KMDA may list those queries as one query & respond to such query only once.

2.3. Site Visit

a. Each Bidder is advised to visit and inspect the site/alignment of the Sewerage Network, SPS (the "Site Visit") and their surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into the Contract. The costs of visiting the site shall be at the Bidder's own expense.

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



2.4. Data Room and Background Information

KMDA shall establish a data room (the "Data Room") at the location specified in Bid Data Sheet with a collection of relevant data to be accessible to Bidders or their representatives from the date set out in the timetable until the deadline for submission of Bids (the "Submission Deadline"), in accordance with a schedule established by KMDA.

2.5 Pre-Bid Meeting

Each prospective Bidder is invited to attend a Pre-Bid Meeting, which will take place at the venue and time specified later. While attendance at the pre-bid meeting is not mandatory, Bidders are strongly encouraged to attend. The purpose of the pre-bid meeting is to provide a technical presentation and to clarify issues and answer questions on any matter that may be raised at the meeting. Each prospective Bidder is requested, as far as possible, to submit any question in writing to reach KMDA not later than one week before the pre-bid meeting. It may not be practicable at the meeting to answer questions received late, but questions and responses will be transmitted as indicated hereafter. Minutes of the pre-bid meeting will be transmitted without delay to all prospective Bidders that have been issued Bidding Documents. All responses to questions raised at the pre-bid meeting will be included in the Response to Questions Document. The proceedings of the pre-bid meeting, reply to the queries and corrigendum if any will also be uploaded on the website

2.6 Amendment of Bidding Documents

a. At any time prior to the Submission Deadline, KMDA may, for any reason, whether at its own initiative, or in response to a clarification requested by a prospective Bidder, amend the Bidding Documents by addendum. No other communications of any kind whatsoever, including, without limitation, the minutes of the pre-bid meeting or the Response to Questions Document, shall modify the Bidding Documents.

b. Addenda, if any, will be sent in writing by air mail, courier or facsimile to all prospective Bidders and will be binding on them. Bidders shall immediately acknowledge receipt to KMDA of any such amendment, and it will be assumed that the information contained therein has been taken into account by the Bidder in its Bid. Such Addenda will also be uploaded on the website specified in ITB.

c. In order to afford prospective Bidders reasonable time in which to take the amendment into account in preparing their Bids, KMDA may, at its discretion, extend the Submission Deadline, in which case, KMDA will notify all prospective Bidders in writing of the extended deadline.

2.7. Contact with KMDA for the Purpose of Clarification

The prospective Bidders shall contact only the persons for the purpose of requesting information and clarification or for any other purpose relating to the bidding process. The prospective Bidders shall not contact any other person at KMDA during the bidding process. From the time

of Bid opening to the time of Contract award, if any Bidder wishes to contact KMDA on any matter related to the bidding process, it may do so in writing.

2.8. Information Provided by KMDA/Bidders Due Diligence

a. Each Bidder is solely responsible for conducting its own independent research, due diligence, and any other work or investigations and for seeking any other independent advice necessary for the preparation of Bids, negotiation of agreements, and the subsequent delivery of all services to be provided by the Bidder that has been successful in the bidding process (the "Successful Bidder").

b. No representation or warranty, express or implied, is made and no responsibility of any kind is accepted by KMDA or its advisors, employees, consultants or agents, for the completeness or accuracy of any information contained in the Bidding Documents or the Response to Questions Document, or provided during the bidding process or during the term of the Contract. KMDA and its advisors, employees, consultants and agents shall not be liable to any person or entity as a result of the use of any information contained in the Bidding Documents or the Response to Questions Document, or provided during the bidding process or during the term of the Contract.

c. Bidders shall not rely on any oral statements made by KMDA or its advisors, employees, consultants or agents.

d. All Bidders shall, prior to submitting their Bid, review all requirements with respect to corporate registration and all other requirements. The Bidders are solely responsible for all matters relating to their legal capacity to operate in the jurisdiction to which this bidding process applies.

2.9. Timetable

KMDA may, in its sole discretion and without prior notice to the Bidders, amend the estimated timetable specified in the Bid Data Sheet. Bidders shall not rely in any way whatsoever on the estimated timetable and KMDA shall not incur any liability whatsoever arising out of amendments to the estimated timetable. KMDA shall give notice of timetable changes, if any, by addenda.

Section 3. Preparation of Bids

3.1. Language of Bid

The Bid prepared by the Bidder, all correspondence and documents related to the Bid exchanged by the Bidder and KMDA and the bidding process shall be written in the English language Documents Comprising the Bid

a. Each Bidder shall submit only one Bid which shall consist of,

1. One Technical Section which contains the following parts in the following order:

i. Part I – the information required by ITB;

ii. Part II – the Bid Security required by ITB;

iii. Part III – the Bid Form required by ITB, and the information required by ITB and Appendix to bid containing completed tables of Schedule of Adjustment Data as required by ITB;

iv. Part IV – where applicable, the joint venture documents required by ITB;

v. Part V – the power of attorney required by ITB;

vi. Part VI – the declaration of commissions and gratuities required by ITB;

vii. Part VII – Optional, separately bound pre-printed literature as per ITB; and

2. One Financial Section which shall consist of the Price Schedules completed in accordance with ITB.

b. Each Bidder shall also submit an initialed Draft Contract, in accordance with ITB, in the same envelope as its Technical Section.

3.2. ~~Technical Section – Part I~~ – Technical and Staffing Information

The Bidder, while making his technical proposal shall consider the following aspects.

For Network

(a) KMDA shall make available the right of way for the Sewerage Network and land area allocated for setting up the Sewage Pumping Station and all appurtenant structures. Part-I of the Technical Section of the Bid

(b) For Network: Part-I of the Technical Section of the Bid for Network shall consist of the following sub-parts in the following order:

1. An Executive Summary of the Technical Section;

2. A detailed work plan for conducting field survey, Topographical survey of total Municipal area, reviewing the designs (Total Municipal Area) provided by KMDA, redesigning the same (where necessary or can submit a full design but the specifications such as proposed pipe materials etc. remain the same so that there will not be any need for revising BOQ etc. except modifying some quantities) and build-work-plan comprising a detailed program timetable (the "Design-Build Work Plan") setting out the manner in which the Bidder proposes to carry out the design-build services as defined in the Draft Contract (the "Design-Build Services") and meet the design-build technical standards in accordance with the Technical Standards Schedule to the General Conditions. The Design-Build Work plan shall be divided into the following sections:

i. A well-defined proposal for the configuration of Sewerage Network proposed by the bidder along with the details of the manholes, Pumping Stations, system design of the pumping stations etc. The bidder's design should aim at optimizing the energy requirements for pumping of the sewage.

ii. a section entitled "Drawings" which consists of conceptual drawings that are sufficiently detailed to communicate the Bidder's design intent for all components of the proposed Sewerage Network. The conceptual drawings shall include the following:

a. The site plan / layout for Pumping Station, Layout of piping between various units and unit bypass for each unit, compound wall and gate house, etc. Location of power transformer, if applicable, location of administrative office and control centre, and any other features for safe and efficient working during operations and maintenance.

b. a layout plan showing all proposed works

iii. a detailed narrative in support of the conceptual drawings setting out the Bidder's plan for compliance with the Design-Build Services Schedule and the technical standards set out in the Technical Standards Schedule, to include construction quality assurance and control;

iv. a detailed program and schedule setting out the proposed sequence of works to be undertaken, including estimated start date, finish date and time allocations for individual units of the works, proposed resources to be allocated and the identification of all major milestones, including the submission of schematic design documents, design development documents, the Design-Build Documents and the commissioning of individual units of the Sewage Pumping Station; and

v. an itemized list of the principal codes of practice and standards proposed to be used for the Design-Build Services; and

The Bidder shall provide the total estimated connected load in kW, maximum power demand, average energy consumption in kWh per day with full load of pumping sewage up to the installed capacity, estimated power factor, any proposals for improving efficiency in terms of lower power consumption

(c) Part-I of the Technical Section of the Bid shall further consist of the following sub-parts in the following order:

1. a section entitled "Plant and Equipment and Contractor's Equipment" which consists of a list of proposed suppliers of major Plant and Equipment and Contractor's Equipment (Design-Build) and Contractor's Equipment (Operations), including:

i. plant and equipment;

ii. materials including pipe work and principal construction materials.

For all items, the Bidders shall provide either catalogues or detailed information with respect to manufacturer and source, model Designation, primary specifications, and year of manufacture, as applicable.

2. a detailed description of the Bidder's plans and methodologies to ensure that the requirements of the applicable Environmental Management Plan specified in the special conditions of contract for the proposed Sewerage Network and allied services at Site will be implemented and monitored;

3. a detailed staffing plan (the "Staffing Plan") setting out the Bidder's proposed staffing arrangements for the carrying out of the Design-Build Services. The Staffing Plan shall be divided into the following sections:

i. a sub-sections, (for the Design-Build Services) each entitled the "Staffing Chart" and each consisting of a chart setting out a list of all proposed Contractor's Personnel positions, the role of each position, the duration of existence of the position, and the location of the staff person filling the position during the periods of assignment to carry out the Design-Build and Operations Services;

ii. a section entitled "Summary of Staff Qualifications" which consists of a summary table setting out,

a. for the Key Staff positions, the names of the Bidder's employees who will occupy the Key Staff positions during Design-Build Services; and

b. all proposed positions for the Contractor's Key Personnel and the qualifications, years of experience and areas of expertise, including a clear indication of the expertise that the staff will provide consistent with the requirements for each of the proposed positions; The Bidder's

personnel as indicated in the bid proposals shall not be changed during the period of the contract. In case if the successful Bidder, intends to change the key staff, such change will be subject to approval from KMDA on justification provided by the successful Bidder. The replaced key staff shall have to be of equivalent or higher qualification and experience.

iii. a section entitled, "Curriculum Vitae" which contains the signed curriculum vitae for each of the Key Staff, in the format set out in Annexure A Part e to the Bidding Documents;

4. For the purpose of ITB, "Key Staff" means those individuals that will fill the positions listed in the Bid Data Sheet; and

3.3. ~~Technical Section – Part II~~ – Bid Security

a. In Part II of the Technical Section of its Bid, the Bidder shall furnish, as part of its Bid, a Bid security in the amount stipulated in detail NIT. The bid security of a Joint Venture must define as "Bidder" all Joint Venture Partners and list them in the following manner:
"a Joint Venture consisting of '.....', '.....' and '.....'.

b. The Bid Security shall, at the Bidder's option, be in the form of a bank guarantee from a reputable bank selected by the Bidder. The format of any bank guarantee provided by a Bidder shall be in accordance with the form of Bid Security contained in Annexure A Part c to the Bidding Documents. The Bidder shall ensure that the Bid Security remains valid for a period of 45 days after the end of the original Bid Validity Period, as defined in ITB, and 45 days after any extension subsequently requested by KMDA in accordance with ITB.

c. Any Bid not accompanied by an acceptable Bid Security shall be rejected by KMDA as being non-responsive. The Bid Security of a joint venture must be in the name of all of the participants in the joint venture submitting the Bid.

d. KMDA will return the Bid Securities of the unsuccessful Bidders as promptly as possible, upon the successful Bidder's signing the contract and furnishing the required performance security.

e. The Bid Security of the Successful Bidder will be returned when the Bidder has signed the Form of Contract pursuant to ITB and has provided the required Performance Security as set out in the Contract and ITB.

f. The Bid Security may, in the discretion of KMDA, be forfeited,

1. if the Bidder withdraws its Bid during the Bid Validity Period; or

2. in the case of the Successful Bidder, if the Successful Bidder fails within the specified time limit,

i. to execute the Form of Contract in accordance with ITB; or

ii. to furnish the Performance Security to KMDA in accordance with ITB.

3.4. ~~Technical Section – Part III~~ – Bid Form and Qualification Information

a. In Part III of the Technical Section of its Bid, each Bidder shall provide a completed Bid Form in the same form and substance as the Bid Form contained in Annexure A Part a to the Bidding Documents.

b. In Part III of the Technical Section of its Bid, Bidders shall submit Information Forms duly completed to evidence compliance with the Qualification Criteria provided in the Annexure A

Part g to the bidding documents. The Information Forms are provided in the Annexure A Part h to the Bidding Documents.

3.5. ~~Technical Section – Part IV~~ - Joint Venture Documents and Requirements

a. Each Joint Venture Bidder shall submit, as Part IV of the Technical Section of its Bid, a written commitment, in the form of a letter duly executed by an authorized officer of each joint venture participant which,

1. Confirms each joint venture participant's commitment to the joint venture and acceptance of the joint venture arrangements described in the Bid;
2. Confirms each joint venture participant's willingness to provide a joint and several guarantee to KMDA to underwrite the performance of the joint venture in respect of the Contract; and
3. Identifies which joint venture participant,

i. will assume the leading role on behalf of the other joint venture participants; and

ii. will have the authority to commit all joint venture participants.

iii. will have the authority to incur liabilities and receive instructions for and on behalf of any and all participants of the joint venture.

b. A copy of the Joint Venture Agreement entered into by the Partners (JV Participants) shall be submitted with the bid. Alternatively, a Letter of Intent as per format provided under Annexure A – Part i to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the bid together with a copy of the proposed Agreement, clearly indicating the objectives of the joint venture, the proposed management structure, the contribution of each participant to the joint venture operations, the commitment of the participants to joint and several liability for performance of the contract, recourse or sanctions within the joint venture in the event of default or withdrawal of any participant, and arrangements for providing the required indemnities.

c. If the Successful Bidder is a Joint Venture to whom the contract is awarded, each partner of the Joint Venture shall sign and execute the contract with KMDA and shall be jointly and severally responsible to KMDA for the performance of the contract.

3.6. ~~Technical Section – Part V~~ – Power of Attorney

Each Bidder shall provide, as Part V of the Technical Section of its Bid, a written power of attorney in accordance with ITB Section.

3.7 ~~Technical Section – Part VI~~ – Commissions and Gratuities

In Part VI of the Technical Section of its Bid, each Bidder shall provide detailed information listing all commissions and gratuities, if any, paid or to be paid by the Bidder to agents relating to this Bid or the Contract if the Bidder is awarded the Contract. The Bidder shall list the name and address of any agents, the amount and currency paid or to be paid to the agents and the purpose of the commission or gratuity. If no such commissions and gratuities have been paid, the Bidder shall provide this information in Part VI of the Technical Section of its Bid.

3.8. ~~Technical Section – Part VII~~ – Pre-Printed Literature

If the Bidder wishes to provide pre-printed literature about the Bidder or the joint venture participants that pre-printed literature shall be contained in the Technical Section of the Bid only.

3.9. Financial Section – Price Schedules

Each Bidder shall submit completed and properly executed Price Schedules Financial Section – Bid Prices

a. Bidders shall quote their Bid Price covering the total cost of survey, review of design, redesign where necessary, new infrastructure components and improvement of sewage collection network, pumping stations, and dovetailing the existing infrastructure, construction, testing and commissioning of Sewerage Network (including pumping stations), and all appurtenant structures and allied works within the period on a "single responsibility" basis such that the total Bid Price covers all of the Contractor's obligations mentioned in or to be reasonably inferred from the Bidding Documents in respect of the design/redesign, construction, commissioning, installation, testing, etc. of the Sewerage Network (including pumping stations) as set out in the Contract.

b. The Bidders shall quote their Bid Price as follows:

For Sewerage Network:

1) Bid Price for-BOQ items: The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities (BOQ) including cost of review and redesign of network and design of sewage pumping station including vetting of all the designed from any IIT, or Jadavpur University, or IIEST (Formerly Bengal Engineering and Science University) and for which the scrutiny/ proof checked charges shall be borne by the Contractor and the delay in checking & vetting designs by the third party as mentioned above shall be treated as the delay on the part of the Contractor for operation of the Contract clause, and new infrastructure components and dovetailing the existing infrastructure for all materials, electro mechanical equipment, labour, temporary works required for the construction, initial site clearance, cutting trees, bushes, site development, access roads, ancillary & allied works, consumables, acquisition of all permits / approvals / licences, duties and taxes and all related items of work as may be necessary for setting up the Network and making it fully functional in compliance with the provisions of the Contract. Items against which no rate or price is entered by the Bidder shall be deemed covered by the rates for other items in the Bill of Quantities and will not be paid for separately by KMDA. An item not listed in the priced Bill of Quantities shall be assumed to be not included in the Bid, and provided that the Bid is determined substantially responsive notwithstanding this omission, the average price of the item quoted by substantially responsive bidders will be added to the bid price and the equivalent total cost of the bid so determined will be used for price comparison. The bid prices shall remain firm and fixed and will not be subject to price adjustment, unless otherwise provided the Conditions of Contract.

3. 10. Financial Section

Bidders shall quote their prices in Indian Rupees only.

3.11. Bidding of alternatives not to be considered

a. The Bidders shall base their Bids on the terms and conditions of the Bidding Documents and, without limiting the generality of the foregoing, shall,

1. Submit their prices based on the terms and conditions in the Bidding Documents;
2. submit their Bids based on the assumption that the final Contract will be the same as the Draft Contract and shall not base their Bids on the premise that they may be able to change the Draft Contract; and

b. No Bidder shall submit a Bid that contains statements that are inconsistent with the Bidding Documents.

c. A Bidder shall not submit a Bid that proposes an arrangement between KMDA and the Bidder which, in the discretion of KMDA, is different than the arrangement set out in the Bidding Documents (an "Alternative Bid"). KMDA intends to enter into a contract to design, build and operate a Sewerage Network based on the terms and conditions of the Bidding Documents.

3.12. Period of Validity of Bid

a. Bids shall remain valid for the period 120 days. A Bid valid for a shorter period shall be rejected by KMDA as being non-responsive.

b. If a Bidder accepts to prolong the Bid Validity Period, the Bid Security shall also be suitably extended. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request will not be required nor permitted to modify its Bid.

Section 4. Submission of Bids

4.1. Deadline for Submission of Bids

KMDA may, at its discretion, extend the Submission Deadline by amending the Bidding Documents, in which case all rights and obligations of KMDA and Bidders will thereafter be subject to the Submission Deadline as extended.

Section 5. Bid Opening and Evaluation

5.1. Opening of Bids by KMDA

KMDA shall conduct the bid opening as per e-procurement norms.

5.2. Clarification of Bids

During Bid evaluation, KMDA may, at its discretion, ask the Bidder for a clarification of its Bid. The request for clarification and the response shall be in writing, and no change in the price or substance of the Bid shall be sought, offered or permitted.

5.3. Preliminary Examination of Bids

a. KMDA will examine each Bid to determine whether it is complete, whether any computational errors have been made, whether required securities have been furnished, whether the documents have been properly signed, and whether the Bid is generally in order.

b. KMDA may waive any minor informality, nonconformity or irregularity in a Bid that does not constitute a material deviation, and that does not prejudice or affect the relative ranking of any Bidder as a result of the technical and price evaluation.

c. Prior to the detailed evaluation, KMDA will determine whether each Bid is of acceptable quality, is complete and is substantially responsive to the Bidding Documents. For purposes of this determination, a substantially responsive Bid is one that conforms to all the terms, conditions and specifications of the Bidding Documents without material deviations, objections, and conditional ties or reservations. A material deviation, objection, conditionality or reservation is one,

1. that affects in any substantial way the scope, quality or performance of the contract;
2. that limits in any substantial way, inconsistent with the Bidding documents, KMDA's rights or the Successful Bidder's obligations under the contract; or
3. whose rectification would unfairly affect the competitive position of other Bidders who are presenting substantially responsive Bids.

If a Bid is not substantially responsive, it will be rejected by KMDA, and may not subsequently be made responsive by the Bidder by correction of the nonconformity. KMDA's determination of a Bid's responsiveness is to be based on the contents of the Bid itself without recourse to extrinsic evidence.

5.4. Technical Evaluation

a. KMDA will carry out a detailed evaluation of the Technical Sections previously determined to be substantially responsive in order to determine on a pass/fail basis whether the technical aspects are in accordance with the requirements set forth in the Bidding Documents. Bidders acknowledge that, in order to reach such a determination, KMDA will examine and analyse the technical aspects of each Bid on the basis of the information supplied by Bidders, taking into account the completeness, consistency and level of detail of the following factors:

1. with respect to the Design-Build construction plan,

i. the Bidder's ability to demonstrate how it will meet KMDA's project objective and requirements, the technical standards and the Environmental Management Plan;

ii. the soundness of the proposed methodology and approach, and the extent to which the Design-Build Work plan demonstrates an understanding of the local conditions and specific Project requirements;

2. with respect to the Staffing Plan,

i. the qualifications and competence of the Key Staff; and

ii. the overall quality of the Staffing Plan, including the depth and organisational strength demonstrated by the Plan and the extent to which it meets the expertise requirements.

b. For the purpose of ITB, the evaluation of the overall quality of the Staffing Plan shall be based on,

1. the clarity, comprehensiveness and level of detail of the Staffing Plan;
2. the extent to which the expertise required by the Contractor's Key Staff is included in the Staffing Plan; and
3. the extent to which the Staffing Plan addresses the specific Services that are required by the Design-Build and Operations Services Schedules to the General Conditions.

5.5. Price Evaluation and Comparison of Bids

a. KMDA shall examine each Bidder's Financial Section to determine whether such Financial Section is complete and substantially responsive to the Bidding Documents.

b. The Financial Sections, which are substantially responsive to the Bidding Documents, shall be evaluated to determine the lowest evaluated bid.

5.6. Qualification of the Bidder

a. KMDA shall determine to its satisfaction whether the Bidder that is selected as having submitted the lowest evaluated and substantially responsive bid meets the Qualification Criteria specified in Annexure A Part g of bidding documents.

b. The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder.

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

5.7. Contacting KMDA

a. From the time of bid opening to the time of Contract award, if any Bidder wishes to contact KMDA, it must do so in writing.

b. Any effort by a Bidder to influence KMDA, its advisors, employees, consultants or agents, in KMDA's Bid evaluation, Bid comparison, or Contract award decision may, in the discretion of KMDA, result in rejection of the Bidder's Bid.

Section 6. Award of Contract

6.1. Award Criteria

Subject to ITB, KMDA will award the Contract to the Bidder whose Bid has been determined, by the technical and price evaluation, to be substantially responsive, has received a "pass" in the technical evaluation, and has the lowest evaluated Bid Price, provided further that the Bidder is determined to be qualified to perform the contract satisfactorily.

6.2. KMDA's Right to Accept or Reject and Waive Irregularities

a. KMDA reserves the right to,

1. accept any Bid;
2. reject any Bid;
3. annul the bidding process and reject all Bids;
4. annul the bidding process and commence a new process; and
5. waive irregularities, minor informalities, or minor non-conformities which do not constitute material deviations in the submitted Bids from the Bidding Documents, at any time prior to the award of the Contract without incurring any liability to the affected Bidder or Bidders and without any obligation to inform the affected Bidder or Bidders of the grounds for KMDA's actions.

b. Nothing in ITB is intended to permit KMDA to refuse to provide reasons for rejection to an unsuccessful Bidder.

6.3. Notification of Award

Prior to the expiration of the Bid Validity Period, KMDA shall notify the Successful Bidder in writing by courier that its Bid has been accepted by KMDA (the "Notification of Award"). The effectiveness of the Contract shall be as of the date of KMDA's signing of the Contract.

6.4. Signing the Form of Contract

a. At the same time as KMDA sends the Successful Bidder the Notification of Award, KMDA shall send the Successful Bidder,

1. Form of Contract; and
2. the other Contract Documents.

b. Not later than 30 days after the Successful Bidder's receipt of the Notification Award, the Form of Contract and the other Contract Documents, the Successful Bidder shall sign and date the Form of Contract and initial each page of the Contract and return them to KMDA.

6.5. Performance Security

a. No later than 30 days after the Successful Bidder's receipt of the Notification of Award, the Successful Bidder shall provide KMDA with the performance security and in the substance and form set out in Annexure A Part d or in another form approved by KMDA. The Performance Security of a Joint Venture shall be in the name of Joint Venture.

b. In case if KMDA finds from the break-up of design build prices of Network contained in Price Schedule that the prices indicated therein are unbalanced, the successful bidder shall have to provide additional performance guarantee as may be required by KMDA for such unbalanced bid prices.

6.6 Failure to Sign the Form of Contract or provide the Performance Security

If the Successful Bidder fails to comply with the provisions of ITB, this failure shall constitute sufficient grounds for annulment of the award and forfeiture of the Bid Security, and in which event KMDA may make the award to the next lowest evaluated Bidder or call for new bids.

6.7 Fraud and Corruption

Bidders, suppliers, Contractors and their agents (whether declared or not), sub-contractor, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement

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

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

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

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

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

(v) "obstructive practice" is

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

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

Annexure A to the Bidding Documents

a. Bidder's Bid Form
b. Price Schedules
c. Form of Bid Security
d. Form of Performance Security
e. Format of Curriculum Vitae for Proposed Key Staff
f. Form for Clarification Questions
g. Qualification Criteria
h. Information Forms
i. Form of Letter of Intent by JV Partners
j. Form of Power of Attorney for Joint Venture
k. Form of undertaking by JV Partners

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Annexure A – Part a

BIDDER'S BID FORM

[NAME OF PROJECT]-

Date:
Contract No: Date:

[Name of Contract]:

To: The Superintending Engineer,
North Circle, GAP Sector, KMDA,
Unnayan Bhawan, Block-D, 1st Floor, Kolkata-700 091.

Gentlemen,
Having examined the Bidding Documents, including Addendum Nos.*[insert numbers]*, the receipt of which is hereby acknowledged, we, the undersigned, offer to Review the Design, Build, Test, pre-commission and commission the Sewerage Network; under the above-named Contract in full conformity with the said Bidding Documents in accordance with the Price Schedules and are made part of this Bid:
We meet the eligibility requirements and have no conflict of interest in accordance with ITB.

We have not been suspended nor declared ineligible by KMDA based on execution of a Bid Securing Declaration in the KMDA in accordance with ITB.

We undertake, if our Bid is accepted, to commence the construction of Sewerage Network and to achieve Completion within the respective times stated in the Bidding Documents.
If our Bid is accepted, we undertake to provide an advance payment security and the Performance Security in the form, in the amounts, and within the times specified in the Bidding Documents.
We are not participating, as a Bidder in more than one bid in this bidding process in accordance with ITB,

We, including any of our subcontractors or suppliers for any part of the contract, have not been declared ineligible by;

We are not a government owned entity / we are a government owned entity but meet the requirements of ITB

We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Name of Recipient	Address	Reason	Amount
----------	----------	----------	----------
----------	----------	----------	----------
----------	----------	----------	----------
----------	----------	----------	----------

We agree to abide by this Bid, which consists of this letter and the other documents listed in ITB, for the period of the Bid Validity Period, and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.

Until a formal contract is prepared and executed between us, this Bid, together with your written acceptance thereof and your notification of award, shall constitute a binding contract between us.

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

We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this day of,*[Year]*.

_____

[signature]

In the capacity of _____

[position]

Duly authorized to sign this bid for and on behalf of _____

[name of Bidder]

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Annexure A – Part b

PRICE SCHEDULES

1.1 The Price Schedules do not give a full description of the Network and other services, to be supplied and the Services to be performed under each item. Bidders are deemed to have read the Draft Contract, including the Technical Specifications Schedule, consisting of the Design-Build Services Schedule and Technical Standards Schedule, and other sections of the Bidding Documents to ascertain the full scope of the requirements of the Contract included in each item prior to filling in the prices. The entered prices are deemed to include the full scope as aforesaid, including overheads and profit.

1.2 If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with the Instructions to Bidders in the Bidding Documents prior to submitting their Bid.

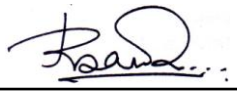
1.3 Prices shall be fixed and firm for the duration of the Contract.

1.4 The Bid Price shall be quoted in the manner indicated and in INR as specified in the Instructions to Bidders in the Bidding Documents. For each item, Bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

1.5 Bidder shall submit with its bid details evidencing that the cost claimed for the payment is based on a realistic assessment of setting up the Sewerage Network. KMDA shall have the option to seek further details including details of costs of similar contracts executed by the Bidder in the past.

1.6 Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in the Draft Contract or elsewhere in the Bidding Documents.

1.7 KMDA will make payments in INRs.



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Annexure A – Part c

FORM OF BID SECURITY (BANK GUARANTEE)

WHEREAS, ...(*name of Bidder including names of all Joint Venture Participants*) (hereinafter called "the Bidder") has submitted its Bid (hereinafter called the "Bid") dated (*date*) for the performance of (*name of Contract*).

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 ..... (hereinafter called "KMDA") in the sum of .....for which payment well and truly to be made to the said KMDA, the Bank binds itself, its successors, and assigns by these presents.

[The Bidder should insert the amount of the guarantee in words and in figures. This figure should be the same amount as set out in ITB. The details related to the Bid Security are set out in the same ITB.]

The CONDITIONS of this obligation are:

a. if the Bidder withdraws its Bid during the Bid Validity Period; or

b. if the Bidder, having been notified of the acceptance of its Bid by KMDA during the period of Bid validity,

   1. fails to sign the Form of Contract in accordance with and when required by ITB; or

   2. fails to provide the performance security to KMDA in accordance with and when required by ITB.

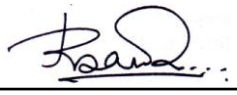
We undertake to pay to KMDA up to the above amount upon receipt of its first written demand, without KMDA having to substantiate its demand, provided that in its demand KMDA will note that the amount claimed by it is due to it owing to the occurrence of one or more of the conditions set out above, specifying the occurred condition or conditions.

This Guarantee will remain in full force up to and including 45 days after the expiry of the Bid Validity Period and it may be extended by KMDA in accordance with the Bidding Documents.

SEALED with the Common Seal of the said

Bank this ..... day of ....., *[Year]*.

_____	_____
WITNESS	SIGNATURE OF THE BANK
(signature, name and address)	SEAL
	Name: _____
	Position: _____



Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Annexure A – Part d

FORM OF PERFORMANCE SECURITY

_____*[Bank's Name, and Address of Issuing Branch or Office]*

Beneficiary:_____*[Name and Address of KMDA]*

Date: _____

PERFORMANCE GUARANTEE NO.: _____

We have been informed that *[name of Bidder]* (hereinafter called "the Bidder") has entered into Contract No. *[reference number of the contract]* dated with you, concerning a contract to Design, build, operate and transfer, Sewerage Network, Pumping Stations, all appurtenant structures and allied works in ……..*[city and State]*(hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we *[name of Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[amount in figures]* ( )*[amount in words]*, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligations under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire no later than the earlier of:

(a) six months after the End Date, as defined in the Contract; or

(b) six months after the date of termination of the Contract pursuant to its terms.

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

Yours truly,

*[Name of Bank]*_____

Authorised Signature

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Annexure A – Part e

FORMAT OF CURRICULUM VITAE (CV) FOR PROPOSED KEY STAFF

Proposed Position: _____

Name of Firm: _____

Name of Staff: _____

Profession: _____

Date of Birth: _____

Years with Firm/Entity: _____ Nationality: _____

Membership in Professional Societies: _____

_____

Detailed Tasks Assigned: _____

_____

Key Qualifications:

[Give an outline of staff member's experience and training most pertinent to tasks on assignment. Describe degree of responsibility held by staff member on relevant previous assignments and give dates and locations. Use about half a page.]

_____

Education:

[Summarize college/university and other specialized education of staff member, give names of schools, dates attended, and degrees obtained. Use about one quarter of a page.]

_____

Employment Record:

[Starting with present position, list in reverse order every employment held. List all positions held by staff member since graduation, giving dates, names of employment organizations, titles of positions held, and locations of assignments. For experience in last ten years, also give types of activities performed and client references, where appropriate. Use about two pages.]

_____

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Languages:

[For each language indicate proficiency: excellent, good, fair or poor in speaking, reading and writing.]

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications, and my experience. I also certify that I have only given permission for my CV to be included in the Bid submitted by

[Fill in name of Bidder here.]

Date:

[Signature of staff member and authorized representative of the firm] *Day/Month/Year*

Full name of staff member:

Full name of authorized representative:

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Annexure A – Part f

FORM FOR CLARIFICATION QUESTIONS

Bidder's Name: _____

Item No.	Section / Article Reference No.	Page No.	Question / Query / Clarification / Comment
1.			
2.			
3.			
4.			
5.			
6.			

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Annexure A – Part g
QUALIFICATION CRITERIA

Section 1. QUALIFICATION CRITERIA

1.1. General

a. Evaluation of the Bidders' qualifications will be based on compliance with all the following minimum pass-fail criteria regarding their general Design, build, construct, operation and maintenance experience Sewerage Network, financial strength, personnel and management capabilities, and other relevant information as demonstrated by the Bidders' responses in the Information Forms that they submit as per the attached Bid Forms. Additional requirements for joint ventures are given in Section 2.

b. Bidders may submit the Bid either as,

1. A stand-alone firm, company, legal entity formed as per the applicable law; or
2. A joint venture of up to a maximum of 3 partners, provided that they meet the requirements of the Bidding Documents. For the purpose of assessing some qualification criteria, the qualifications and experience of Sub-Consultants may be included and the specific provisions in this regard are set out in Section.

1.2. Subcontracting / Sub-consultancy

a. Bidders will be evaluated based on the qualifications of,

1. the Bidder; and
2. nominated Sub-Consultants only with respect to the experience evaluation as set out in Section, and only if the Sub-Consultants are nominated for the purpose of this bid.

   For the purposes of Section 1.6, Bidders may nominate personnel of Sub-Consultants to fill the key positions, during the Design-Build Period, as listed/referred to in the ITB.

b. The Bidder shall provide a detailed list of all nominated Sub-Consultants and a record of their experience and qualifications in the applicable Information Forms. The Contractor under the Contract shall be prohibited from entering into a contract or contracts that will result in the Contractor exceeding the maximum percentage of sub-consulting permitted by KMDA, as set out in the ITB.

c. Bidders will not be permitted to change the Sub-Consultants nominated in their Bid.

1.3. Contractor's Responsibility

After award of the Contract, the subcontracting of any part of the work, except for those Sub-Consultants nominated in the Bid, shall require the prior written consent of KMDA. Notwithstanding such consent, the Contractor shall remain responsible for the acts, defaults, and neglects of all Sub-Consultants during Contract implementation.

1.4. Experience in Construction Sewerage Network

For the purpose of determining a bidder's compliance with the qualification criteria specified in Annexure A – Part g, following definitions shall apply:

"Sewerage Network" means the pipe line network laid for collecting the Sewage from consumer connections including 'nallaha', main, trunk, secondary lines from the individual take over points of the Consumers up to the Sewage Treatment Plant and including Sewage lifting and pumping stations and all appurtenant structures forming a part of both the New Sewerage Network and the Existing Sewerage Network".

(a) The Bidder shall provide evidence that

1. It has designed, developed, built, tested and commissioned at least one Sewerage Network (including Pumping Stations) of 22 Km Length of Sewerage Network of which 10% should be equal to or above 400 mm during the last 5 years preceding the bid submission date.

2. It has designed, developed, built, tested and commissioned at least one Sewage Pumping Stations through well sinking method during last 5 years preceding the bid submission date.

The period of 5 years referred to in Section 1.4 will be the period from year 2011-12 to 2015-16 from the date of this NIT in any Govt. / Semi-Govt. / Govt. Undertakings / Autonomous Bodies / Statutory Bodies and Local Bodies is eligible for the said work.

(b) For the purpose of demonstrating compliance with Section the Bidder, whether a single entity or a joint venture Bidder may claim the experience of its sub-consultants nominated in the Information Forms.

Subcontractors can be Technology Providers having experience in "design" and "commissioning"

1.5. Financial Capabilities

a. The Bidder shall demonstrate that it possesses a net worth equivalent to minimum of INR 187.50 million, average of the last three financial years preceding the date of submission of bid (i.e. 2013-14 to 2015-16).

b. The Bidder shall demonstrate by submitting along with its bid, a banker's certificate that it has available cash credit facility equivalent to minimum INR 75.00 million as on the date of submission of bid.

c. The Bidder's audited balance sheets for the last three years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability. If deemed necessary by KMDA, KMDA shall have the authority to make inquiries with the Bidder's bankers.

1.6. Personnel Capabilities

The Bidder shall supply general information on the management structure of the firm, and shall make provision for suitably qualified personnel to fill the key positions listed, as required during Contract implementation. The Bidder shall supply information on a candidate for each key

position, who shall meet the experience requirements specified. The Bidder may nominate personnel of sub-contractors and sub consultants to fill key positions listed.

1.7. Litigation History and Legal Matters

The Bidder shall provide accurate information on the "Historical Contract Non-Performance Form" about contract non-performance and pending litigation with respect to contracts completed or ongoing under its execution over the last five years. A consistent history of awards against the Bidder or any Partner of a joint venture may result in rejection of the Bid.

1.8. Right to Waive

KMDA reserves the right to waive minor deviations in the qualification criteria if they do not materially affect the capability of a Bidder to perform the Contract.

Section 2. JOINT VENTURES

2.1. Qualification Criteria

a. One of the Joint Venture partners shall satisfy the criteria specified in Section 1.4 and the same or other Joint Venture partner(s) shall satisfy the criteria specified in Sections. Each JV partner shall have experience of building & commissioning a Sewerage Network during the last 5 years (i.e. 2011-12 to 2015-16).

b. The joint venture partners shall satisfy the requirements specified in Section of Qualification Criteria.

c. The Joint Venture partners shall jointly satisfy all the requirements specified in Section of Qualification Criteria.

d. For the purpose of satisfying the qualification criteria set out in Section 1, Joint Venture (all partners combined) must satisfy the following qualification criteria :

1. financial soundness as stated in Section 1 of Qualification Criteria in respect of each partner of the Joint Venture;
2. adequate sources to meet financial commitments as set out in Section 1 Qualification Criteria for all partners jointly;
3. personnel capabilities as stated in Section 1 of Qualification Criteria for all partners jointly; and
4. legal disclosure as stated in Section 1 of Qualification Criteria for each partner of the JV.

e. Each partner of a joint venture Bidder shall provide the information to evidence compliance with the criteria set out in Section 2 of Qualification Criteria.

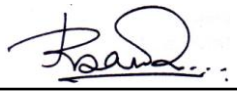
2.2.(a) Lead Partner

One of the joint venture Partners who is responsible for performing a key function in contract management or in executing a major component of the proposed Contract shall be nominated as being in charge during the bidding process and, in the event of a successful bid, during Contract

execution (the "Lead Partner"). The Lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture. This authorization shall be evidenced by the submission of a power of attorney signed by legally authorized signatories of each of the joint venture Partners as per proforma enclosed in Annexure A Part j, as part of the Bid.

(b) All Partners

All partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a copy of the undertaking as per format provided under Annexure A – Part k signed by the joint venture partners shall be submitted with the bid.



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Annexure A – Part h

INFORMATION FORMS

Information Form (1)

General Information

All individual firms and each participant in a joint venture submitting the bids are required to complete the information in this form. Nationality information should be provided for all Bidders that are partnerships or individually owned firms.

If the Bidder proposes to use nominated sub-consultants, the following information should also be supplied for the sub-consultant(s).

1.	Name of firm	
2.	Head office address	
3.	Telephone	Contact
4.	Fax	Telex
5.	Place of incorporation / registration	Year of incorporation / registration

INFORMATION FORM (2)

General Design, Build, Operation and Management Experience Information

Name of Bidder or participant of a joint venture

All individual firms and all participants of a joint venture are requested to complete the information in this form with regard to their experience in Designing, building, operating, managing and maintaining Sewerage Networks

Description of Contract/ Sewerage Network Components along with its Capacity and appurtenant structures	
Name of Joint Venture Participant Responsible	
Name of City	
Country	
Population served	
Contract Role (joint venture participant, sub consultant, lead, etc.) and percentage share in the total contract	
Nature, role and extent of participation (describe fully)	
Date of contract commencement	
Date of contract termination	
Contract value (INR)	
Individual for reference	
Address, Telephone, Fax for reference	

INFORMATION FORM (2A)

Financial Capability Information[#]

Name of Bidder or participant of a joint venture

All individual firms and all participants of a joint venture are requested to complete the information in this form with regard to their experience in Designing, building, operating, managing and maintaining Sewerage Networks. The information supplied should be the annual turnover of the Bidder (or each partner of a joint venture) in terms of the amounts billed to clients for each year for work in progress or completed, at the end of the period reported. The annual periods should be calendar years, with partial accounting for the year up to the date of submission of Applications.

Use a separate sheet for each participant of a joint venture.

Bidders should not enclose testimonials, certificates, and publicity material with their Application as they will not be taken into account in the evaluation of qualifications.

Annual financial data (in the area of infrastructure development and engineering construction).			
Year	**Turnover (Rs. Million)**	**Net Worth (Rs. Million)**	**Net Cash Accruals (Rs. Million)**
[Year]			
[Year]			
[Year]			
[Year]			
[Year]			

Instructions and Applicable Conditions:

1. The applicant shall provide details of its own financial capacity;
2. The Applicant / its constituent Joint Venture Partners shall attach copies of balance sheets, financial statements and Annual report for 5 (five) years preceding the Application due date. The financial statements shall:
    a. Reflect the financial situation of the Bidder or Joint Venture Partners,
    b. Be audited by a statutory auditor
    c. Be complete including all notes to the Financial statements; and
    d. Correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted)

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

3. Net Worth (The definition of Net Worth shall be as follows: Based on the type of the Applicant whether a company, partnership firm, etc. the net worth is defined as follow:

    a. In case of a company registered under Companies Act, 1956: Net worth shall mean the sum of subscribed and paid up equity share capital and reserves from which shall be deducted the sum of revaluation reserves, miscellaneous expenditure not written off and reserves not available for distribution to equity share holders.

    For the company = (Subscribed and Paid-up Equity + Reserves) less (Revaluation reserves + miscellaneous expenditure not written off + reserves not available for distribution to equity share holders).

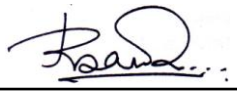
    b. In case of a Partnership firm: Net worth shall mean the sum of Aggregate of partners' capital account and Reserves from which the aggregate of drawings by partners and aggregate of advances to partners shall be deducted.

    For Partnership Firm = Aggregate of partners' capital account + Reserves - Aggregate of drawings by partners - Aggregate of advances to partners

    c. In case of a Trust / Society: Net worth shall mean the sum of corpus and the returns not set aside for any particular purpose.

    For Trust / Society = corpus + returns not set aside for any particular purpose

4. Net Cash Accruals shall be defined as follows: Net Cash Accruals = Profit after Tax + Depreciation;
5. Year 1 will be the latest completed financial year, preceding the bidding. Year 2 shall be immediately preceding year 1 and so on. In case the Bid Submission date falls within 3 (three) months of the close of the latest financial year of the applicant, it shall ignore such financial year for the purpose of its bid and furnish all its information and certification with reference to the 5 (five) years preceding its latest financial year. For the avoidance of doubt, financial year shall, for the purpose of the Bid hereunder, mean the accounting year followed by the Bidder in the course of its normal business.
6. The Bidder shall provide an Auditor's Certificate specifying the Net Worth and Net Cash Accruals of the Bidder and also specifying the methodology adopted for calculating such net worth in accordance with the formula mentioned in point 3 and 4 above.
7. The Bidder shall provide from its concerned client (s) or Statutory Auditor, certificate(s) stating the payments made / received or works commissioned, as the case may be, during the past 5 (five) years in respect of the Projects specified in Information Forms.



INFORMATION FORM (2B)

Joint Venture Summary

Names of all participants of a joint venture
1. Lead Participant
2. Participant
3. Participant

Annual turnover data (in the area of infrastructure development and engineering construction).						
Participant	**Information Form (2A) page no.**	***[Year]***	***[Year]***	***[Year]***	***[Year]***	***[Year]***
1. Lead Participant						
2. Participant						
3. Participant						
Totals						

Bidders shall append to Form 2B:

a. A document confirming the percentage shareholding of each joint venture participant in the company to be established including the financial stake of each partner in the JV partnership; and

b. A description of the role and responsibility of each joint venture participant. (Bidders shall make the precise role of each joint venture participant clear in this description).

Bidders are reminded to submit the appropriate powers of attorney as required by Section 2 of Annexure A – Part g. The Joint Venture Bidders may also note the requirements mentioned in ITB for compliance while submitting the Bid.

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

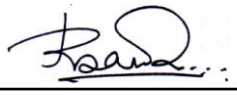
INFORMATION FORM (3A)

Design, development, construction, testing and commissioning of Sewerage Network.

Name of Bidder or participant of a joint venture

Description of Contract/ Sewerage Network	
Name of Joint Venture Participant Responsible	
Name of City	
Country	
Capacity of Sewerage Network	
Population served	
Contract Role (joint venture participant, sub consultant, lead, etc.) and percentage share in the total contract	
Nature, role and extent of participation (describe fully)	
Date of contract commencement	
Date of contract termination	
Contract value in INR	
Individual for reference	
Address, Telephone, Fax for reference	

Provide a complete description of the services provided under this contract demonstrating that the definition in Section 1 of Annexure A Part g to Bidding documents has been met.



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Information Form (3)

Financial Capabilities

Name of Bidder or participant of a joint venture

Bidders, including each partner of a joint venture, shall provide financial information to demonstrate that they meet the requirements stated in the Schedule to ITB. Each Bidder or participant of a joint venture shall complete this form. If necessary, separate sheets shall be used to provide complete banker information. A copy of the audited balance sheets shall be attached.

Banker	Name of banker	
	Address of banker	
	Telephone	Contact name and title
	Fax	Telex

Summarize actual assets and liabilities in INR for the previous five calendar years.

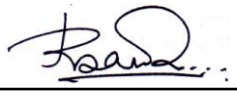
Financial information in INR	**Actual: Previous five years**				
	[Year]	***[Year]***	***[Year]***	***[Year]***	***[Year]***
1. Total assets					
2. Current assets					
3. Total liabilities					
4. Current liabilities					
5. Profits before taxes					
6. Profits after taxes					

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject Contract or contracts as indicated in Schedule to ITB.

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Source of Financing	Amount in INR
1.	
2.	
3.	
4.	

Attach audited financial statements—including, as a minimum, profit and loss account, balance sheet, and explanatory notes—for the period stated in Section 1 of Annexure A Part g to Bidding documents (for the individual Bidder or each participant of a joint venture).



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Information Form (4)

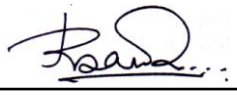
Personnel Capabilities

Name of Bidder or participant of a joint venture

For specific positions noted below, Bidders must provide the names of a candidate qualified to meet the specified requirements stated for each position. The data on their experience should be supplied on separate sheets using one Form (4A) for each candidate.

Bidders may propose alternative management and implementation arrangements requiring different key personnel, whose experience records should be provided.

1.	Title of position
	Name of candidate
2.	Title of position
	Name of candidate
3.	Title of position
	Name of candidate
4.	Title of position
	Name of candidate
5.	Title of position
	Name of candidate
6.	Title of position
	Name of candidate



Signature of Tenderer | **Signature of Tender Inviting Authority** | **Signature of Tender Accepting Authority**

Information Form (4A)

Candidate Summary

Name of Bidder or participant of a joint venture

Position		Candidate
Candidate Information	Name of Candidate	Date of Birth
	Professional qualifications	
Present Employment	Name of KMDA	
	Address of KMDA	
	Telephone	Contact (manager/personnel officer)
	Fax	Telex
	Job title of candidate	Years with present KMDA

Summarize professional experience over the last twenty years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the Project.

From	**To**	**Company / Project / Position / Relevant technical and management experience**

Signature of Tenderer | **Signature of Tender Inviting Authority** | **Signature of Tender Accepting Authority**

Information Form (5)

Historical Contract Non-Performance

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

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

Non-Performing Contracts in accordance with ITB			
Contract non-performance did not occur during the [number] years specified in ITB. Contract(s) not performed during the [number] years specified in ITB.			
Year	**Non performed portion of contract**	**Contract Identification**	**Total Contract Amount (current value in INR)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/number, and any other identification]* Name of KMDA: *[insert full name]* Address of KMDA: *[insert street/city/country]* Reason(s) for non-performance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with of Bidding documents.			
☐ No pending litigation in accordance with of Bidding documents. ☐ Pending litigation in accordance with of Bidding documents.			

Signature of Tenderer | **Signature of Tender Inviting Authority** | **Signature of Tender Accepting Authority**

Annexure A – Part i

FORM OF LETTER OF INTENT BY JV PARTNERS TO

ENTER INTO JV AGREEMENT

THIS LETTER OF INTENT signed on this..... day of..... Two Thousand and .....by..... a company incorporated under the laws of ..... and having its Registered Office at .....(hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s ..... a company incorporated under the laws of ..... and having its Registered Office at .....(hereinafter called the "Party No.2" which expression shall include its successors, executors and permitted assigns) and M/s.. .. .. a Company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" (in case of award) against the work for the design and build Sewerage Network and all Appurtenant Structures and Allied Works, of Complete Works associated with ....(hereinafter called the "KMDA").

WHEREAS the Party No.1, Party No.2 and Party No.3 intend to enter into a Joint Venture Agreement

AND WHEREAS KMDA invited bids as per the above mentioned Specification to design and build Sewerage Network and all Appurtenant Structures and Allied Works of Complete Works stipulated in the bidding documents.

AND WHEREAS ITB and Annexure A Part g Qualification Criteria forming part of the bidding documents, inter-alia, stipulates that two or more qualified partners, meeting the requirements of 'Qualification Requirement of the Bidder', as applicable may bid, provided, they submit a Letter of Intent to enter into Joint Venture Agreement and the Joint Venture Partners fulfill all other requirements under ITB 'Qualification of the Bidder' and in such a case, the Letter of Bid (Bid Form) shall be signed by the Partner - In Charge so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract by entering into Joint Venture Agreement as per proforma submitted with the Bid which will be legally binding on all partners and all obligations hereunder.

The above clause further states that this Letter of Intent shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

AND WHEREAS the bid is being submitted to KMDA vide proposal No……..dated…… by Party No.1 based on this letter of Intent between all the parties; under these presents and the bid has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreement all the parties of this letter of Intent do hereby declare and undertake:

1. In requirement of the award of the Contract by KMDA to the Joint Venture Partners, we, the Parties do here by undertake that M/s..... the PartyNo.1, shall act as lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto KMDA for the successful performance of the Contract and shall be fully responsible for the design and build Sewerage Network and all Appurtenant Structures and Allied Works of Complete Works accordance with the Contract for which we shall enter into Joint Venture Agreement as per proforma submitted with the Bid which will be legally binding on all partners:

2. If the Contract is awarded to Joint Venture then in case of any breach or de fault of the said Contract by any of the parties to the Joint Venture, the party(s) will be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

3. Further, if KMDA suffers any loss or damage on account of any breach in the Contract or any short fall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents will promptly make good such loss or damages caused to KMDA, on its demand without any demur. It shall not be necessary or obligatory for KMDA to proceed against lead Partner to the represents before proceeding against or dealing with the other Party(s), KMDA can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to KMDA.

4. The financial liability of the Parties of the Deed of Undertaking to KMDA in the event of award of Contract on the Joint Venture, with respect to any of the claims a rising out of the performance or non-performance of the obligations set for thin the Deed of Undertaking, read in conjunction with there levant conditions of the Contract shall, however not be limited in anyway so as to restrictor limit the liabilities or obligations of any of the Parties of the Deed of Undertaking.

5. It is expressly understood and agreed between the Parties to this Letter of Intent that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix-I (to be suitably appended by the Parties along with this Letter of Intent in its bid). It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract in the even to faward on Joint Venture.

6. It is also understood that this Letter of Intent is provided for the purposes of undertaking joint and

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Letter of Intent shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Letter of Intent or on the Joint Venture, other than the express provisions of the Contract.

7. This Letter of Intent shall be construed and interpreted in accordance with the provisions of the Contract.
8. In case of an award of a Contract, we the parties to this Letter of Intent do hereby agree that we shall enter into Joint Venture Agreement as per proforma submitted with the Bid which will be legally binding on all partners and we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favor of KMDA in the currency/currencies of the Contract.

9. It is further agreed that this Letter of Intent shall be irrevocable and shall for man integral part of the bid. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Letter of Intent have through their authorized representatives executed these presents and affixed Common Seal so their companies, on the day, month and year first mentioned above.

For Lead Partner (PartyNo.-1) For and on behalf of M/s

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....

Name.....

Designation .....

Signature..... Signature of the authorized representative)

WITNESS:

I.....

II.....

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....

Name.....

For Party No.-2 For and on behalf of M/s

Designation .....

Signature..... Signature of the authorized representative)

WITNESS:

I.....

II.....

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....

Name.....

For Party No.-3 For and on behalf of M/s

Designation .....

Signature..... Signature of the authorized representative)

WITNESS:

I.....

II.....

Annexure A – Part j

FORM OF POWER OF ATTORNEY FOR JOINT VENTURE

(On Non-judicial Stamp Paper of Appropriate value, if required as per laws of the country of the bidder, to be purchased in the Name of Joint Venture)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder.....have formed a Joint Venture under the laws of .....(*)/ in to form a Joint Venture (*) [(*) delete whichever is not applicable] and having our Registered Office(s) / Head Office(s) at.....(hereinafter called the 'Joint Venture' which expression shall unless repugnant to the content or meaning thereof, include its successors, administrators and assigns) acting through M/s ..... being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of.....and having its Registered / Head Office at.....as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorized Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Joint Venture in regard to work for the bids for which have been invited by……..,……(hereinafter called KMDA 'KMDA') to undertake the following acts:

1. To sign and submit proposal and participate in the aforesaid Bid Specification of KMDA on behalf of the "Joint Venture".

ii) To negotiate with KMDA the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with KMDA for and on behalf of the "Joint Venture".

iii) To do any other actor submit any document related to the above.

iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

For the above purpose, the person(s) authorized by the Partner In-charge shall be the person(s) authorized to act on behalf of the "Joint Venture" as per the Power of Attorney given to him / her / them by the Partner In-Charge,

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

It is clearly understood that all the partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to fault by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Design Build as well as the Operations and Maintenance Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the what so ever the said Attorney / Authorized Representatives / Partner in-charge quotes in the bid, negotiates and signs the Contract with KMDA and / or proposes to act on behalf of the Joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this ……day of.....under the Common Seal(s) of their Companies.

For and on behalf of the
Partners of Joint Venture

The Common Seal of the above Partners of the Joint Venture:

The Common Seal has been affixed thereunto in the presence of: WITNESS

1. Signature.....

   Name..... Designation……

   Occupation……

2. Signature.....

   Name.....

   Designation…… Occupation……

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Annexure A – Part k

FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS

(On Non-Judicial Stamp Paper of Appropriate Value, if required as per laws of the country of the bidder, to be purchased in the Name of Joint Venture)

THIS JOINT DEED OF UNDERTAKING executed on this .....day of .....Two

Thousand and .....by ..... a company incorporated under the laws of ..... and having its Registered Office at..... (hereinafter called the "Party No. 1 which expression shall include its successors, executors and permitted assigns) and M/s ..... a company in corporate under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No. 2" which expression shall include its successors, executor sand permitted assigns) and M/s.....a Company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No. 3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering in to a contract [hereinafter called the "Contract" (in case of award) against the work to design and build Sewerage Network and all Appurtenant Structures and Allied Works of Complete Works associated with ……(hereinafter called the "KMDA").

WHERE AS the Party No. 1, Party No. 2 and Party No. 3 have entered in to an Agreement dated.....

AND WHERE AS KMDA invited bids as per the above mentioned Specification to design and build Sewerage Network and all Appurtenant Structures and Allied Works of Complete Works stipulated in the bidding documents.

AND WHERE AS ITB and Annexure A Part g Qualification Criteria forming part of the bidding documents, inter-alia, stipulate that an undertaking of two or more qualified partners, meeting the requirements of 'Qualification Criteria of the Bidder', as applicable may bid, provided, the Joint Venture fulfills all other requirements 'Qualification of the Bidder 'and in such a case, the Letter of Bid (Bid Form) shall be signed by the Partner- In Charge so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

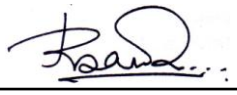
The above clause further states that this Undertaking shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to KMDA vide proposal No.....dated..... by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of ITB and Annexure A Part g Qualification Criteria, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

1. In requirement of the award of the Contract by KMDA to the Joint Venture Partners, we, the Parties do hereby undertake that M/s..... the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto KMDA for the successful performance of the Contract and shall be fully responsible to design and build Sewerage Network and all Appurtenant Structures and Allied Works Complete Works in accordance with the Contract.
2. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the parties do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if KMDA suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents undertake to promptly make good such loss or damages caused to KMDA, on its demand without any demur. It shall not be necessary or obligatory for KMDA to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), KMDA can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to KMDA.
4. The financial liability of the Parties of this Deed of Undertaking to KMDA, with respect to any of the claims arising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.
5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix - I (to be suitably appended by the Parties along with this undertaking in its bid). It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.
6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.
7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.
8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of KMDA in the currency / currencies of the Contract.



Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall for man integral part of the bid and shall continue to been forceable till KMDA discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHERE OF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....

Name.....

Designation .....

Signature.....

For Lead Partner (PartyNo.-1) For and on behalf of M/s

Signature of the authorized representative)

For Party No. - 2

For and on behalf of M/s.....

WITNESS:

I.....

II.....

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....

Name.....

Designation .....

Signature.....

For Party No.-2 For and on behalf of M/s

Signature of the authorized representative)

WITNESS:

I.....

II.....

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Common Seal of ..... has been affixed in my/ our presence pursuant to Board of Director's Resolution dated .....
Name.....

For Party No.-3 For and on behalf of M/s

Designation .....

Signature..... Signature of the authorized representative)

WITNESS:

I.....

II.....

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Government of West Bengal
Kolkata Metropolitan Development Authority

Agreement No.

For A Contract

DESIGN AND BUILD NEW UNDERGROUND SEWERAGE NETWORK OF ABOUT 44 KM. LENGTH INCLUDING SURVEY AND CONSTRUCTION OF 4 NOS. PUMPING STATIONS INCLUDING ALL APPURTENANT STRUCTURES & ALLIED WORKS IN KHARDAH MUNICIPAL TOWN, WEST BENGAL UNDER AMRUT.

NIT No.: KMDA/GAP/SE(N)/NIT-7/16-17 Dated 9/1/17

Superintending Engineer, North Circle, GAP Sector, KMDA,
Unnayan Bhawan, Block 'D', 1st Floor, Kolkata - 700091.
West Bengal, India.
Phone No.: +91 2337 1483
Email: kmdagap@gmail.com.
Project Website: http://wbtenders.gov.in and http://kmdaonline.org

For A Contract

DESIGN AND BUILD NEW UNDERGROUND SEWERAGE NETWORK OF ABOUT 44 KM. LENGTH INCLUDING SURVEY AND CONSTRUCTION OF 4 NOS. PUMPING STATIONS INCLUDING ALL APPURTENANT STRUCTURES & ALLIED WORKS IN KHARDAH MUNICIPAL TOWN, WEST BENGAL UNDER AMRUT.

FORM OF CONTRACT

THIS CONTRACT is made and entered into this ____ day of _____, *[Year]*

Between

Kolkata Metropolitan Development Authority_ under Government of West Bengal law and having its principal place of business at Kolkata.

(hereafter the "KMDA")

– and –

[Name of the Successful Bidder whether Joint Venture or the Individual entity] with its principal place of business at *[Address of the Contractor]*

(hereafter the "Contractor")

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

WHEREAS:

a. KMDA has the jurisdiction to enter into the Contract, as defined in Section 1.1 below, pursuant to the Applicable Law;

b. KMDA has received all requisite approvals necessary and has conformed with all requisite laws in accordance with the Applicable Law to permit the KMDA to enter into the Contract;

c. KMDA desires to engage the Contractor to Design and Build New Underground Sewerage Network of about 44 Km. Length including Survey and Construction of 1 No. existing Sewage Pumping Station and 3 Nos. Underground Pumping Stations including all Appurtenant Structures & Allied Works in Khardah Municipal Town, West Bengal under AMRUT and ensure the effectiveness and sustainability of the said facility;

d. The Contractor has represented to KMDA that it has the skills and ability to Design and Build New Underground Sewerage Network of about 44 Km. Length including Survey and Construction of 1 No. existing Sewage Pumping Station and 3 Nos. Underground Pumping Stations including all Appurtenant Structures & Allied Works in Khardah Municipal Town, West Bengal under AMRUT and ensure the effectiveness and sustainability of the said facility in an economical and effective manner and agrees to do so upon and subject to the terms and conditions of the Contract Documents;

e. The Contractor responded to the Bidding Documents dated…….. organized by KMDA and was selected as the recommended Contractor to fulfill the Design-Build and Operating Services set out in the Technical Standards Schedule;

f. The Contractor has the corporate capacity and authority to enter into the Contract;
NOW THEREFORE, in consideration of the mutual covenants and Agreements hereinafter set forth, KMDA and the Contractor agree as follows:

ARTICLE 1. CONTRACT DOCUMENTS

1.1. Contract Documents

This Contract to Design and Build New Underground Sewerage Network of about 44 Km. Length including Survey and Construction of 1 No. existing Sewage Pumping Station and 3 Nos. Underground Pumping Stations including all Appurtenant Structures & Allied Works in Khardah Municipal Town, West Bengal under AMRUT. Between KMDA and the Contractor (the "Contract") consists of the following documents (collectively, the "Contract Documents"), and each of the following shall be read and construed as an integral part of the Contract:

a. Form of Contract
b. Letter of Acceptance
c. Corrigenda Nos. ___
d. Minutes of Pre bid conference dated _____
e. Special Conditions of Contract (Schedule 1 to GCC)
f. General Conditions of Contract
g. Schedule "2" – Design Build Services ("the Design Build Services Schedule")
h. Schedule "3" – Description of Site and Service Area
i. Schedule "4" – Price Schedule
j. Schedule "5" – Terms and Procedure of Payment
k. Schedule "6" - Schedule of Performance Guarantee & Advance Payment Guarantee
l. Schedule "7" – Technical Specifications for construction
m. Schedule "8" – KMDA form No. I

1.2. Order of Precedence

a. In the event of any ambiguity or conflict between the Contract Documents listed in Section 1.1 of this Form of Contract, the order of precedence shall be the order in which the Contract Documents are listed in this Form of Contract.

b. Notwithstanding of this Form of Contract and any other term or condition in the Contract Documents, if any statement or provision in Contractor's Bid incorporated in the Contract is not consistent with or conflicts with any other term or condition in the remainder of the Contract Documents, the remainder of the Contract Documents shall govern.

1.3. Definitions

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions of Contract and various Schedules attached to the Contract.

ARTICLE 2. CONTRACTOR'S COMPENSATION AND TERMS OF PAYMENT

2.1. Contractor's Compensation

KMDA hereby agrees to pay to the Contractor the Contract Price, in consideration of the performance by the Contractor of its obligations hereunder, and the Contract Price is specified in Schedule 4 of the contract (Price Schedule).

2.2. Terms of Payment

The terms and procedures of payment by which KMDA will compensate the Contractor are set out in the General Conditions of the Contract.

ARTICLE 3. EFFECTIVE DATE AND STARTING DATES

3.1. Effective Date and Starting Date

The Effective Date, the Design-Build Starting Date and Operations Starting Date for the Contract shall be determined in accordance with the General Conditions of the Contract.

IN WITNESS WHERE OF KMDA and the Contractor have caused this Form of Contract to be duly executed by their duly authorized representatives.

EXECUTED as of the date first written above.

[KMDA]

By: _____

Name: _____

Title: _____

Witness: _____

[The Contractor]

By: _____

Name: _____

Title: _____

Witness: _____

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

GENERAL CONDITIONS OF CONTRACT

ARTICLE 1. CONTRACT AND INTERPRETATION

1.1. Definitions

Unless the context otherwise requires, the following terms wherever used in this Contract have the following meanings:

"Applicable Law" means the laws and any other instruments having the force of law in the Country specified in the SCC, as they may be issued and in force from time to time, including any decree of government;

"Appointing Authority" is the authority specified in the SCC;

"As built drawings" means completion drawing after executing the work

"Authorities" means KMDA, ULB and the Country as specified in the SCC;

"Background Information Document" means the Background Information Document provided to the Contractor by KMDA during the bidding process that preceded this Contract;

"Bidding Documents" means the documents issued by KMDA in respect of the bidding process for the selection of an Contractor to Design and build the Project Facility and to execute the work;

"Change" is defined in GC Section;

"Client" means the Party named as KMDA in the Form of Contract;

"Change Order" is defined in GC Section;

"Completion" means that the Project Facility and all Design-Build Services have been completed operationally and structurally and put in a tight and clean condition in accordance with the Technical Standards Schedule, and the Contractor is entitled to have a Operational Acceptance Certificate issued in respect of the Project Facility, or part thereof, in accordance with Design-Build Services Schedule;

"Contract" means the agreement between KMDA and the Contractor which consists of the Contract Documents;

"Contract Documents" means the Form of Contract, General Conditions, and all appendices to the General Conditions as set out in GC Section;

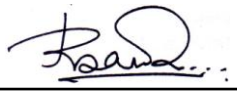
"Contract Price" is defined in Section of the Form of Contract;

"Contract Records" is defined in GC Section;

"Contractor" means the Network Contractor retained by KMDA to carry out the Services and is the Party named as the Contractor in the Form of Contract;

"Contractor's Equipment (Design-Build)" means all machinery, apparatus, vehicles and other equipment required for the execution and completion of the Design-Build Services and the remedying of any defects, but does not include material, machinery, apparatus and other equipment forming part of the Plant and Equipment of the Project Facility;

"Contractor's Equipment (Operations)" means all things of any kind whatsoever, including the equipment, materials, supplies, vehicles and consumables required to operate, maintain and repair the Site and Project Facility;
"Contractor's Personnel" is defined in GC Section;
"Contractor's Representative" is defined in GC Section;
"Contract Term" means the term of the Contract, including any renewals approved by the KMDA, commencing on the Effective Date and continuing to, and including, the End Date;
"Costs" means all expenditures reasonably incurred, or to be incurred, by the Contractor including overhead but excluding profit;
"Data Room" means the data room which may be established by KMDA in the bidding process as set out in the Bidding Documents;
"DBSS Section" means Design-Build Services Schedule Section;
"Design-Build Documents" means the plans, specifications, designs, models, electronic models and other documents and materials relating to the design and construction of the Site and Project Facility as may be set out or contemplated in the Design-Build Services Schedule or agreed to by the Parties from time to time during the Contract Term;
"Design-Build Period" is defined in GC Section;
"Design-Build Services" means the Design-build services to be performed by the Contractor as contemplated by the General Conditions and the Design-Build Services Schedule;
"Design-Build Starting Date" is defined in GC Section;
"Discharge Point" means at MPS;
"Engineer-in-Charge" means the Consultant or KMDA's representative i.e. Engineer-in-Charge retained by KMDA to supervise the Contractor, in accordance with the Contract Documents, in carrying out the Design-Build and Operations Services;
"Effective Date" means the date on which this Contract comes into force and effect pursuant to GC Section;
"End Date" is defined in GC Section;
'Environmental Management Plan (EMP)' – A set of mitigation measures to be implemented by the Contractor;
"Existing Sewerage Network" shall mean the existing Sewerage Network in location specified in SCC and of length indicated in SCC that is included in the scope of work for repair and refurbishment / integration with proposed network as a part of the Contract.
"Extension Date" is defined in GC Section;
"Force Majeure" is defined in GC Section;
"GC Section" means General Conditions of Contract Section;
"including" means including without limitation and "includes" means includes without limitation, unless expressly stated otherwise;
"KMDA" means the Party named as KMDA in the Form of Contract;
"KMDA's Representative" is defined in GC Section;
"Liquidated Damages – Delay" is defined in GC Section;
"Manager" is defined in GC Section;



"New Sewerage Network" shall mean the new Sewerage Network in Khardah Municipal Town of approximately 44 Km length including Sewage Pumping Station(s) of specified capacity and all appurtenant structures which shall be designed and built by the Contractor as a part of the Contract.

"Operations Period" is defined in GC Section;

"Operational Acceptance Certificate" means a certificate issued by the Engineer-in-Charge in accordance with Design-Build Services Schedule;

"Operations Starting Date" is defined in GC Section;

"Operational Acceptance" means the acceptance by KMDA of the Project Facility, or part thereof, in accordance with DBSS Section;

"Party" means the client or the Contractor, as the case may be, and "Parties" means both of them;

"Performance Security" is defined in GC Section;

"Plant and Equipment" means the permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and intended to permanently form or forming part of the Project Facility;

"Project Facility" means the Sewerage Network and Pumping Stations Designed, Built, refurbished, by the Contractor pursuant to this Contract;

"Services" means the Design-Build Services to be performed by the Contractor as set out in the General Conditions and the Appendices to the General Conditions;

"Sewage" or "Wastewater" means the night soil and other discharges from water closets, latrines, privy, urinals, cesspools or drains and polluted water from sinks, bathroom, stables, cattle sheds and other like places and includes domestic sewage and wastewater effluents and discharges from manufacturers of all kinds;

"Sewerage Network" shall mean the pipe line network laid for collecting the Sewage from consumer connections including 'nallaha', main, trunk, secondary lines from the individual take over points of the Consumers up to the Sewage Treatment Plant and including Sewage pumping stations and all appurtenant structures forming a part of both the New Sewerage Network and the Existing Sewerage Network;

"Site" means the physical area as set out in the Site Schedule identified for the location of the Project Facility;

"Site Information" is defined in GC Section;

"Submission Deadline" means the last date for the submission of bids, as stated in the Bidding Documents;

"Subsequent Contractor" means the Contractor that is to assume the provision of the works upon termination or completion of the Contract and may include one of the Authorities;

Superintending Engineer means KMDA's representative;

"Taxes" is defined in GC Section;

"Technical Standards" is defined in the Technical Standards Schedule;

"Tests on Completion" means those tests set out in Attachment 1 to the Technical Standards Schedule as conducted pursuant to DBSS Section;

"Testing, Trial and Commissioning Period" shall have the meaning as defined in Special Conditions of Contract, Schedule 1;
"Third Party" means any person or entity other than the Parties;
"Threshold Sewage Flow Rate" means the expected level of sewage flow available for treatment immediately on completion of the STP facility.
"Time for Completion" is defined in GC Section;
"Time Schedule" is defined in GC Section;
"Transition Assistance" is defined in GC Section;
"TSS Section" means Technical Standards Schedule Section;
"Unforeseeable" means not reasonably foreseeable on the Submission Deadline by an experienced Contractor that conducted or should have conducted the inspections and examinations or who knew or should have known the information described in GC Section; and
"War Risks" is defined in GC Section.

1.2. Contract Documents

Subject to the Form of Contract provisions, all documents forming part of the Contract, and all parts thereof, are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole. The following schedules which are incorporated by reference into the Contract shall be referred to as follows:
Schedule "1" – Special Conditions of Contract (the "SCC")
Schedule "2" – Design Build Services ("the Design Build Services Schedule")
Schedule "3" – Description of Site and Service Area
Schedule "4" – Price Schedule
Schedule "5" – Terms and Procedure of Payment
Schedule "6 - Schedule of Performance Guarantee & Advance Payment Guarantee
Schedule "7" – Technical Specifications for Construction
Schedule "8" – KMDA Form No. I

1.3. Interpretation

1.3.1. Language

(1) All Contract Documents, all correspondence and communications to be given, and all other documentation to be prepared and supplied under the Contract shall be written in the language specified in the SCC and the Contract shall be construed and interpreted in accordance with that language.

(2) If any of the Contract Documents, correspondence or communications are prepared in any language other than the governing language under GC Section, the translation of such documents, correspondence or communications into the governing language shall prevail in matters of interpretation.

1.3.2. Singular or Plural

The singular shall include the plural and the plural shall include the singular except where the context otherwise requires.

1.3.3. Headings

The headings in the Contract Documents are included for ease of reference and shall neither constitute a part of the Contract nor affect its interpretation.

1.3.4. Persons

Words importing persons or entities shall include firms, corporations and government entities.

1.3.5. Entire Agreement

This Contract constitutes the entire agreement between KMDA and the Contractor with respect to the subject matter of the Contract and supersedes all communications, negotiations and agreements, whether written or oral, made by the Parties with respect thereto made prior to the date of the Contract.

1.3.6. Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract and is signed by a duly authorised representative of each Party to the Contract.

1.3.7. Number of Days

Except as expressly stated to the contrary elsewhere herein, in computing the number of days for the purposes of the Contract all days shall be counted, including Saturdays, Sundays and legal holidays, provided, however, that if the final day of any period shall fall on a Saturday, Sunday, or legal holiday, then the final day shall be deemed to be the next day which is not a Saturday, Sunday or legal holiday.

1.3.8. Independent Contractor

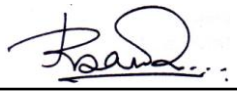
(1) The Contractor shall be an independent Contractor in its performance of the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between KMDA and the Contractor or its Shareholders.

(2) Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, agents, representatives or Sub-contractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of KMDA, and nothing contained in the Contract, or in any Subcontract awarded by the Contractor, shall be construed to create any contractual relationship or legal obligation between the Contractor's employees, agents, representatives or Sub-contractors and KMDA.

1.3.9. Joint Venture

(1) If the Contractor consists of a joint venture of more than one person, all the Partners hereby authorize the representative named in the SCC to act on their behalf in exercising all the Partner's and Contractor's rights and obligations toward KMDA under this Contract, including the receiving of approvals, consents, orders, certificates, instructions and payments from KMDA, amendment of the Contract and in all other matters under the Contract, including the settlement of disputes.

(2) If the Contractor is a joint venture of two or more Partners, each Partner of the joint venture, shall be jointly and severally bound to the KMDA for the fulfillment of the provisions of the Contract by the Contractor.



(3) The composition, control or constitution of the Contractor shall be in accordance with the Contractor's Bid and shall not be altered without the prior consent of KMDA.

1.3.10. Non-waiver

(1) Subject to GC Section, no relaxation, waiver, forbearance, delay or indulgence by either Party in enforcing any of the terms and conditions of the Contract or the granting of time by either Party to the other shall prejudice, affect or restrict the rights of that Party under the Contract, nor shall any waiver by either Party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

(2) To be a valid waiver, any waiver of a Party's rights, powers or remedies under the Contract shall,

(a) be in writing;

(b) be dated and signed by KMDA's or Contractor's Representative, whichever is granting such waiver; and

(c) specify the right, power or remedy being waived and the extent to which it is being waived.

1.3.11. Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

1.3.12. Survival of Obligations

Upon the termination or expiration of the Contract pursuant to the Contract, all rights and obligations of the contractor hereunder shall cease, except those noted in the SCC.

1.4. Notice

(1) All notices to be given under the Contract shall be in writing and shall be sent by personal delivery, courier or facsimile to the address for notice of the relevant Party as set out in the SCC and the following provisions apply:

(a) Any notice sent by facsimile shall be confirmed by the sender no later than two days after dispatch by a notice sent by courier;

(b) Any notice sent by courier shall be deemed to have been delivered 10 days after dispatch. In proving the fact of dispatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, with proper payment for the courier, and conveyed to the courier service for transmission; and

(c) Any notice delivered personally or sent by facsimile shall be deemed to have been delivered on the date of dispatch.

(2) A Party may change its address for notice pursuant to this Contract by giving the other Party notice of change in accordance with this GCC Section.

(3) The Contractor's address for the purpose of giving notice pursuant to this GC Section shall be named in the SCC.

(4) Notices shall be deemed to include any approvals, consents, instructions, orders, certificates and similar communications to be given under the Contract.

1.5. Governing Law

This Contract, its meaning and interpretation, and the relation between the Parties shall be governed by the Applicable Law.

1.6. Assignment

(1) The Contractor shall not assign to any Third Party the Contract, or any part thereof, or any right, benefit, obligation or interest therein or thereunder without the prior consent of KMDA, which consent may not be unreasonably withheld.

(2) The Contractor may assign, absolutely or by way of charge, any monies due and payable to it or that may become due and payable to it under the Contract.

(3) To be a valid assignment which has been approved by KMDA pursuant to GC Section, the assignment must,

(a) be in writing;

(b) be dated and signed by KMDA's Representative; and

(c) state the specific details of the assignment.

1.7. Contract Records, Accounting and Auditing

1.7.1. Contract Records

(1) Except as provided in GC Section, all data, information, documentation, account, plans, programs, reports, surveys and guidelines of any kind whatsoever (the "Contract Records") prepared by the Contractor in performing the Services shall become and remain the property of KMDA and the Contractor shall deliver all Contract Records and a detailed inventory of those Contract Records to KMDA no later than the date of termination or expiration of the Contract, except in respect of such Contract Records that are required to be delivered at an earlier date.

(2) The Contract Records shall include,

(a) information of any kind whatsoever related to the finances, revenues or expenditures of KMDA's operations;

(b) all files, documents, plans, drawings, specifications, notes, minutes of meetings and minutes of conversations;

(c) all the plans, programs, reports, surveys and guidelines prepared by the Contractor in carrying out the Operations Services;

(d) all manuals, reports, condition surveys, safety records, audit records, inventories, laboratory test results, procurement records, customer information, financial information, financial statements, invoices, accounting records, subcontracts and personnel records; and

(e) the Design-Build Documents, whether stored in hard copy or electronically.

(3) The Contractor shall provide KMDA with unrestricted access to the Contract Records during the term of the Contract, including the right to make and retain copies.

(4) The Contractor may retain a copy of the Contract Records but shall not use them for purposes unrelated to this Contract without the prior approval of KMDA. This GC Section does not in any way relieve the Contractor of its obligation of confidentiality pursuant to GC Section.

(5) Except as provided in GC Section, the Contractor acknowledges that KMDA, as KMDA of the Contract Records, may deal with the Contract Records in any way it determines, including making the Contract Records publicly available and making them available to prospective Bidders who may be involved in the process to select a Subsequent Contractor.

1.7.2. Accounting

The Contractor shall keep accurate and systematic accounts in respect of the Services and the Contract.

1.7.3. Auditing the Contractor's Own Accounts and the Contract Records

(1) KMDA may, in its sole discretion, audit,

(a) the Contractor's own accounts, financial information, financial statements and technical information at any reasonable time and with 24 hours' notice to the Contractor; and

(b) the Contract Records and Design-Build Documents at any reasonable time and without notice to the Contractor,

(c) in respect of any matters related to the Contract.

(2) KMDA may complete the audit or audits itself or may retain an independent auditor, at KMDA's expense, to complete the audit or audits.

1.7.4. Contractor's Audited Accounts

The Contractor shall submit to KMDA, no later than 90 days after the end of the Contractor's fiscal year, the annual audited accounts of its own finances for each of the Contractor's fiscal years that occur during the Contract Term.

1.8. Contractor's Claims during the Design-Build Period

(1) If the Contractor considers itself to be entitled to any extension of the Time for Completion or any additional payment, under any section related to the Design-Build Services of these General Conditions, the Contractor shall give notice to the Engineer-in-Charge, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and no later than 30 days, after the Contractor became aware, or should have become aware, of the event or circumstance.

(2) If the Contractor fails to give notice of a claim within such period of 30 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and KMDA shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this GC Section shall apply.

(3) The Contractor shall also submit any other notices related to the Design-Build Services which are required by the Contract, and supporting particulars for the claim, that are relevant to such event or circumstance.

(4) The Contractor shall keep such contemporary records as may be necessary to substantiate any claim related to the Design-Build Services, either on the Site or at another location acceptable to the Engineer-in-Charge. Without admitting KMDA's liability, the Engineer-in-Charge may, after receiving any notice under this GC Section, monitor the record-keeping or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer-in-Charge to inspect all these records, and shall, if instructed, submit copies to the Engineer-in-Charge.

(5) No later than 42 days after the Contractor became aware, or should have become aware, of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer-in-Charge, the Contractor shall send to the Engineer-in-Charge a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect,

(a) this fully detailed claim shall be considered as interim;

(b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay or amount claimed, and such further particulars as the Engineer-in-Charge may reasonable require; and

(c) the Contractor shall send a final claim no later than 30 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer-in-Charge.

(6) No later than 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer-in-Charge and approved by the Contractor, the Engineer-in-Charge shall respond with approval, or with disapproval and detailed comments. The Engineer-in-Charge may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time.

(7) Each invoice sent by the Contractor shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as it has been able to substantiate.

(8) The Contractor shall proceed in accordance with GC Section to request,

(a) an extension, if any, of the Time for Completion before or after its expiry in accordance with GC Section; or

(b) an additional payment, if any, to which the Contractor believes it is entitled under the Contract.

(9) The requirements of this GC Section are in addition to those of any other provision which may apply to a claim. If the Contractor fails to comply with this or another provision in relation to any claim, any extension of or additional payment shall take account of the extent, if any, to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under GC Section.

(10) This GC Section shall apply only in respect of the Design-Build Services excluding the Existing Operations Services.

ARTICLE 2. CONTRACT TERM, TIMING AND COMPLETION

2.1. General

2.1.1. Effectiveness of Contract

The Form of Contract shall be signed by the Contractor, and all partners, if the Contractor is a joint venture company, prior to its signing by KMDA. The Contract shall come into force and effect on the date the Form of Contract is signed by KMDA (the "Effective Date").

2.1.2. Expiration of Contract

This Contract shall terminate on either,

(1) the specified number of months after the Operations Starting Date named in the SCC;

(2) the Extension Date pursuant to GC Section; or

(3) the date of Contract termination pursuant to GC Section,

(the "End Date"), whichever is applicable.

2.1.3. Commencement of Services

(1) Unless otherwise stated in the SCC, the Design-Build Starting Date shall be no later than 30 days after the Effective Date and KMDA shall give the Contractor at least seven days prior notice of the Design-Build Starting Date.

(2) The "Operations Starting Date" shall be the date of the Operational Acceptance Certificate.

2.2. Design-Build Period

the period commencing on the Effective Date and ending on the day immediately prior to the Operations Starting Date (the "Design-Build Period"); and

2.3. Design-Build Period – Commencement, Delays and Suspension

2.3.1. Commencement of the Design-Build Services

The Design-Build Starting Date, and shall then proceed with the Design-Build Services with due expedition and without delay.

2.3.2. Time for Completion

The Contractor shall complete the whole of the Design-Build Services in accordance with the time for completion set out in the SCC ("Time for Completion") for the Design-Build Services including,

(a) successfully completing the Tests on Commissioning; and

(b) completing all of the Design-Build Services such that the completed Project Facility can be used as a fully operational Project Facility in accordance with the Contract.

2.3.3. Design-Build Time Schedule

(1) The Contractor shall submit a detailed time programme (the "Time Schedule") to the Engineer-in-Charge no later than 30 days after the Design-Build Starting Date. The Contractor shall also submit a revised Time Schedule whenever the previous Time Schedule is inconsistent with actual progress or with the Contractor's obligations. Each Time Schedule shall include a description of,

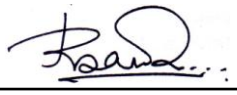
(a) the order in which the Contractor intends to carry out the Design-Build Services, including the anticipated timing of each stage of Design, Design-Build Documents, procurement, manufacture, inspection, delivery to the Site, construction, erection, testing and commissioning;

(b) the periods for review and any other submissions, approvals and consents specified in the Contract;

(c) the sequence and timing of inspections and tests specified in the Contract;

(d) the scheduled Time for Completion, the planned Time for Completion and the planned Operations Starting Date;

(e) all major events and activities in the production of Design-Build Documents; and



(f) all major phases and milestones of the Design-Build Services.

(2) The Engineer-in-Charge shall review each Time Schedule and provide comments to the Contractor as to whether the Time Schedule complies with the Contract. The Contractor shall be entitled to rely upon the Time Schedule when planning its activities.

(3) The Contractor shall promptly give notice to the Engineer-in-Charge of specific probable future events or circumstances which may adversely affect the Design-Build Services or delay the execution of the Design-Build Services. The Engineer-in-Charge may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, or a proposal under GC Section.

(4) If, at any time, the Engineer-in-Charge gives notice to the Contractor that a Time Schedule fails, to the extent stated, to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised Time Schedule to the Engineer-in-Charge in accordance with this GC Section.

2.3.4. Extension of the Time for Completion

(1) The Time for Completion shall be extended if the Contractor is delayed or impeded in the performance of the Design-Build Services by reason of any of the following:

(a) a Change, unless the Parties have already agreed to an adjustment to the Time for Completion as part of the applicable Change;

(b) an occurrence of Force Majeure as provided in GC Section, Unforeseeable physical conditions as provided for in GC Section, or loss or damage as a result of the occurrences set out in GC Section;

(c) any suspension order given by KMDA pursuant to GC Section;

(d) any change in the Applicable Law in accordance with GC Section;

(e) any default or breach of the Contract by KMDA or any activity, act or omission of any other Contractors employed by KMDA; or

(f) any other matter specifically mentioned in the Contract.

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the actual delay or impediment sustained by the Contractor.

(2) The Contractor shall submit, to the Engineer-in-Charge, any notice of a claim for an extension of the Time for Completion in accordance with GC Section.

(3) The Contractor shall, at all times, use reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

2.3.5. Rate of Progress

(1) If, at any time, the Contractor's progress in respect of the Design-Build Services,

(a) is too slow to complete the Design-Build Services in accordance with the Time for Completion; or

(b) has fallen, or will fall, behind the current Time Schedule

other than as a result of a cause listed in GC Section, then the Engineer-in-Charge may instruct the Contractor to submit a revised Time Schedule and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete the Design-Build Services.

(2) Unless the Engineer-in-Charge notifies otherwise, the Contractor shall adopt the revised methods referred to in GC Section, which may require increases in,

(a) the working hours or in the numbers of Contractor's Personnel, or both; or

(b) Plant and Equipment,

at the risk and cost of the Contractor. If these revised methods cause KMDA to incur additional costs, the Contractor shall, subject to GC Section, pay these costs to KMDA, in addition to delay damages, if any, under GC Section.

2.3.6. Delay of Completion – Liquidated Damages - Delay

(1) The Contractor guarantees that it shall attain Completion of the Project Facility in accordance with the Time for Completion specified in the SCC and GC Section or in accordance with an extension of the Time for Completion granted to the Contractor in accordance with GC Section.

(2) If the Contractor fails to attain Completion of the Project Facility within the Time for Completion, or any extension thereof in accordance with GC Section, the Contractor shall pay to KMDA liquidated damages in the amount specified in the SCC ("Liquidated Damages-Delay").The aggregate amount of Liquidated Damages - Delay shall in no event exceed the amount specified as "Maximum" in the SCC. KMDA may terminate the Contract pursuant to GC Section if the Contractor reaches the "Maximum" level for Liquidated Damages – Delay.

(3) The payment or payments by the Contractor of Liquidated Damages – Delay shall completely satisfy the Contractor's obligation to attain Completion of the Project Facility within the Time for Completion or any extension thereof pursuant to GC Section.

(4) The payment or payments by the Contractor of Liquidated Damages – Delay shall not in any way relieve the Contractor of its obligations to complete the Project Facility or any other obligations and liabilities of the Contractor under the Contract.

2.3.7. Services after the End Date

The Contractor, upon written request by KMDA no later than 60 days prior to the End Date, shall provide assistance to KMDA, at no cost to KMDA, during a transitional period of up to 60 days after the End Date (the "Transition Assistance"). The purpose of the Transition Assistance is to ensure a smooth transition between the Contractor and a Subsequent Contractor of the Project Facility. The Transition Assistance shall be related to only transition services.

ARTICLE 3. OBLIGATIONS OF THE CONTRACTOR

3.1. General – Services and Standards of Performance

The Contractor shall,

(a) perform the Design-Build Services set out in the Design-Build Services Schedule;

(b) perform the Services in accordance with the Technical Standards set out in the Technical Standards Schedule,

3.2. Law Governing Services

The Contractor shall comply with the Applicable Law and shall ensure that the Contractor's Personnel comply with the Applicable Law. The Contractor shall indemnify and hold harmless KMDA from and against any and all liabilities, damages, claims, fines, penalties and expenses of

whatever nature arising or resulting from violation of the Applicable Law by the Contractor, the Contractor's Personnel.

3.3. Conflict of Interest

(1) The compensation of the Contractor pursuant to GC Article shall constitute the Contractor's sole compensation in connection with this Contract and, except as provided in GC Article, the Contractor shall not accept for its own benefit any trade commission, discount or similar payment in connection with activities pursuant to this Contract or in the discharge of its obligations hereunder, and the Contractor shall use its best efforts to ensure that the Contractor's Personnel similarly shall not receive any such additional remuneration.

(2) The Contractor, and any entity affiliated with the Contractor or the shall be disqualified, during the Contract Term from providing goods, works or services, other than the Services, with respect to,

(a) the goods, works and services purchased from the Contingency Fund; and

(b) the Capital Investment Program.

(3) The Contractor, Contractor's Personnel, and the employees and either directly or indirectly, in any business or professional activities which would conflict with the activities assigned to them under this Contract.

(4) The Contractor and its Shareholders shall not participate in any discussions or work and shall not provide any services or advice to KMDA related to,

(a) the development or review of bidding documents to retain any Subsequent Contractor; or

(b) the preparations for the procurement process to retain any Subsequent Contractor.

(5) Failure of the Contractor or the Shareholders to comply with this GC Section, in addition to constituting a breach of this Contract, may result in the disqualification of the Contractor and the Shareholders from bidding in the procurement process to retain any Subsequent Contractor.

3.4. Plant and Equipment, Contractor's Equipment (Design-Build)

(1) Any Plant and Equipment, Contractor's Equipment (Design-Build) that will be incorporated in or be required for the Site and Project Facility or shall have their origin as specified under GC Section.

(2) The Contractor shall prepare a list of all Contractor's Equipment (Design-Build) and The Contractor shall update the Contractor's Equipment Lists on an annual basis and shall provide the updated Contractor's Equipment Lists to KMDA no later than 30 days after the end of each of the Contractor's fiscal years during the Contract Term.

3.5. Site Information and Investigation

(1) The Contractor acknowledges that KMDA made available to the Contractor, during the bidding process, either directly or by placing the data in the Data Room and Background Information Document, all available data on hydrological and sub-surface conditions of the Site, and studies on environmental impact that had been obtained by or on behalf of KMDA from investigations in

anticipation of the Design-Build Services (the "Site Information"). The Contractor shall be responsible for interpreting all data about the Site that is provided to it by KMDA.

(2) The Contractor shall be deemed to have inspected and examined the Site, its surroundings, the Site Information and other available information, and to have satisfied itself before entering into the Contract, as to,

(a) the form and nature of the Site, including the sub-surface conditions;

(b) the applicable hydrological, hydro-geological and climatic conditions;

(c) the extent and nature of the work, Plant and Equipment, Contractor's Equipment (Design-Build) and necessary for the execution and completion of the Services, and the remedying of any defects; and

(d) the Contractor's requirements for access to the Site, accommodation, personnel, power, transport, water and other services.

(3) The Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and all other circumstances that may influence or affect the performance of its obligations under the Contract.

(4) To the extent the Contractor did not make any of the interpretations, investigations or examinations, or did not satisfy itself, or did not obtain such information as called for in this GC Section, the Contractor represents and warrants that it is willing to assume and does hereby assume responsibility for any and all loss and damage from any cause whatsoever which the Contractor's interpretations, investigations, examinations and obtaining of information may have avoided and agrees to indemnify KMDA from all risk thereof and from conditions arising or developing in the course of performing the Services which may make the performance of the Services more onerous and more expensive to fulfill or perform than was contemplated on the Effective Date. Notwithstanding anything in the Contract to the contrary, the Contractor acknowledges and declares that in entering into the Contract it did not and does not rely upon any information or report provided by or on behalf of KMDA or its agents, representatives or employees.

3.6. Access to the Site and Project Facility

(1) The Contractor shall, during both the Design-Build Period provide free and open access to the Site and the Project Facility at KMDA's request. KMDA shall make reasonable efforts to provide reasonable notice to the Contractor prior to KMDA's access but such notice is not mandatory. KMDA's representative on the Site or at the Project Facility shall observe all safety and health regulations and reasonable instructions of the Contractor.

(2) The Contractor shall give all reasonable access to any other Contractors employed by KMDA on or near the Site to carry out their work.

(3) If the Contractor makes available to other Contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other Contractors of the Contractor's Equipment (Design-Build) or provides any other service of whatsoever nature for such other Contractors, KMDA shall fully compensate the Contractor for any loss or damage caused or occasioned by such other Contractors in respect of any such use or service, and shall pay to the

Contractor reasonable remuneration for the use of such equipment or the provision of such services.

(4) The Contractor shall also arrange to perform its work so as to minimize, to the extent possible, interference with the work of other Contractors. The Engineer-in-Charge shall determine the resolution of any difference or conflict that may arise between the Contractor and other Contractors and the workers of KMDA in regard to their work.

(5) The Contractor shall notify the Engineer-in-Charge, as applicable, promptly of any defects in the other Contractors' work that come to its notice, and that could affect the performance of the Services by the Contractor. The Engineer-in-Charge, as applicable, shall determine the corrective measures, if any, required to rectify the situation after inspection of the Site, the Network. Decisions made by the Engineer-in-Charge, as applicable, shall be binding on the Contractor.

ARTICLE 4. OBLIGATIONS OF KMDA

4.1 KMDA's Assistance to the Contractor

KMDA shall obtain consent from the respective Pollution Control Board / Authority and all other requisite clearances to establish and operate the Network unless the same have been obtained already.

KMDA shall use reasonable efforts to,

(a) provide the Contractor and Contractor's Personnel with work permits and such other documents as shall be necessary to enable the Contractor, or Contractor's Personnel to perform the Services; and

(b) issue to officials, agents and representatives of KMDA all such instructions as may be necessary or appropriate for the prompt and effective implementation of the Services.

4.2 Access to the Site and Project Facility

KMDA shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto and for providing possession and access to all other areas reasonably required for the proper execution of the Contract including all requisite rights of way. KMDA shall provide the Contractor, free of charge, full possession of the Site and the Project Facility during the term of the Contract.

4.3 Reviews and Approvals of Submissions

(i) Except as otherwise provided in the Contract, if the Contractor submits a plan, report or other documentation to KMDA in writing, and KMDA, or the Engineer-in-Charge, is required to approve that submission, the Engineer-in-Charge as applicable, shall review and either approve or provide written comment on the Contractor's submission no later than 3O days after the day of submission by the Contractor to the Engineer-in-Charge.

(ii) If the Engineer-in-Charge, as applicable, fails to approve or refuses to approve the Contractor's submission in accordance with GC Section, the Contractor shall notify KMDA in writing that it has not received a response to its submission.

If the Engineer-in-Charge, as applicable, fails to respond to the Contractor's written notification pursuant to GC Section within 3O days after the receipt by the Engineer-in-Charge, as applicable, of the Contractor's written notification, the Contractor's submission shall be deemed to be approved.

ARTICLE 5. CONTRACT PRICE AND PAYMENT

5.1 Contract Price

(1) The Contract Price shall be as specified in the Price Schedules offered by the Contractor and accepted by KMDA while awarding the Contract. These prices have been incorporated in Schedule 4 of the Contract.

(2) Subject to GC Section, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract, including all costs and expenses for the Design, Building and Successful Commissioning of the Project Facility in accordance with the provisions of this Contract.

(3) Unless indicted in the SCC, the contract price shall not be subject to any alteration except in the event of a change to the design build services in accordance with GC Section.

5.2 Terms of Payment

(1) The Contract Price shall be paid as specified in the SCC.

(2) No payment made by KMDA herein shall be deemed to constitute acceptance by KMDA of the Project Facility or any part thereof.

5.3 Performance Incentive Compensation

If KMDA intends to pay the Contractor performance incentive compensation, KMDA will pay such compensation at the end of the Operations Period and in accordance with the Performance Incentive Compensation Schedule.

5.4 Securities

5.4.1 Performance Security

(1) The Contractor shall provide a security for the Contractor's proper performance of the Contract to KMDA no later than the date specified in the Bidding Documents (the "Performance Security").

(2) The Performance Security shall be,

(a) in the amount specified in the SCC;

(b) shall be in the form specified in the Bidding Documents or in another form approved by KMDA.

(a) The Performance Security is a Bank Guarantee and shall be issued by any schedule bank.

(3) The Performance Security shall be valid until 180 days after the End Date, or any extension to the End Date.

(4) KMDA shall return the Performance Security no later than 14 days after its expiration.

(5) The cost of complying with this GC Section shall be borne by the Contractor.

5.4.2 Advance Payment Security

(1) The Contractor shall provide a security in an amount equal to the advance payment calculated in accordance with the Terms and Procedures of Payment Schedule

(2) The mobilization advance paid to the Contractor by KMDA shall be recovered commencing from the date on which the payment to the Contractor has reached 25% of the price schedule and shall be fully recovered by completion of 90% of the time for completing the works.

5.5 Taxes and Duties

Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges (the "Taxes") assessed on the Contractor, or their employees by all Municipal, State or National Government Authorities in connection with the works.

ARTICLE 6. COPYRIGHT : DESIGN-BUILD DOCUMENTS

6.1. Copyright – Design-Build Documents

(1) As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Design-Build Documents made by or on behalf of the Contractor.

(2) The Contractor shall be deemed, by signing the Contract, to give KMDA a non-terminable, transferable, non-exclusive, royalty-free licence to copy, use and communicate the Design Build Documents, including making and using modifications of them. This licence shall,

(a) apply throughout the actual or intended working life, whichever is longer, of the relevant parts of the Site or Project Facility;

(b) entitle any person in proper possession of the relevant part of the Site or Project Facility to copy, use and communicate the Design-Build Documents for the purposes of completing, managing, altering, adjusting, and repairing the Project Facility;

(c) in the case of Design-Build Documents which are in the form of computer programs and other software, permit their use on any computer on the Site or at the Project Facility and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor; and

(d) entitle KMDA to make the Design-Build Documents available for inspection by a prospective Bidder who may be involved in the process to select a Subsequent Contractor.

(3) KMDA shall not, without the Contractor's consent, use, copy or communicate the Design-Build Documents to a Third Party by, or on behalf of, KMDA for purposes other than those permitted under GC Section.

6.2. Confidentiality

(1) The Contractor shall keep confidential and shall not, without the written consent of KMDA, divulge to any Third Party any documents, data or other information arising directly or indirectly from the performance of Services under the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding this GC Section, the Contractor may furnish to such documents, data and other information to the extent required to perform their work under the Contract, in which event the Contractor shall obtain an undertaking of confidentiality similar to that imposed on the Contractor under this GC Section.

(2) The Contractor shall not use such documents, data and other information received from KMDA for any purpose other than the Services as are required for the performance of the Contract. The Contractor shall not publish, permit to be published, or disclose any particulars of the Services, Site or Project Facility in any trade or technical paper or advertising materials without the prior written consent of KMDA.

(3) The obligations of the Contractor under GC Sections, shall not apply to that information which,

(a) now or hereafter enters the public domain through no fault of the Contractor;

(b) can be proven to have been possessed by the Contractor at the time of disclosure and which was not previously obtained, directly or indirectly, from KMDA; or

(c) otherwise lawfully becomes available to the Contractor from a Third Party that has no obligation of confidentiality.

ARTICLE 7. CONTRACT ADMINISTRATION AND SUPERVISION DURING THE DESIGN-BUILD PERIODS

7.1. General

The Parties acknowledge that two separate approaches to contract administration and supervision will be in place during the Contract Term as follows:

(a) from the Effective Date until the Design-Build Supervision approach will be put in place by KMDA; and

7.2. Design-Build Supervision

7.2.1. Supervision during the Design-Build Period

GC Section shall apply only during the Design-Build Period.

7.2.2. Engineer-in-Charge's Duties and Authority (Design-Build Period)

(1) KMDA shall appoint the Engineer-in-Charge who shall be responsible for day to day contract management and supervision during the Design-Build Period. The Engineer-in-Charge's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

(2) The Engineer-in-Charge shall have no authority to amend the Contract.

(3) Except, as specifically provided otherwise in the Contract, the Engineer-in-Charge may exercise the authority attributable to the Engineer-in-Charge as specified in or necessarily to be implied from the Contract. KMDA undertakes not to impose further constraints on the Engineer-in-Charge's authority, except as agreed with the Contractor.

(4) If the Engineer-in-Charge is obligated to obtain the approval of KMDA before exercising a specific authority, these restrictions shall be set out in the SCC. If the Engineer-in-Charge exercises a specified authority for which KMDA's approval is required then, for the purposes of the Contract, KMDA shall be deemed to have given approval.

(5) Except as otherwise stated in the Contract,

(a) if the Engineer-in-Charge carries out duties or exercises authority, specified in or implied by the Contract, the Engineer-in-Charge shall be deemed to act for KMDA;

(b) the Engineer-in-Charge has no authority to relieve any Party of any duties, obligations or responsibilities under the Contract; and

(c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test or similar act by the Engineer-in-Charge, including absence of disapproval, shall not relieve the Contractor from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.

7.2.3. Delegation by the Engineer-in-Charge

(1) The Engineer-in-Charge may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a Engineer, or independent inspectors appointed to inspect or test items of Plant or Equipment. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. Unless otherwise agreed by both Parties, the Engineer-in-Charge shall not delegate the authority to determine any matter in accordance with GC Section.

(2) Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in GC Section.

(3) Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer-in-Charge. However,

(a) any failure to disapprove any work or Plant and Equipment shall not constitute approval, and shall therefore not prejudice the right of the Engineer-in-Charge to reject the work or the Plant and Equipment; and

(b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer-in-Charge, who shall promptly confirm, reverse or vary the determination or instruction.

7.2.4. Instructions of the Engineer-in-Charge

(1) The Engineer-in-Charge may issue to the Contractor, at any time during the Design-Build Period, instructions which may be necessary for the execution of the Design-Build Services and the

remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer-in-Charge, or from an assistant to whom the appropriate authority has been delegated under GC Section.

(2) The Contractor shall comply with the instructions given by the Engineer-in-Charge or delegated assistant, on any matter related to the Contract. These instructions shall be given in writing.

7.2.5. Replacement of the Engineer-in-Charge

If KMDA intends to replace the Engineer-in-Charge, KMDA shall, give notice to the Contractor.

7.2.6. Determinations by the Engineer-in-Charge

(1) Whenever the Contract provides that the Engineer-in-Charge shall proceed in accordance with this GC Section to agree or determine any matter, the Engineer-in-Charge shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer-in-Charge shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

(2) The Engineer-in-Charge shall give notice to the Parties of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination unless and until revised under GC Section.

ARTICLE 8. REPRESENTATIVES AND STAFF

8.1. Representatives

8.1.1. KMDA's Representative

(1) KMDA's representative (the "KMDA's Representative") shall be as follows:

(a) during the Design-Build Period, KMDA's Representative shall be the Engineer-in-Charge; and

(b) during the Operations Period, KMDA's Representative shall be the as mentioned in SCC

(2) KMDA shall name its representative,

(a) after the Effective Date for the Engineer-in-Charge; and

(3) KMDA may change its representative from time to time and shall give notice of the change without delay. KMDA shall not change its representative at a time and in such a manner as to impede the progress of either the Design-Build Services.

(4) KMDA's Representative shall represent and act for KMDA at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract by KMDA shall be given by the Engineer-in-Charge as applicable, except as herein otherwise provided.

(5) All notices, instructions, information and other communications given by the Contractor to KMDA under the Contract shall be given to the Engineer-in-Charge as applicable, except as herein otherwise provided.

8.1.2. Contractor's Representative

(1) If the Contractor's representative is not named in the SCC, the Contractor shall name its representative (the "Contractor's Representative") no later than 14 days after the Effective Date and shall request KMDA to approve the proposed Contractor's Representative. If KMDA makes

no objection to the proposed Contractor's Representative, the Contractor's Representative shall be deemed to have been approved.

(2) If KMDA objects to the proposed Contractor's Representative before the expiration of 14 days after the proposal, the Contractor shall propose a replacement immediately after receiving KMDA's objection and reasons for the objection and GC Section shall apply to the proposed replacement.

(3) The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract by the Contractor shall be given by the Contractor's Representative, except as herein otherwise provided.

(4) All notices, instructions, information, and other communications given by KMDA to the Contractor under the Contract shall be given to the Contractor's Representative as established pursuant to this GC Section.

(5) The Contractor shall not revoke the appointment of the Contractor's Representative without KMDA's prior written consent, which shall not be unreasonably withheld. If KMDA consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in this GC Section.

(6) The Contractor's Representative may, subject to the approval of KMDA, which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to KMDA and the Engineer-in-Charge.

(7) Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with GC Section shall be deemed to be an act or exercise by the Contractor's Representative.

8.2. Contractor's Superintendence

(1) Throughout the term of the Contract, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the Services.

(2) Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications as set out in the SCC and of the operations to be carried out, including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents, for the satisfactory and safe execution of the Services.

(3) The Contractor's Representative shall appoint a suitable person as construction or operations manager as applicable (the "Manager"). The Manager shall supervise all work done at the Site and Project Facility by the Contractor and shall be present at the Site or Project Facility through normal working hours except when on leave, sick or absence connected with the proper performance of the Contract. Whenever the Manager is absent from the Site Project Facility, a suitable person shall be appointed to act as his or her deputy.

8.3. Contractor's Personnel

(1) The Contractor shall provide and employ on the Site for the performance of the Services such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution of the Contract (the "Contractor's Personnel"). The Contractor is encouraged to use local labour that has the necessary skills. The Contractor shall provide all expertise needed to carry out the Services including the Key Staff with the expertise specified in the SCC for the design build services.

(2) Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, employment, transportation, accommodation and catering of all labour, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.

(3) The Contractor shall be responsible for obtaining all necessary permits and visas from the appropriate authorities for the entry of all labour and personnel to be employed on the Site into the Country.

(4) The Contractor shall at its own expense provide the means of repatriation to all of its personnel employed on the Contract at the Site to their various home countries. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, KMDA may provide the same to such personnel and recover the cost of doing so from the Contractor.

(5) The Contractor shall at all times during the progress of the Contract use its best endeavours to prevent any unlawful, riotous or disorderly conduct or behaviour by or amongst its employees and the labour of its Sub-contractors.

(6) The Contractor shall, in all dealings with its labour and the labour of its currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labour.

8.4. Replacement of Contractor's Personnel

KMDA or Engineer-in-Charge may require the Contractor to remove and replace any member of the Contractor's Personnel who,

(a) persists in any misconduct or lack of care;

(b) carries out duties incompetently or negligently;

(c) fails to comply with any provision of the Contract; or

(d) persists in any conduct which gives KMDA reasonable cause to be dissatisfied with him or her.

8.5. Existing Staff

If the Contractor is obliged to retain staff employed by KMDA as stated in the SCC, it shall do so in accordance with the Existing Staff Schedule.

ARTICLE 9. LIABILITY AND RISK DISTRIBUTION

9.1. Defect Liability

(1) The Contractor warrants that the Site and Project Facility or any part thereof shall be free from defects in the Design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed.

(2) The Defect Liability Period shall be 12 months after the date of Completion of Network and after successful testing of Network of the Project Facility, unless specified otherwise in the SCC.

(3) If during the Defect Liability Period any defect should be found in the Design, engineering, materials and workmanship of the Site, Project Facility or Plant and Equipment supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with KMDA regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good, as the Contractor shall, at its discretion, determine, such defect as well as any damage to the Project Facility caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Project Facility arising out of or resulting from normal wear and tear.

(4) The Contractor's obligations under this GC Section shall not apply to,

(a) any Designs, specifications or other data Designed, supplied or specified by or on behalf of KMDA; and

(b) any other materials supplied or any other work executed by or on behalf of KMDA, except for the work executed by KMDA under GC Section.

(5) KMDA shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. KMDA shall give all reasonable opportunity for the Contractor to inspect any such defect.

(6) KMDA shall give the Contractor all necessary access to the Project Facility and the Site to enable the Contractor to perform its obligations under this GC Section.

(7) The Contractor may, with the consent of KMDA, remove from the Site any Plant and Equipment, Contractor's Equipment (Design-Build) or any part of the Project Facility that are defective if the nature of the defect, or any damage to the Project Facility caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

(8) If the repair, replacement or making good is of such a character that it may affect the efficiency of the Project Facility or any part thereof, KMDA may give to the Contractor a notice requiring that tests of the defective part of the Project Facility shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

(9) If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Project Facility passes such tests. The tests shall be agreed upon by KMDA and the Contractor.

(10) If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Project Facility caused by such defect within a reasonable time, which shall in no event be considered to be less than 15 days, KMDA may, following notice to the Contractor, proceed to do

such work, and the reasonable costs incurred by KMDA in connection therewith shall be paid to KMDA by the Contractor or may be deducted by KMDA from any monies due the Contractor or claimed under the Performance Security.

(11) If the Project Facility or any part thereof cannot be used by reason of such defect or making good of such defect, the Defect Liability Period of the Project Facility or such part, as the case may be, shall be extended by a period equal to the period during which the Project Facility or such part cannot be used by KMDA because of any of the aforesaid reasons.

(12) Except as provided in GC Sections, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Project Facility or any part thereof, the Plant and Equipment, Design or engineering or work executed that appear after Completion of the Site, the Project Facility or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal or wilful action of the Contractor.

(13) The Contractor shall also provide an extended warranty for any such component of the Project Facility and during the period of time as may be specified in the SCC. Such obligation shall be in addition to the Defect Liability Period specified under GC Section.

9.2. Limitation of Liability

Except in cases of criminal negligence or willful misconduct,

(a) the Contractor shall not be liable to KMDA in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits of interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to KMDA; and

(b) the aggregate liability of the Contractor to KMDA, whether under the Contract, in tort or otherwise, shall not exceed the aggregate of the total Contract Price and the total available Performance Incentive Compensation, provided that this limitation shall not apply to any obligation of the Contractor to indemnify KMDA with respect to patent infringement.

9.3. Transfer of ownership and Existing Equipment and Materials

9.3.1. Transfer of ownership

(1) Ownership of the Plant and Equipment, including spare parts, to be imported into the Country shall be transferred to KMDA upon delivery at the Site.

(2) Ownership of the Plant and Equipment procured in the Country shall be transferred to KMDA when the Plant and Equipment are brought on to the Site.

(3) Ownership of any Plant and Equipment in excess of the requirements of the Project Facility shall revert to the Contractor upon Completion of the Project Facility or such earlier time if KMDA and the Contractor agree that the Plant and Equipment in question are no longer required for the Project Facility.

(4) Subject to GC Section, Ownership of the Contractor's Equipment (Design-Build) including spare parts, shall remain with the Contractor.

(5) KMDA may, in its sole discretion, purchase as of the End Date any of the Contractor's Equipment including spare parts, at the fair market value and the Contractor shall transfer ownership and possession of such Contractor's Equipment to KMDA as of the End Date.

(6) Notwithstanding the transfer of Ownership of the Plant and Equipment, the responsibility for care and custody of the Plant and Equipment, Contractor's Equipment (Design-Build) together with the risk of loss or damage thereto, shall remain with the Contractor pursuant to GC Section until the End Date.

9.4. Care of the Site and Project Facility

(1) Except as provided in GC Sections, the Contractor shall be responsible for the care and custody of the Site and Project Facility or any part thereof until the End Date and shall make good at its own cost any loss or damage that may occur to the Site or Project Facility from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Site or Project Facility caused by the Contractor in the course of any work carried out, pursuant to GC Section.

(2) If any loss or damage occurs to the Site or Project Facility or any part thereof by reason of,

(a) In so far as they relate to the Country, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced Contractor or Contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks, taken out under GC Section;

(b) any use or occupation by KMDA or any Third Party authorized by KMDA of any part of the Site or Project Facility; or

(c) any use of or reliance upon any Design, data or specification provided or Designated by or on behalf of KMDA, or any such matter for which the Contractor has disclaimed responsibility herein,

KMDA shall pay to the Contractor all sums payable in respect of the Site executed, notwithstanding that the same be lost, destroyed or damaged. If KMDA requests the Contractor in writing to make good any loss or damage to the Plant thereby occasioned, the Contractor shall make good the same at the cost of KMDA in accordance with GC Section. If KMDA does not request the Contractor in writing to make good any loss or damage to the Project Facility thereby occasioned, KMDA shall either request a change in accordance with GC Section, excluding the performance of that part of the Project Facility thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Project Facility, KMDA shall terminate the Contract pursuant to GC Section.

(3) The Contractor shall be liable for any loss of or damage to any Contractor's Equipment (Design-Build), or any other property of the Contractor used or intended to be used for purposes of the Site or the Project Facility, except where such loss or damage arises by reason of any of the matters specified in GC Sections.

(4) With respect to any loss or damage caused to the Project Facility or any part thereof, the Contractor's Equipment (Design-Build) by reason of any of the matters specified in GC Section, the provisions of GC Section shall apply.

9.5. Indemnification

(1) Subject to GC Section, the Contractor shall indemnify and hold harmless KMDA and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property, arising in connection with the Contractor's performance of the Services and by reason of the negligence of the Contractor or its Sub-contractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of KMDA, its Contractors, employees, officers or agents.

(2) If any proceedings are brought or any claim is made against KMDA that might subject the Contractor to liability under GC Section, KMDA shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in KMDA's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

(3) If the Contractor fails to notify KMDA prior to the expiration of 30 days after receipt of a notice given pursuant to GC Section that it intends to conduct any such proceedings or claim, then KMDA shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify KMDA within the 30 day period, KMDA shall make no admission that may be prejudicial to the defence of any such proceedings or claim.

(4) KMDA shall, at the Contractor's request, provide all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

(5) KMDA shall indemnify and hold harmless the Contractor and its employees, officers and Sub-consultants from any liability for loss of or damage to property of KMDA that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GC Section, provided that such fire, explosion or other perils were not caused by any act or omission of the Contractor.

(6) The contractor entitled to the benefit of an indemnity under this GC Section shall take all reasonable measures to mitigate any loss or damage which has occurred. If the contractor fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

9.6. Insurance

The Insurance to be provided by the Contractor during his entire duration of Contract Term has been specified in SCC.

9.7. Unforeseeable Physical Conditions

(1) In this GC Section, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when

performing of the Design-Build Services, including sub-surface and hydrological conditions but excluding climatic conditions.

(2) If the Contractor encounters adverse physical conditions which it considers to have been Unforeseeable, the Contractor shall give notice to the Engineer-in-Charge as soon as practicable.

(3) The Contractor's Notice pursuant to GC Section shall describe the physical conditions, so that they can be inspected by the Engineer-in-Charge, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue performing the Design-Build Services, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer-in-Charge may give. If an instruction constitutes a Change GC Section shall apply.

(4) If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives the notice required by GC Section, and suffers delay or incurs Cost due to these conditions, the Contractor shall be entitled subject to GC Section to,

(a) an extension of time for any such delay, if completion is or will be delayed, under GC Section; and

(b) payment of any such Cost, which shall be included in the Contract Price.

(5) After receiving such notice and inspecting or investigating these physical conditions, the Engineer-in-Charge shall proceed in accordance with GC Section to agree or determine,

(a) whether and to what extent these physical conditions were Unforeseeable; and

(b) the amount of delay or Cost, if any, pursuant to GC Section.

(6) Before additional Cost is finally agreed or determined under GC Section, the Engineer-in-Charge, pursuant to GC Section, may also review whether other physical conditions were more favourable than could reasonably have been foreseen when the Contractor submitted the Bid. If and to the extent that these more favourable conditions were encountered, the Engineer-in-Charge may proceed in accordance with GC Section to agree or determine the reductions in Cost which were due to these conditions, which may be included, as deductions, in the Contract Price. The net effect of all adjustments under GC Section and all these reductions, for all the physical conditions encountered on the Site, shall not result in a net reduction in the Contract Price.

(7) The Engineer-in-Charge may take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Bid, which may be made available by the Contractor, but shall not be bound, by any such evidence.

9.8. Force Majeure

(1) "Force Majeure" shall mean any event,

(a) beyond the reasonable control of KMDA or of the Contractor, as the case may be; and

(b) which is unavoidable notwithstanding the reasonable care of the Party affected.

(2) Force Majeure shall include the events listed below in this GC Section, if the conditions set out in GC Section are satisfied:

(a) war, hostilities or warlike operations, whether a state of war be declared or not, invasion, act of foreign enemy and civil war;

(b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts;

(c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any Government or de jure or de facto authority or ruler or any other act or failure to act of any local State or National Government Authority;

(d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague;

(e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster; and

(f) shortage of labour, materials or utilities where caused by circumstances that are themselves Force Majeure.

(3) If the Parties are prevented, hindered or delayed from or in performing any of their obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 14 days after the occurrence of such event.

(4) The Party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such Party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GC Section for events of Force Majeure during the Design-Build Period. If the Time for Completion is extended in accordance with GC Section, the End Date shall be extended for a period of time equal to the period of time during which the relevant event of Force Majeure continued.

(5) The Party or Parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfil its or their obligations under the Contract, but without prejudice to either Party's right to terminate the Contract under GC Sections.

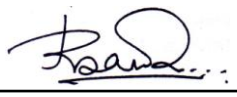
(6) No delay or non-performance by either Party hereto caused by the occurrence of any event of Force Majeure shall,

(a) constitute a default or breach of the Contract; or

(b) subject to GC Sections, give rise to any claim for damages or additional Cost occasioned thereby,

if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure.

(7) If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than 60 days or an aggregate period of more than 120 days on account of one or more events of Force Majeure during the term of the Contract, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other, but without prejudice to either Party's right to terminate the Contract under GC Section.



(8) In the event of termination pursuant to GC Section, the rights and obligations of KMDA and the Contractor shall be as specified in GC Sections.

(9) Notwithstanding GC Section, Force Majeure shall not apply to any obligation of KMDA to make payments to the Contractor herein.

9.9. War Risks

(1) "War Risks" shall mean any event specified in GC Section and any explosion or impact of any mine, bomb, shell, grenade or other Projectile, missile, munitions or explosive of war, occurring or existing in or near the Country.

(2) Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to,

(a) destruction of or damage to the Site and Plant and Equipment or any part thereof;

(b) destruction of or damage to property of KMDA or any Third Party; or

(c) injury or loss of life,

if such destruction, damage, injury or loss of life is caused by any War Risks, and KMDA shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.

(3) If the Site, Project Facility or any Plant and Equipment, Contractor's Equipment (Design-Build), or any other property of the Contractor used or intended to be used for the purposes of the Services sustains destruction or damage by reason of any War Risks, KMDA shall pay the Contractor for,

(a) any part of the Project Facility or the Plant and Equipment so destroyed or damaged, to the extent not already paid for by KMDA;

(b) replacing or making good any Contractor's Equipment (Design-Build), or other property of the Contractor so destroyed or damaged; and

(c) so far as may be required by KMDA, and as may be necessary for completion of the Services, replacing or making good any such destruction or damage to the Site, Project Facility or the Plant and Equipment or any part thereof.

(4) If KMDA does not require the Contractor to replace or make good any such destruction or damage to the Site or Project Facility, KMDA shall either request a Change in accordance with GC Section excluding the performance of that part of the Project Facility thereby destroyed or damaged or, where the loss, destruction or damage affects a substantial part of the Site or Project Facility, shall terminate the Contract, pursuant to GC Section.

(5) Notwithstanding anything contained in the Contract, KMDA shall pay the Contractor for any increased Costs that are in any way attributable to, consequent on, resulting from, or in any way connected with any War Risks, if the Contractor notifies KMDA in writing of any such increased Cost as soon as practicable.

(6) If, during the term of the Contract, any War Risks occur that financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its

personnel engaged in the work on the Services. If the execution of the Services becomes impossible or is substantially prevented for a single period of more than 60 days or an aggregate period of more than 120 days on account of any War Risks, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other.

(7) In the event of termination pursuant to GC Section, the rights and obligations of KMDA and the Contractor shall be as specified in GC Section.

9.10. Change in Laws and Regulations

If, after a date which is 30 days prior to the Submission Deadline in the Bidding Documents, in the State, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed, which shall be deemed to include any change in interpretation or application by the competent authorities, that subsequently affects the costs and expenses of the Contractor or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the Contract Price adjustment provisions where applicable, in accordance with the SCC if so provided.

9.11. Patent Indemnity

9.11.1. Indemnity by Contractor

The Contractor shall indemnify and hold harmless KMDA and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which KMDA may suffer as a result of any infringement or alleged infringement by the Contractor, Sub-contractors, or their employees, agents, or representatives, of any patent, utility model, registered Design, trademark, copyright or other intellectual property right registered or otherwise existing.

9.11.2. Notice of Claim

(1) If any proceedings are brought or any claim is made against KMDA arising out of the matters referred to in GC Section, KMDA shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in KMDA's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

(2) If the Contractor fails to notify KMDA no later than 30 days after receipt of such notice that it intends to conduct any such proceedings or claim, then KMDA shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify KMDA no later than the 30 day period, KMDA shall make no admission that may be prejudicial to the defence of any such proceedings or claim.

(3) KMDA shall, at the Contractor's request, give all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

9.11.3. Indemnity by KMDA

KMDA shall indemnify and hold harmless the Contractor and its employees, officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement by KMDA of any patent, utility model, registered Design, trademark, copyright or other intellectual property right registered or otherwise existing at the Effective Date arising out of or in connection with any Design, data, drawing, specification, or other documents or materials provided or Designed by or on behalf of KMDA.

9.12. Functional Guarantees

(1) The Contractor guarantees that during the Tests and Inspection set out in DBSS Article 2, the Project Facility and all parts thereof shall attain the Functional Guarantees as required.

(2) If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees are not met either in whole or in part, the Contractor shall at its cost and expense make any such changes, modifications or additions to the Project Facility or any part thereof as may be necessary to meet at least the minimum level of the Functional Guarantees. The Contractor shall notify KMDA upon completion of the necessary changes, modifications or additions, and shall request KMDA to repeat the applicable Tests and Inspection until the minimum level of the Functional Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, KMDA may consider termination of the Contract, pursuant to GC Section.

(3) If, for any reasons attributable to the Contractor, the Functional Guarantees are not attained either in whole or in part, but the minimum level of the Functional Guarantees is met, the Contractor shall, at the Contractor's option, either

(a) make such changes, modifications or additions to the Project Facility or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request KMDA to repeat the Tests and Inspection and the expenditure incurred due to the same shall be borne by the contractor.

ARTICLE 10. CHANGE IN CONTRACT ELEMENTS

10.1. Change to the Design-Build Services

10.1.1. Introducing a Change

(1) Subject to GC Sections, KMDA shall have the right to propose, and subsequently require, that the Engineer-in-Charge order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Design-Build

Services (the "Change"), provided that such Change falls within the general scope of the Design-Build Services and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Design-Build Services and the technical compatibility of the Change envisaged with the nature of the Design-Build Services as specified in the Contract.

(2) The Contractor may from time to time during its performance of the Contract propose to KMDA, with a copy to the Engineer-in-Charge, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Design-Build Services. KMDA may at its discretion approve or reject any Change proposed by the Contractor.

(3) Notwithstanding GC Section, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

(4) The procedure on how to proceed with and execute Changes is specified in GC Section, and the Engineer-in-Charge shall provide Contractor with further details and sample forms on the Change procedures prior to the Design-Build Starting Date.

10.1.2. Changes Originating from KMDA

(1) If KMDA proposes a Change pursuant to GC Section, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Engineer-in-Charge as soon as reasonably practicable a "Change Proposal," which shall include the following:

(a) brief description of the Change;

(b) effect on the Time for Completion;

(c) estimated cost of the Change; and

(d) effect on any other provisions of the Contract.

(2) Prior to preparing and submitting the Change Proposal, the Contractor shall submit to the Engineer-in-Charge an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal.

(3) Upon receipt of the Contractor's Estimate for Change Proposal, KMDA shall,

(a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal;

(b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate; or

(c) advise the Contractor that KMDA does not intend to proceed with the Change.

(4) Upon receipt of KMDA's instruction to proceed under GC Section (the "Change Order"), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GC Section.

(5) The pricing of any Change shall, as far as practicable, be calculated in accordance with the prices included in the Contract.

(6) The Contractor's failure to object pursuant to GC Section shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

(7) Upon receipt of the Change Proposal, KMDA and the Contractor shall mutually agree upon all matters therein contained. No later than 14 days after such agreement, KMDA shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

(8) If KMDA decides not to proceed with the Change for whatever reason, it shall notify the Contractor prior to the expiration of 14 days after the agreement on the Change. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GC Section.

10.1.3. Changes Originating from Contractor

(1) If the Contractor proposes a Change pursuant to GC Section, the Contractor shall submit to the Engineer-in-Charge a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GC Section.

(2) Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GC Sections. If KMDA chooses not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

10.1.4. Design-Build Period

GC Sections shall apply during only the Design-Build Period.

ARTICLE 11. SUSPENSION AND TERMINATION

11.1. Suspension

11.1.1. Suspension by KMDA

(1) KMDA notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefore. The Contractor shall there upon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Site or Project Facility, until ordered in writing to resume such performance by the Engineer-in-Charge as applicable.

(2) If, by virtue of a suspension order given by the Engineer-in-Charge, as applicable, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than 90 days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Engineer-in-Charge as applicable, requiring that KMDA shall, no later than 30 days after KMDA's receipt of the notice, order the resumption of such performance or request and subsequently order a Change in accordance with GC Section, excluding the performance of the suspended obligations from the Contract.

(3) If KMDA fails to order the resumption of performance in accordance with GC Section, the Contractor may, by a further notice to the Engineer-in-Charge, elect to treat the suspension,

where it affects a part only of the works, as a deletion of such part in accordance with GC Section or, where it affects the whole of the works, as termination of the Contract pursuant to GC Section.

11.2. Termination

(1) KMDA may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GC Section.

(2) Upon receipt of the notice of termination under GC Section,

(a) the Contractor shall, either immediately or upon the date specified in the notice of termination,

(i) cease all further work, except for such work as KMDA may specify in the notice of termination for the sole purpose of protecting that part of the Facility already executed, or any work required to leave the Site in a clean and safe condition; and

(ii) remove all Contractor's Equipment (Design-Build) and, except if KMDA asserts its rights pursuant to GC Section, from the Site, repatriate the Contractor's Personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition; and

(b) the Contractor, subject to the payment specified in GC Section shall,

(i) deliver to KMDA the parts of the Project Facility executed by the Contractor and all materials which have been paid for by KMDA up to the date of termination; and

(ii) deliver to KMDA all the Contract Records, including the Design-Build Documents, prepared by the Contractor as at the date of termination.

(c) Further if KMDA certifies with a copy to the Contractor that in his opinion, the contractor.

(d) Committed any breach of any of the terms of contract, or

(e) Has given false or untrue information regarding eligibility to bid as revealed after the selection process is over or even earlier, or

(f) Non observance of Safety Norms for workers and public.

(g) Breach of any of the terms and conditions of the contract for any reason whatsoever.

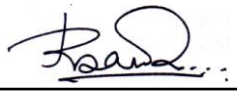
Then KMDA may, after giving 15 days' notice to the contractor, enter upon the site and works and terminate the Employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the contract or affecting the rights and authorities conferred on the Employer by the contract, and may himself complete the works or may employ any other contractor to complete the works, at his risk and cost.

11.2.1. Payment upon Termination by KMDA for Convenience

(1) Upon termination of the contract under clause above, the amount of performance Security will be forfeited by KMDA. KMDA shall make only the following payments to the Contractor,

(a) any portion of the Contract Price payable to the Contractor for work satisfactorily performed prior to the date of termination and calculated as set out in GC Section;

(2) The Contractor acknowledges that the only payments to be made to the Contractor on termination by KMDA are set out in this GC Section. The Contractor shall not make a claim for lost or foregone profits, revenues, consequential damages or any other costs, damages, expenses or losses of any kind as a result of or in connection with the termination of this Contract.



11.2.2. Termination for Contractor's Default

(1) KMDA, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances, by giving a notice of termination and its reasons therefore to the Contractor, referring to this GC Section:

(a) If the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction, a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt;

(b) If the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GC Section; or

(2) If the Contractor,

(a) has abandoned or repudiated the Contract;

(b) has without valid reason failed to commence work on the Site or Project Facility promptly or has suspended, other than pursuant to GC Section, the progress of Contract performance for more than 30 days after receiving a written instruction from KMDA to proceed;

(c) persistently fails to carry out the works in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause; or

(d) refuses or is unable to provide sufficient materials, services, labour or personnel to perform the works, then KMDA may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within 14 days after its receipt of such notice, then KMDA may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GC Section.

(3) Upon receipt of the notice of termination under GC Sections the Contractor shall, either immediately or upon such date as is specified in the notice of termination,

(a) cease all further work, except for such work as KMDA may specify in the notice of termination for the sole purpose of protecting that part of the Site and Project Facility already executed, or any work required to leave the Site and Project Facility in a clean and safe condition;

(b) deliver to KMDA the parts of the Project Facility executed by the Contractor up to the date of termination; and

(c) deliver to KMDA all Contract Records, including the Design-Build Documents, prepared by the Contractor as of the date of termination.

(4) KMDA may enter the Project Facility and upon the Site, expel the Contractor, and, if the Project Facility is not completed, KMDA may complete the Facility itself or by employing any Third Party. KMDA may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of KMDA and with an indemnification by KMDA for all liability including damage or injury to persons arising out of KMDA's use of such equipment, any Contractor's Equipment

(Design-Build) owned by the Contractor and on the Site in connection with the Project Facility for such reasonable period as KMDA considers expedient for the completion of the Project Facility. Upon completion of the Project Facility or at such earlier date as KMDA thinks appropriate, KMDA shall give notice to the Contractor that such Contractor's Equipment (Design-Build) and, except if KMDA asserts its rights pursuant to GC Section, Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment (Design-Build) to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

11.2.2.1. Corrupt or Fraudulent Practices

If KMDA determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then KMDA may, after giving 14 days' notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Section shall apply as if such termination had been made under Section [Termination for Contractor's Default].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work, then that employee shall be removed in accordance with Section [Replacement of Contractor's Personnel].

For the purposes of this Sub-Clause:

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

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

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

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

(v) "obstructive practice" is

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

(ii) acts intended to materially impede the exercise of the inspection and audit rights provided for under Section

11.2.3. General Provisions - Termination

(1) In this GC Section, the expression "Project Facility executed" shall include all work executed, Services provided, and all Plant and Equipment acquired, or subject to a legally binding

obligation to purchase by the Contractor and used or intended to be used for the purpose of the performing the Services, up to and including the date of termination.

(2) In this GC Section, in calculating any monies due from KMDA to the Contractor, account shall be taken of,

(a) any sum previously paid by KMDA to the Contractor under the Contract, including any advance payment paid pursuant to the Terms and Procedures of Payment Schedule;

(b) any sum owing by the Contractor to KMDA under the Contract, including Liquidated Damages – Delay or liquidated damages calculated pursuant to GC Section.

Schedule 1
Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement the General Conditions. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract (GCC). The corresponding article and section numbers of the General Conditions are indicated in parentheses.

Article 1: Contract and interpretation

1. Definitions (GC Section) No change

2. Language

The language shall be "English"

3. Survival of Obligations

Upon termination or expiration of the Contract, the following rights and obligations of the Parties survive:

(a) Such rights and obligations as may have accrued or to which the Parties may be entitled on the date of termination, and any rights which a Party may have under Applicable Law;

(b) On termination or expiration of the contract, the rights and obligations of the parties towards settlement of disputes through arbitration in the form of an arbitration clause / agreement.

(c) The Contractor's obligations with respect to Contract Records, accounting and auditing set out in GC Section;

(d) The Contractor's obligations with respect to Transition Assistance set out in GC Section;

(e) The Parties' rights and obligations with respect to copyright set out in GC Section;

(f) The Contractor's obligations of confidentiality as set out in GC Section;

(g) The Parties' rights and obligations with respect to defect liability set out in GC Section; and

(h) The Parties' rights and obligations with respect to indemnification set out in GC Section.

4. Notice

All notices to the relevant party shall be sent to the following address:

a. Contractor

_____

_____

b. KMDA

Superintending Engineer, North Circle, GAP Sector, KMDA, Unnayan Bhawan, 1st Floor, Block-D, Kolkata – 700 091, West Bengal, India.

5. Governing Law

The Applicable Law will be the Laws of India as well as the laws prevailing in the State of West Bengal.

6. Arbitration

No arbitration is allowed.

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Article 2: Contract Term, Timing and Completion

7. Expiration of Contract

The Contract shall terminate after successful testing of Network of the project facility or Defect Liability Period which is even latter.

8. Time for Completion

The Time for completion of the Design – Build Services shall be 30 months from the Effective Date.

9. Maximum Liquidated Damages – Delay

The Maximum Liquidated Damages – Delay shall be 10 % of the Design-Build price of the Contract.

10. Delay in Completion - Liquidated Damages

The Contractor shall be liable to pay Liquidated Damages to KMDA in accordance with GCC clause, if the Contractor fails to achieve the various activities for ensuring completion of the works as follows.

Sl. No.	Activity/Milestone	Target Completion Time	Liquidated damages per day for delay in completion of activity/Milestone
1	Completion of works of 10% of Contract value of Design Build Services stipulated in the signed contract	7.5 months	INR37500
2	Completion of works of 20% (cumulative) of Contract value of Design Build Services stipulated in the signed contract	11months	INR37500
3	Completion of works of 40% (cumulative) of Contract value of Design Build Services stipulated in the signed contract	17 months	INR75000
4	Completion of works of 60% (cumulative) of Contract value of Design Build Services stipulated in the signed contract	23months	INR75000
5	Completion of works of 75% (cumulative) of Contract value of Design Build Services stipulated in the signed contract	26 months	INR112500
6	Completion of works of contracted Design-Build Services in all respects	30 months	0.05 % (Zero point zero five Percent) of the Value of the Design Build Services stipulated in the signed contract for each day of delay beyond the Completion Time.

Note

1. The value of works stipulated in column 2 of the table above excludes the value of materials intended for the works but not used or incorporated in the works.
2. The target time for completion stipulated in column 3 will be subject to revision, if justified, in the event of extension of time for completion agreed under GCC clause.

   Liquidated Damages recovered on account of delay in completion of an activity/activities listed in serial number 1 to 5 of the table above, will qualify for refund to the Contractor, if the contracted works of the design-build services part of the contract are completed in all respects within the stipulated period or the revised completion period if so agreed to by the parties in accordance GCC clause.

Article 4: Obligations of KMDA

11. Access to the Site and Project Facility

Add the following

(1) KMDA shall provide the Contractor free of charge full possession and access of the above mentioned sites and right of way for the Project Facility only during the Contract Term.

(2) KMDA shall be responsible for acquiring and providing legal and physical possession of Land for new Sewage Pumping Station(s) at the site(s) of proposed Sewage Pumping Station(s) and shall provide access thereto and all other areas along the selected alignment for the Sewerage Network, reasonably required for the proper execution of the contract including all rights of way.

(3) KMDA shall provide the Contractor free of charge possession and access of the above mentioned sites and right of way for the Sewerage Network during the Contract Period, so as to ensure that the Contractor shall achieve progress of work consistent with the milestones, laid down in SCC clause.

(4) The Contractor shall complete the work on the sites handed over to him from time to time within in the specified time, as and when so instructed by the Engineer-in-Charge or advised by KMDA, so as to minimize the inconvenience to the households and the public over prolonged durations of time.

Article 5: Contract Price and Payment

12. Terms of Payment

Provisions in Clauses shall be replaced with the following clauses:

(1) The Contract Price shall be paid in accordance with the provisions in Schedule 4 – Price Schedule and Schedule 5 – Terms and procedures of Payment of the Contract.

(3) Payments shall be made in Indian Rupees only.

13. Performance Security

The Contractor shall provide a Performance Security of 10 % (Ten percent) of the total Contract Price, i.e. Design-Build price.

Total Contract Price = Total price of BOQ items.

14. Advance Payment Security

Provision shall be replaced with the following clauses:

The Mobilization Advance paid to the Contractor by KMDA shall be recovered commencing from the date on which the payment to the Contractor has reached 20% of the value of Design, Build and Commissioning Services and shall be recovered at the rate of 15% from each bill submitted by the Contractor for the payment. The entire amount of mobilization advance shall be recovered latest by the time 90% of the value of Design Build and Commissioning services has been claimed by the Contractor.

Article 7: Contract administration and supervision during the Design-Build

15. Design-Build Supervision

Provisions shall be replaced with the following clauses.

7.2.1 Supervision during the Design-Build Period

GC Section shall apply during the Design-Build Period and immediately after the End date solely for the purpose of resolving transition issues and any outstanding issues arising.

7.2.2 Engineer-in-Charge's Duties and Authority (Design-Build)

(1) KMDA shall appoint the Engineer-in-Charge who shall be responsible for day to day contract management and supervision during the Design-Build Period. The Engineer-in-Charge's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

(2) The Engineer-in-Charge shall have no authority to amend the Contract.

(3) Except, as specifically provided otherwise in the Contract, the Engineer-in-Charge may exercise the authority attributable to the Engineer-in-Charge as specified in or necessarily to be implied from the Contract. KMDA undertakes not to impose further constraints on the Engineer-in-Charge's authority, except as agreed with the Contractor.

(4) The Engineer-in-Charge is obligated to obtain the approval of KMDA for matters specified in the sub-clause of the SCC. If the Engineer-in-Charge exercises a specified authority for which KMDA's approval is required then, for the purposes of the Contract, KMDA shall be deemed to have given approval.

(5) Except as otherwise stated in the Contract,

(a) if the Engineer-in-Charge carries out duties or exercises authority, specified in or implied by the Contract, the Engineer-in-Charge shall be deemed to act for KMDA;

(b) the Engineer-in-Charge has no authority to relieve any Party of any duties, obligations or responsibilities under the Contract; and

(c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test or similar act by the Engineer-in-Charge, including absence of disapproval, shall not relieve the Contractor from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.

(d) The Engineer-in-Charge shall obtain the approval of KMDA before exercising its authority in the following circumstances:

(a) approving assignment of the Contract, or any part thereof;
(b) determining an extension of the Time for Completion; and
(c) certifying additional costs determined under GCC.

7.2.3 Delegation by the Engineer-in-Charge

(1) The Engineer-in-Charge may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, or independent inspectors appointed to inspect or test items of Plant or Equipment. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. Unless otherwise agreed by both Parties, the Engineer-in-Charge shall not delegate the authority to determine any matter in accordance with GC Section.

(2) Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in GC Section.

(3) Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer-in-Charge. However,

(a) any failure to disapprove any work or Plant and Equipment shall not constitute approval, and shall therefore not prejudice the right of the Engineer-in-Charge to reject the work or the Plant and Equipment; and

(b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer-in-Charge, who shall promptly confirm, reverse or vary the determination or instruction.

7.2.4 Instructions of the Engineer-in-Charge

(1) The Engineer-in-Charge may issue to the Contractor, at any time during the Design-Build Period, instructions which may be necessary for the execution of the Design-Build Services and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer-in-Charge, or from an assistant to whom the appropriate authority has been delegated under GC Section. If an instruction constitutes a Change, GC Section shall apply.

(2) The Contractor shall comply with the instructions given by the Engineer-in-Charge or delegated assistant, on any matter related to the Contract. These instructions shall be given in writing.

7.2.5 Replacement of the Engineer-in-Charge

If KMDA intends to replace the Engineer-in-Charge, KMDA shall, give notice to the Contractor.

7.2.6 Determinations by the Engineer-in-Charge

(1) Whenever the Contract provides that the Engineer-in-Charge shall proceed in accordance with this GC Section to agree or determine any matter, the Engineer-in-Charge shall consult with contractor in an endeavour to reach agreement. If agreement is not achieved, the Engineer-in-Charge shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

(2) The Engineer-in-Charge shall give notice to the Parties contractor of each agreement or determination, with supporting particulars. Contractor shall give effect to each agreement or determination unless and until revised under GC Section.

Article 8: Representatives Staff

16. Contractor's Representative

The Contractor's Representative is: _____

17. Existing Staff

The Contractor is not obliged to retain staff employed by KMDA.

18. Contractor's Personnel

The Contractor's Key Staff employed during the design build services shall have the expertise and qualifications specified in the Table below:

Sl. No.	Staff	No.	Minimum Qualifications
1	Project Manager	1	A Graduate in Civil Engineer with not less than 10 years' experience in construction of Sewage Treatment Plants/ Sewerage Networks.
2	Civil Engineer	2	A Civil Engineer (Graduate Engineer) with not less than eight years' experience in construction of similar engineering works or Diploma in Civil Engineer with 10 years' experience
3	Electro Mechanical Engineer	2	A Electro /Mechanical Engineer (Graduate Engineer) with not less than 8 years' experience in construction of similar engineering works or Diploma in Electro/ Mechanical Engineering with 10 years' experience
4	Civil Supervisors	5	Diploma in Civil Engineering with minimum 2 years' experience in Construction of Civil Engineering works
5	Environmental Engineer	1	Degree in Environmental Science with minimum 5 years' experience or Environmental Engineering with minimum 2 years' experience in environmental management works for urban infrastructure projects.

Article 9: Liability and Risk Distribution

19. Defect Liability Period

The Contractor shall be responsible for the repair and maintenance of the Sewerage Network, SPSs and other facilities at his own cost during defect liability period.

The Defect Liability Period will be 12 calendar months after successful commissioning of the project. The defects, if any, arising, in the opinion of the Authority, within such reasonable time shall be amended and made good and in case of defaults, the Authority may employ and pay other persons to make good such damages and all loss and expenses consequent thereupon or incidental thereto shall be borne by the contractor and shall be recovered from any money that

may be come due to the contractor. During this period, the contractor's technical personnel responsible for civil and electro – mechanical works should visit the plants and machinery, at least once a month and advice the working staff in continuing for smooth operation, as may be necessary.

20. Insurance

Delete the existing clause and replace it with the following clause:

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause. Wherever the Contractor is the insuring Party, each insurance shall be affected with insurers and in terms approved by KMDA. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

Wherever KMDA is the insuring Party, each insurance shall be affected with insurers and in terms consistent with the details contained under this contract. If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that KMDA shall act for KMDA's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within 28 days from the Effective Date submit to the other Party:

a) evidence that the insurances described in this Clause have been effected, and

b) copies of the policies for the insurances described in Sub-Clause (Insurance for works and Contractor's Equipment) and Sub-Clause (Insurance against Injury to Persons and Damage to Property).

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer-in-Charge.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Project and ensure that insurance is maintained in accordance with this Clause. Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies

in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or KMDA, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or KMDA in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to the provisions of GCC & SCC as contained in this contract as applicable. The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause) with insurers from any eligible source country.

21. Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph of Sub-Clause (General Requirements for Insurances), until the End Date.

The insuring Party shall maintain this insurance to provide cover until the End Date, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the End Date, and for loss or damage caused by the Contractor in the course of any other operations.

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

a) shall be effected and maintained by the Contractor as insuring Party,

b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated between the Parties for the sole purpose of rectifying the loss or damage,

c) shall cover all loss and damage from any cause not listed in the GCC / SCC of this contract.

d) shall also cover loss or damage to a part of the Projects which is attributable to the use or occupation by KMDA of another part of the Works, and loss or damage from KMDA's risks listed in the GCC / SCC excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the Contract Data (if an amount is not so stated, this sub-paragraph (d) shall not apply), and

e) may however exclude loss of, damage to, and reinstatement of: (i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below), (ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship, (iii) a part of the Works which has been taken over by KMDA, except to the extent that the Contractor is liable for the loss or damage, and (iv) Goods while they are not in the Country, subject to the provisions of GCC / SCC contained in this contract as applicable.

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to KMDA, with supporting particulars. KMDA shall then (i) be entitled subject to provisions of GCC / SCC contained in this contract as applicable. to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause [General Requirements for Insurances].

22. Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property {except things insured under Clause [Insurance for Works and Contractor's Equipment]} or to any person {except persons insured under Sub-Clause [Insurance for Contractor's Personnel]}, which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

The Insurance cover under this clause shall be as under and to be borne by the Contractor:

1. Loss of human life – Rs. 1.00 million or equivalent amount in convertible currency and to be recouped as and when it is used.
2. Permanent Disability of human beings - Rs. 0.50 million or equivalent amount in convertible currency and to be recouped as and when it is used.
3. Human Body Injury not resulting into permanent disability -Rs. 0.1 million or equivalent amount in convertible currency and to be recouped as and when it is used.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

a) shall be effected and maintained by the Contractor as insuring Party,
b) shall be in the joint names of the Parties,
c) shall be extended to cover liability for all loss and damage to KMDA's property (except things insured under Sub-Clause) arising out of the Contractor's performance of the Contract, and
d) may however exclude liability to the extent that it arises from:

i. KMDA's right to have the Project executed on, over, under, in or through any land, and to occupy this land for the Project,
ii. damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and

iii. a cause listed as KMDA's Risks as contained in GCC / SCC, except to the extent that cover is available at commercially reasonable terms.

23. Insurance for Contractor's Personnel

The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel. KMDA and the Engineer - in - Charge shall also be indemnified under the policy of insurance, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of KMDA or of KMDA's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works, but the Contractor shall be responsible for compliance with this Clause.

Article 10:

24. Payment of Extra Work

It is binding on the contractor to carry out such extra work as will be ordered when the same can conveniently and economically be carried out by the contractor in the opinion of the Superintending Engineer and when such extra work forms, in the opinion of the Superintending Engineer, an integral part of the main work, either an addition or an alternation or a legitimate and reasonable extension, which cannot conveniently be carried out by other agency.

The rates for such additional works shall be based on relevant items of West Bengal PWD (Presidency Circle) Schedule of Rates (Building, Sanitary & Plumbing and Road Works) in vogue at the time of acceptance of the original tender. In case these items are not available in West Bengal PWD (Presidency Circle) Schedule of Rates, the KMDA Schedule of Rates in vogue at the time of acceptance of the original tender shall be followed. Items which are not available in KMDA / PWD Schedule of Rates will be payable on the basis of current market rates of labour and materials plus 10% profit. The decision of the Superintending Engineer will be binding for all rates of additional items.

25. Assignment.

The whole of the work included in the contract shall be executed by the contractor and no part of it shall be directly or indirectly transferred, assigned or let out. The contractor shall not take a new partner without the written consent of the Superintending Engineer and no subletting shall relieve the contractor from the entire responsibility of the contract.

26. Action in Case of Non-compliance.

Failure to comply with the conditions and specifications of the contract will result in the Department taking action at the risk and cost of the Contractor. Submission of the contract binds the Contractor for complying with requirements of the contract conditions and specifications without any extra payment.

27. Failure by the Contractor, to comply with Departmental Instructions.

If the Contractor, after receipt of written instruction from the department, fails to comply with the departmental instructions, within 15 days, the Superintending Engineer may employ, other

persons to execute such works and all costs connected with that, shall be recoverable either from the bill or from performance security of the Contractor.

28. Safeguard of Existing Structures.

The Contractor has to take all precautionary measures to safeguard the existing structures, roads including flank, footpath etc. In case any damage is caused to the existing structure, the contractor will be liable to make good the damages at his own cost upto the full satisfaction of KMDA.

The contractor at their own cost, shall properly give support and effectively protect all such gas, water mains, service pipes, gully pit, connection pipes, house drains and electric, telephone and telegraph cables including their adjuncts and appurtenances, falling within or outside during execution of the work or in consequent thereof in such a manner and with such materials as per required or specified by the concerned public utility agencies and as per instruction of the Engineer – in – Charge and hold them in proper position without any damage being caused to them during execution of the work or in consequence thereof and shall bear the expense of pipes, gas mains, gully pit connections, house drains and electric, telegraph and telephone cables or any other underground structures and services falling within or outside the trench which may be found to have been disturbed or damaged due to their (contractor's) faulty, defective and careless workmanship etc. The decision of the Engineer – in – Charge in this respect shall be binding and final and all cost of rebuilding or repairing of such damaged services or structures as aforesaid shall be deducted from the contractor's bill.

The foregoing will not absolve the contractor of his responsibility in the matter. The contractor should include in his rates the cost of works to be done properly aligning, supporting and adequately protecting of all underground services, utilities and structures.

If the Engineer – in – Charge think it necessary to put permanent support under gas / water mains, cables etc., he will order the contractor to do so. In case of any damage of the utility services, the contractor shall make good damage as per instruction of the Engineer – in – Charge.

The contractor shall enquire of and collect information from all concerned public utility organizations, various Govt. Departments and local bodies as to the pipes, mains, cables and any other construction either overhead or underground or over ground which may be encountered in the course of execution of work and which are likely to affect the progress the work at his own cost and risk. No claim of idle labour or delay in completion of the work within the specified period on this account will be entertained under any circumstances whatsoever.

29. Miscellaneous.

The quantities of materials to be procured at site shall be such that the same is used within a reasonable time frame (not exceeding 3 months from the date of procurement and stacking at site) as determined by KMDA.

Anything not covered in NIT but required for successful commissioning of the project are to be provided by the contractor at no extra cost.

Before the quoting the rate, intending bidders (contractors) are advised to take in consideration, not only the item of works, but to give emphasis on all related items of work that are needed for successful completion of the entire project.

No claim for extra payment beyond the quoted amount will be entertained.

Variations in quantities during actual execution compared with those provided in this Price schedule will not entitle the contractor to any extra payment for items quoted on lump sum basis. On completion of the job to the satisfaction of the Department and after the requisite tests have been carried out, the contractor will be entitled to the payment of the whole of the lump sum amount as quoted. For items quoted on item rate basis, payment will be made on actual measurement.

3O. De–termination of Contract, due to Abandonment or Reduction on Scope of Work.

If any time, after acceptance of the contract, the Department for any reasons whatsoever not require the whole or any part of the work to be carried out, the Department shall give notice to the contractor who shall have no claim to any payment of compensation on account of any profit or advantage which he might have derived from the execution of the whole works. The contractor shall be paid at contract rate full amount for the amount of work executed.

Any other works that may be necessary for successful commissioning of the total Sewerage System of the town.

Schedule 2
Design Build Services Schedule (DBSS)

ARTICLE 1. General

1.1. Description of Design-Build Services:

For Network

The Contractor shall carry out and be responsible for the review of KMDA's design and redesign where necessary; and construction of the Sewerage Network including pipe network, Sewage pumping stations and all allied appurtenant structures, and dovetailing the existing infrastructure and be responsible for its performance. The Contractor's work and services as part of the "Design-Build Services" shall cover all necessary or desirable services / activities for the design and construction of the Sewerage Network and all allied works in accordance with and as contemplated by the Design-Build Documents and the Technical Standards including,

a) The redesign services in respect of Sewerage Network and allied appurtenant structures such as manholes, vent shafts etc., including design, alignment, layout, installation, all civil works, construction drawings and environmental and social assessments; social, safety and environmental safeguards; as set out in DBSS.

b) the design services in respect of the Sewage pumping stations and all allied works including operations process, hydraulic, electrical, instrumentation, mechanical and piping design, all civil, mechanical, electrical and piping drawing including architectural & construction drawings and environmental assessment with necessary mitigation measures, as set out in DBSS.

The Contractor shall propose its own structural design and configuration for SPS and the design will be subject to approval of KMDA. The electromechanical components for the SPS will be adopted as the BOQ in the contract unless otherwise mandated by redesign of network and approved by KMDA.

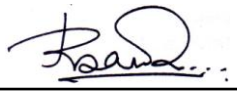
c) the building and construction work and services in respect of the Sewerage Network and all allied works such as Pump stations, road restoration etc. as set out in DBSS;

d) Refurbishment or replacement of existing sewerage network with new infrastructure components and improvement of sewage collection network, pumping stations, waste water treatment system etc. dovetailing the existing infrastructure in compliance to the conditions as set out in the DBSS.

e) Supervising connections to household or any other connections to the network approved by KMDA to ensure such connections are technically complied with necessary requirements for operations and performance.

1.2. Supplementing the General Conditions

The provisions contained in this Design-Build Services Schedule are to be read in conjunction with the General Conditions of Contract and Special Conditions of Contract as contained in this bid document for the purpose of providing greater specificity of the Design-Build Services that the Contractor shall perform.



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

ARTICLE 2. DESIGN SERVICES

2.1 General

2.1.1 Design and Engineering

a) The Contractor shall execute the basic and detailed design of Sewerage Network and allied structures and its execution in compliance with the technical specifications and requirements contained in the contract, codes of practices as published by the Bureau of Indian Standard (BIS) or its equivalent standard as well as the latest version of "Manual on Sewerage and Sewage Treatment" as published by the Central Public Health Engineering Organization (CPHEEO) of the Ministry of Urban Development, Government of India, New Delhi (draft or approved but whichever is latest). Wherever, the codes, standards and manual do not provide for the design and execution of some component i.e. required to be designed and executed, the Contractor shall follow the standard engineering practices as approved by Engineer-in-Charge.

b) Where KMDA provides detailed designs, the Contractor shall review KMDA's designs and come up with its own designs for the Sewerage Network based on the alignment suggested/allowed by KMDA (Allowed alignments/locations). The changes in the suggested that include technical; allowed alignments etc. shall be considered only due to compelling site conditions or unforeseen technical reasons, subject to the approval of KMDA or its authorised representative.

c) The designs and drawings as formulated by the Contractor shall be subject to approval by KMDA or its authorized representative. ALL the designs and drawings as formulated by the Contractor including vetting of all the designed from any IIT, or Jadavpur University, or IIEST (Formerly Bengal Engineering and Science University) and for which the scrutiny/ proof checked charges shall be borne by the Contractor and the delay in checking & vetting designs by the third party as mentioned above shall be treated as the delay on the part of the Contractor for operation of the Contract clause.

d) The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents, desired output / performance of the Sewerage Network, whether specifications, drawings and other documents have been approved by KMDA or its representative or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of KMDA. Normally it is expected that Contractor will not deviate from the specifications prescribed by KMDA unless the proposed changes will result in better performance and cost effectiveness.

2.1.2 Codes and Standards

Wherever references are made in the Contract to codes and standards, in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards 30 days prior to the Submission Deadline shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied after approval by KMDA/KMDA's Representative and shall be treated in accordance with GC Section 10.1.

2.1.3 Design Responsibilities

a) The Contractor's design and design-related services shall include, but not limited to the following:

i. A confirmatory topographical study covering the proposed sites (whole of Municipal Town) and the network alignment. Survey drawings are to be submitted in hard and soft copy (in original format) to KMDA;

ii. Investigation and assessment of the design requirements taking into cognizance of the indicative results of the Asset Condition Assessment Study

iii. Site investigation and data collection including geotechnical assessment and soil analysis for the design and construction of the structures required for the Sewerage Network;

iv. Contractor uses the population data/ projections for future supplied; and per capita wastewater production assumptions by KMDA. Selection, adoption and detailed engineering designs for the most appropriate techno economically feasible cost effective pumping configuration, network alignment and network installation process ensuring that the sewerage system meets with the standards prescribed by the MOEF/ CPHEEO/ CPCB as may be applicable. The hydraulic designs use computer based approved/ proven software.

v. Selection, adoption and detailed engineering design for the sections of the Existing Sewerage Network, wherever required, to integrate with the new network system. Usefulness of existing network will be conducted through a conditional assessment where engineer's team will also participate. Decision regarding the condition assessment shall be communicated by KMDA within 15 days after submitting complete condition assessment report by the Contractor.

vi. the preparation of Hydraulic Flow Diagram (HFD)/schematic/preliminary design documents to illustrate the scale and character of the Design-Build Services and how the units of the process-adopted functionally relate to each other;

vii. Preparation of design development documents, based on the approved HFD /schematic design documents accepted by KMDA, consisting of drawings and other documents appropriate to the size of the Pumping Stations to describe the units and character of the entire proposed plant including architectural, mechanical, civil works, and electrical systems, materials, operations, landscaping, and such other elements as may be appropriate;

viii. the preparation of Design-Build Documents setting forth in detail the requirements for construction based on the design development documents accepted by KMDA;

ix. obtaining all approvals, permits, including building permits, and licenses for the Design-Build Services, necessary compliances with occupational health and safety requirements, except for those approvals, permits or licenses that KMDA is explicitly required to obtain itself under the Applicable Law in which case the Contractor shall prepare all documentation and provide assistance to KMDA in obtaining such approval, permits or licenses;

x. the coordination required to integrate all parts of the Design-Build Services; such other Design-Build Services that may be required from time to time that are agreed to by the Contractor and KMDA in writing; and

xi. the conducting of general reviews of the progress of the design process, to the extent necessary, in order to determine to the Contractor's satisfaction that the design services are performed in compliance with the requirements of the Contract and Applicable Laws.

2.1.4 Design-Build Documents

a) The Contractor shall prepare all the Design-Build Documents. The Design Build Documents shall include the plans, designs, drawings, as-built documents, operations manuals, specifications, schematic design documents, design development documents, and all modifications thereto required in order to properly and fully test for, analyses for, plan, design and build the Sewerage Network and all allied works as contemplated in the Technical Standards and the remaining provisions of the Contract.

b) The Contractor shall prepare all the Refurbishment / Replacement drawings including sections and plans of the Sewerage Network to be replaced / refurbished including schematic/ detailed drawings, engineering drawings, construction drawings, design basis documents, construction methodology and technical standards adopted. The network and other systems built will be placed on a GI based system at the end of construction and handed over to KMDA before operations commences. It also includes hydraulic design system to help monitor and for future upgrades.

c) The Contractor shall prepare any other document, as may be requested by the Engineer-in-Charge, that KMDA considers necessary to monitor the progress of the Design-Build Services and assess the Contractor's compliance with the Contract.

d) The Contractor shall provide KMDA with three sets of all of the Design-Build Documents in reproducible form and shall modify them to keep them up-to-date as requested by KMDA acting in a professionally reasonable manner. The Design-Build Documents, with the exception of the as-built documents, shall be subject to the review and approval of KMDA prior to performing any of the services set out in DBSS in respect of any Design-Build Document.

e) When the Contractor notifies KMDA in accordance with DBSS, the Contractor shall provide to KMDA one copy of the "as built Designs, Drawings/Documents" in reproducible form showing the exact as built locations, sizes and details of the Sewerage Network and the Design-Build Services as executed. The Sewerage Network shall not be considered to have reached Completion for the purposes of DBSS until such Design-Build Documents have been provided. The Contractor shall update the as built Designs, Build Drawings/Documents as necessary for the correction of defects or deficiencies contemplated by DBSS.

2.1.5 Design Considerations

In preparing the design for the Sewerage System and all allied works and the Design-Build Documents, the Contractor shall,

i. Protect public health and safety, including by the means set out in DBSS

ii. Consider the existing infrastructure and the Sewerage Network to be connected with the Trunk infrastructure.

iii. Consider the existing structures and Pumping facility at the proposed SPS site (if any).

iv. Ensure the Sewerage Network and all allied works has the capacity to accommodate the anticipated sewage based upon the verifications prepared by the Contractor pursuant to DBSS;

2.2 Implementation Responsibilities – On Site Issues

In preparing the design for the Sewerage Network and the Design-Build Documents, the Contractor shall ensure that the design,

i. makes adequate preparation and plans to ensure traffic movement and safety during the laying of the network, connecting service connections and construction of pumping stations.

ii. makes adequate preparation and plans and takes adequate measures for controlling access to the Sewage Pumping Station (SPS) site by animals and humans and vehicular traffic at the perimeter of the SPS site, including plans for plantings and vegetation, fencing, lockable gates at vehicular access points, and the creation of an internal (perimeter access corridor inside or, with appropriate local and other approvals, surrounding the Site;

iii. allied works like control valves chambers, anchor /thrust /pedestal blocks, internal access roads within the site and proposed units within the SPS site;

iv. provides utilities services at the SPS site such as electricity, telephone, potable water, non-potable water and sewage collection and disposal.

2.3 Sewerage Network Layout and operation sequence

The Contractor shall be responsible for the planning and designing of the area along the Sewerage Network and the Sewage Pumping Stations (SPS), including,

a) Design and Construction of 1 No. SPS, 3 Nos. UGLS and specified allied works and redesign and construction of 44 Km. long Sewerage Network, and all allied /ancillary works. Contractor shall verify these details as per site condition.

An interception & diversion [I & D] scheme had been executed under Ganga Action Plan (GAP)-phase-II, under Khardah Municipality, in view to intercept & diverts the contaminated dry weather flows of the city drains to sewage treatment plants and after treatment of the raw sewage, the same is discharged into the river.

Desilting and Hydro mechanical cleaning of the existing Sewer Lines, if the same are to be used and connected in the proposed network.

Scope of Civil works at existing L.S (Sewage Pumping Station)

In this proposed scheme under AMRUT, it is decided to reuse the existing pump house over sump and other building of LS constructed under GAP.

1) It observed that invert level of proposed sewer network is much deeper than existing sewer network, so the existing sump well and screen chamber / inlet chamber of L.S will not be utilised in the proposed scheme. A new deeper sump along with inlet chamber at L.S. shall be constructed in the left out area within the boundary premises of existing site.

2) Repair and renovation needs to be execute for all the building of existing lifting station in accordance with technical specification laid down in schedule 7 are as follows:

- Roof treatment is required for the pump house and other building structure in the said premises.
- Rain water pipe should be installed with PVC pipe.
- Parapet wall should be constructed.

- Existing Plaster of inside and outside of the building should be worn out and new plaster should be done.
- Painting for inside and outside of the building should be done properly as per technical specification.
- Dismantling of all existing windows and it should be replaced by new window with glass as per technical specification.
- Dismantling of all existing rolling shutter and it should be replaced by new one, as per technical specification / as per direction of Engineer-in-charge.
- Existing Plaster of inside and outside of the boundary wall should be worn out and new plaster should be done.
- Painting for inside and outside of the boundary wall should be done properly as per direction of Engineer-in-charge.
- Front gate for L.S should be replaced.
- One new toilet block and water closet will be constructed with arrangements of piped water supply from overhead tank which shall be constructed over pump house.
- A ladder shall be constructed for accessing the roof of the building
- Scope of Mechanical and Electrical works at existing L.S.:
- Repair and renovation needs to be execute for all the building of existing lifting station of L.S in accordance with technical specification laid down in schedule 10 are as follows:
- Capacity and head of proposed pump sets are totally different from existing pump set. So the existing pumps will be replaced with new capacity pumps including rising main made of Ductile Iron (class K-7) in proposed scheme. All existing pumps and other material should be handed over to the owner. Existing sluice gate, valves, manual screen and other fittings are totally damage; it cannot be use further and will be replaced by new items.
- Health condition of Chain pulley block and Crane girder needs to assess for reuse over new sump well. If the old one is used over the newly constructed wet well or old sump then Painting shall be done over Chain pulley block and Crain girder as per technical specification before reinstalling / reusing the same. The crane girder &Chain pulley block shall be covered under shed.
- Internal & external electric wiring, bulbs, fans, switch board, LT panel and all the existing lighting work, including wiring should be replaced by new one if required as per design.

b) Selection, adoption and detailed engineering designs for the most appropriate techno economically feasible cost effective pumping configuration, network alignment and network installation process ensuring that the sewerage system meets with the standards prescribed by the MOEF / CPHEEO / CPCB as may be applicable.

c) On completion of defect liability period, the Contractor shall have to handover the facilities to KMDA in full working condition, as it was on the date of commissioning of the Sewerage Network.

d) Design and construction including getting necessary approvals from the concerned public authorities for installation of sewerage network on road crossings, railway line crossings etc.; KMDA shall assist in facilitating such approvals as and when so requested by the Contractor.

e) Plans for disposal of excavated earth in a safe and environmentally compliant manner.

f) Relocation of services within the network layout and restoration of roads, including approvals for relocation of the services from respective Authorities,

g) Plans for rehabilitation of excavated area / roads to its original condition,

h) Plans for the traffic diversion, clearing and excavation of land, disposal of excavated soil, dewatering, debris and other material at the SPS area; Site clearance, site surveys, topographical surveys, soil investigation, submission of process design and hydraulic design calculations, network alignment and SPS lay outs, hydraulic flow diagram (Process & Instrumentation diagram), preparation & submission of specific detailed Environmental Management Plan for the contract Impact Assessment report that complies to the requirements of Environmental Management Plan 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 and laying of Sewerage Network and all allied /ancillary works of required capacity as per approved designs, testing, commissioning, performance testing of process units & trial run.

i) landscaping of SPS area, internal roads with access to all units, illumination of the entire SPS site, pathways, storm water drainage, compound wall all around & gates, administrative building including store house for tools and spares in the proposed as well as existing SPS.

j) Preparation of BOQ in accordance with this Contract to the satisfaction of KMDA.

k) O&M manual and as-built drawings for all civil, electrical & mechanical works.

l) Supply and providing safety equipment 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.

m) Mobilizing necessary sewer cleaning equipment and maintaining such equipment for timely maintenance of sewer network

n) The Contractor shall train KMDA's selected staff for on job training during the specified 3 months of trail run period. A Maximum of Fifteen (15) staff of KMDA/concern Municipal staff will be trained for a total period of 45 days.

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 KMDA.

For Network

2.1. Other Design Responsibilities

The Contractor shall carry out the following Design or Design-related responsibilities:

a. the Contractor shall prepare plans and Designs for all temporary works as required by the Contractor's Design and as required by the Contract

b. the Contractors shall prepare plans and Designs for landscaping of the site;

c. the Contractor shall prepare plans and Designs for the acquisition of all data and information necessary to prepare the Design, including, but not limited to, any intrusive site investigations,

off-site surveys and environmental baseline monitoring required or contemplated under the Contract; and

d. The Contractor shall prepare detailed plans and methodologies for the testing and inspection of the Plant and Equipment.

ARTICLE 3. BUILDING AND CONSTRUCTION SERVICES

3.1. General

a. The Contractor shall carry out all building, refurbishment and Sewerage Network pursuant to Articles of DBSS

b. The Contractor shall provide all of the demolition, excavation, building, co-ordination, repair, warranty, review, inspection, testing, quality assurance and control, monitoring, scheduling, clean-up etc. for connecting incoming sewage network, construction of the Sewerage Network and all appurtenant structures and allied works as contemplated by Design-Build Documents.

c. The Contractor shall effectively direct and supervise these services so as to ensure conformity with the Design-Build Documents.

d. The Contractor shall be solely responsible for installation methodology, construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the Design-Build Services under the Contract.

e. Unless agreed with KMDA, the Contractor has to establish casting RCC pipes; preferably using vertical casting method within the vicinity of the site of construction. Generally, procurement of RCC sewer lines from outside manufacturers is discouraged. KMDA will only consider request for procurement from outside only on cases where quantity required is not viable for setting up a plant.

3.2. Procurement and Transportation

a. Subject to GC Section, the Contractor shall procure and transport all the equipment in an expeditious and orderly manner to the Site.

b. The Contractors shall at its own risk and expense for transport all equipment, to the site.

c. The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of Equipment, to the Site. The Contractor shall indemnify and hold harmless KMDA from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the to the Site.

d. The Contractor shall, at its own expense, handle all imported Equipment, at the point(s) of import and shall handle any formalities for customs clearance. If the Applicable Law requires any application or act to be made by or in the name of KMDA, KMDA shall take all necessary steps to comply with such Applicable Law. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GC Section 2.3.4.

3.2.1. Temporary Supports, Structures and Utility Services

a. The Contractor shall have the sole responsibility for the Design, erection, operation, maintenance, and removal of temporary supports, structures and utility services and the Design and execution of construction methods required in their use.

b. The Contractor shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform those functions referred to in DBSS where required by law or by the Design- Build Documents and in all cases where such temporary supports, structures and utility services and their Designs and method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results

3.2.2. Document Review

The Contractor shall review the Design-Build Documents and shall report promptly to KMDA any error, inconsistency or omission the Contractor may discover. If the Contractor does discover any error, inconsistency or omission in the Design-Build Documents, the Contractor shall not proceed with the work affected until the Contractor has corrected any such errors or inconsistency or supplied any missing information and these corrections have been approved in writing by KMDA.

3.2.3. Plant and Equipment

a. The Contractor shall provide and pay for labor, Plant and Equipment, tools, construction and maintenance machinery and equipment, materials and supplies, water, heat, light, power, transportation, and all other facilities and services necessary for the performance of the Design-Build Services in accordance with the Design-Build Documents.

b. The Contractor shall ensure that all Plant and Equipment provided are new. Plant and Equipment which are not specified shall be of a quality consistent with those specified and their use shall be acceptable to KMDA.

3.2.4. Documents at the Site

The Contractor shall keep one copy of the Design-Build Documents as up-dated, submittals, reports and records of meetings at the Site, in good order and shall make them available to KMDA upon request and at any reasonable time.

For Network

Alignment and Setting Out

a) The Contractor shall be responsible for the true and appropriate alignment of the network and setting-out of the Site and the Sewage pumping Station in relation to benchmarks, reference marks, existing Infrastructure and lines specified in the Design-Build Documents.

b) If, at any time during the construction of the Sewerage Network/ pumping stations etc., any error shall appear in the position, level or alignment of the network or any of its components, the Contractor shall forthwith notify KMDA of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of KMDA.

3.2.5. Quality Assurance

a. The Contractor shall institute a quality assurance system to ensure compliance with the requirements of the DBSS. Compliance with the quality assurance system shall not relieve the Contractor of its duties, obligations or responsibilities.

b. The Contractor shall submit for approval details of all quality assurance procedures and documents relating to Contractor's compliance with the quality assurance system to theKMDA before each stage of the Design-Build Services is commenced as set out in the Time Schedule. When any document is issued to KMDA, it shall be accompanied by the signed quality statements for such document, if any. KMDA may audit any aspect of the quality assurance system and the Contractor shall take any corrective action as KMDA may deem appropriate.

3.2.6. Contractor's Access Routes and Rights of Way during the Design-Build Period

a. The Contractor shall satisfy itself as to the suitability and availability of the access routes it chooses to use during the Design-Build Period for access to and from the Site. He shall, as between the Parties, be responsible for the maintenance of access routes during the Design-Build Period. KMDA will not be responsible for any claims which may arise from the use or otherwise of any access route. KMDA does not guarantee the suitability or availability of any particular access route, and will not entertain any claim for any non-suitability or non-availability for continuous use, during the Design-Build Period, of any such route.

b. The Contractor shall bear all costs and charges for special or temporary rights-of- way required by it for access to the Site. The Contractor shall also provide, at its own cost, any additional facilities outside the Site if required by it for the purposes of the Design-Build Services.

3.2.7. Site Regulations and Safety

a. The Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. He shall prepare and submit to KMDA, proposed Site regulations for KMDA's approval, which approval shall not be unreasonably withheld. Such Site regulations shall include rules in respect of security, safety of Plant, gate control, sanitation, medical care, emergency preparedness, emergency response, on-site safety training of employees and fire prevention.

b. The Contractor shall comply with all applicable safety regulations in providing the Design-Build Services and in occupying any part of the Site, Unless otherwise stated in the Design-Build Documents, the Contractor shall, during the Design- Build Period, provide secure fencing, lighting, guarding and watching; provide temporary roadways, footways, guards and fences which may be necessary for the accommodation and protection of its employees, Site visitors, KMDAs and occupiers of adjacent land, the public and others; carry out safety briefings of applicable site regulations to all employees, Sub-contractors, agents, representatives and visitors to the Site prior to permitting first access of the applicable person to the and at regular intervals thereafter.

c. During the Design-Build Period, the Contractor shall develop and implement a comprehensive occupational health and safety program for the protection of the Contractor's Personnel and all other persons who may attend at the site. The program shall include a description of how the Contractor will,

i. carry out all occupational health and safety responsibilities in respect of the laying of sewerage network as required under the Applicable Law;

ii. develop and manage all required occupational health and safety reporting procedures; and

iii. manage all occupational health and safety claims.

3.2.8. Contractor's Equipment (Design-Build) and Site Clearance

a. All Contractor's Equipment (Design-Build) brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without KMDA's consent that such Contractor's Equipment (Design-Build) is no longer required for the execution of the Contract.

b. The Contractor shall maintain the site of construction and installation in a tidy condition and free from the accumulation of waste products and debris. The Contractor shall remove waste products and debris resulting from the construction / laying and shall leave the Facility clean and suitable for occupancy and performance of the Operations Services before attainment of Substantial Completion. The Contractor shall remove products, tools, construction machinery, and equipment, including the Contractor's Equipment (Design-Build), not required for the performance of the remaining Design-Build Services.

c. Prior to notifying KMDA pursuant to DBSS 6.2(1), the Contractor shall remove products, tools, construction machinery and equipment, and waste products and debris, including the Contractor's Equipment (Design-Build).

d. Upon the issue of any Completion Certificate, the Contractor shall clear away and remove, from the site, all Contractors' Equipment (Design-Build), surplus material, wreckage, rubbish and temporary work or structures. The Contractor shall ensure that the site is in a clean and safe condition to the satisfaction of KMDA.

e. If the Contractor fails to remove, no later than 30 days after the issue of the Completion Certificate, any remaining Contractor's Equipment (Design-Build), surplus material, wreckage, rubbish and temporary work or structures, KMDA may sell or otherwise dispose of such items. KMDA shall be entitled to retain, from the proceeds of such sale, a sum sufficient to meet the costs incurred in connection with the sale or disposal, and in restoring the area around the STP, Sewerage Network and SPS sites. Any balance of the proceeds shall be paid to the Contractor. If the proceeds of the sale are insufficient to meet KMDA's costs, the outstanding balance shall be recoverable from the Contractor by KMDA.

f. KMDA will, if requested, use reasonable efforts to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment (Design-Build) imported by the Contractor solely for use in the execution of the Contract that is no longer required for the execution of the Contract.

3.2.9. Protection of the Environment

a. The Contractor shall take all reasonable steps to protect the environment, both on and off the Site, and to limit damage and nuisance to people and property resulting from pollution, noise, dust and other results of its Services, including,

1. adopting working practices that prevent or minimize the transfer of any pollutant off-site; maintaining the access roads in good repair;
2. using appropriate dust suppressant methods;
3. restricting trucking and loud machinery and equipment use to daylight hours;

4. using mufflers, silencers and other appropriate methods to minimize the noise of the construction;
5. Maintaining clean STP and SPS sites, that are free of garbage.

b. The Contractor shall, at all times during building and construction, ensure that the Environmental Management Plan is fully complied and measures recommended in Environmental and Social Impact Assessment Study for the project are implemented.

3.2.10. Emergency Work

a. If, by reason of an emergency arising in connection with and during the execution of the Design-Build Services, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Sewerage Network infrastructure, the Contractor shall immediately carry out such work.

b. If the Contractor is unable or unwilling to do such work immediately, KMDA may do or cause such work to be done as KMDA may determine is necessary in order to prevent damage to the Sewerage Infrastructure. In such event KMDA shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefore. If the work done or caused to be done by KMDA is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by KMDA in connection therewith shall be paid by the Contractor to KMDA.

ARTICLE 4. TEST AND INSPECTION

4.1. Tests and Inspection

a. The Contractor shall at its own expense carry out at the place of manufacture or on the Site all such tests and inspections of the Plant & Equipment. The Contractor shall, in addition to those tests and inspections set out in the Contract, develop a plan for all testing and inspection of the equipment that is required in order to complete Sewerage Network in accordance with the Technical Standards Schedule and implement such quality assurance plan.

b. The Contractor shall undertake such tests towards the Sewerage Network (sewers, man-holes etc.) so as to ascertain the attainment of self-cleansing velocity, leakage and completeness of the Sewerage Network.

c. KMDA or their designated representatives shall be entitled to attend any test or inspection, provided that the Contractor shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

d. Whenever the Contractor is ready to carry out any test or inspection, the Contractor shall give a reasonable advance notice of such test or inspection and of the place and time thereof to KMDA. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable KMDA or their designated representatives to attend the test or inspection.

e. The Contractor shall provide KMDA with a certified report of the results of any test or inspection. The Contractor will also maintain photographic records with coordinates of all construction activities and use it in support of quality of construction and to support payments –

more importantly shoring, bedding, bailing of water etc. have to be supported by photographic evidence with proper referencing.

f. If KMDA, or their designated representatives, fails to attend the test or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test or inspection in the absence of such persons, and shall provide KMDA with a certified report of the results thereof.

g. KMDA may require the Contractor to carry out any test or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test or inspection shall be added to the Contract Price. Further, if such test or inspection impedes the progress of work on the Sewerage Network or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

h. If any Plant and Equipment or any part of the Sewerage Network fails to pass any test or inspection, the Contractor shall either rectify or replace such Plant and Equipment or part of the Sewerage Network and shall repeat the test or inspection upon giving a notice under DBSS Section 5.1(3).

i. The Contractor shall give KMDA, at KMDA's expense, access at any reasonable time to any part of the Sewerage Network or any place where the Plant and Equipment are being manufactured or installed in the Sewerage Network, in order to inspect the progress of the work and the manner of manufacture or installation, provided that KMDA shall give the Contractor a reasonable prior notice.

j. The Contractor agrees that neither the execution of a test or inspection of Plant and Equipment or any part of the Site, Sewerage Network, nor the attendance by KMDA, nor the issue of any test certificate pursuant to DBSS, shall release the Contractor from any other responsibilities under the Contract.

k. No part of the Sewerage Network and Pumping Stations and foundations shall be covered up on the Site without the Contractor carrying out any test or inspection required under the Contract. The Contractor shall give a reasonable notice to KMDA whenever any such part of the plant or foundations is ready or about to be ready for test or inspection; such test or inspection and notice thereof shall be subject to the requirements of the Contract.

ARTICLE 5. COMPLETION OF SEWERAGE NETWORK

5.1. Monthly Progress Notice

a. The Contractor shall submit to KMDA after the end of each month six copies, each signed by the Contractor's Representative named in accordance with GC Section, a notice (the "Monthly Progress Notice") in such form as KMDA may from time to time prescribe, showing the percentage of completion that the Contractor considers it has effected in the preceding month, in respect of the Design-Build Services.

b. KMDA shall, no later than 30 days after receipt of the Monthly Progress Notice, deliver to KMDA a statement (the " Engineer-in-Charge's Statement") indicating, separately, the percentage of completion of the Design-Build Services with documentary evidence such as photographs etc. that KMDA considers the Contractor has effected in the applicable month.

c. If KMDA notifies the Contractor of any defects or deficiencies, or both, in any of the Design-Build Services, the Contractor shall then correct the defects or deficiencies, and shall repeat the procedure described in DBSS.

5.2. Completion

a) As soon as the Design-Build Services have, in the opinion of the Contractor, been completed in accordance with the Technical Standards Schedule (including restoration of services and roads cut to lay sewer lines), excluding minor items not materially affecting the operation or safety of the Sewerage Network, has satisfactorily passed all Tests on Completion as set out in DBSS and Technical Standards Schedule, the Contractor shall so notify KMDA in writing (the "Notice of Completion") and provide the as-built Design-Build Documents referred to in DBSS. It may be true that at times, parts of the networks are commissioned and hence such completion should be notified to KMDA. However, final completion has to cover all such part commissioned networks. Operation of such commissioned sub-networks shall be the responsibility of the Contractor.

b) KMDA shall, no later than 30 days after receipt of the Contractor's notice under DBSS Section either issue a Completion Certificate stating that the Sewerage Network has reached Completion as of the date of the Contractor's notice under DBSS Section, or notify the Contractor in writing of any defects or deficiencies or both.

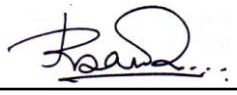
c) If KMDA is not satisfied that the Design-Build Services are complete, KMDA shall notify the Contractor in writing of any defects or deficiencies no later than 30 days after receipt of the Notice of Completion.

d) If KMDA notifies the Contractor of any defects or deficiencies or both, the Contractor shall then correct such defects or deficiencies, and shall repeat the procedure described in DBSS.

e) If KMDA is satisfied that the Design-Build Services have reached Completion, KMDA shall, no later than 30 days after receipt of the Contractor's repeated Notice of Completion, issue a Completion Certificate stating that the Design-Build Services have reached Completion as of the date of the Contractor's repeated Notice of Completion.

f) If KMDA fails to issue the Completion Certificate and fails to inform the Contractor of any defects or deficiencies 30 days after receipt of the Notice of Completion or 30 days after receipt of the Contractor's repeated Notice of Completion, then the Design- Build Services shall be deemed to have reached Completion as of the date of the Notice of Completion or repeated Notice of Completion as the case may be.

g) As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Sewerage Network are fully in accordance with the requirements of the Contract, failing which KMDA will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.



ARTICLE 6. COMMISSIONING AND OPERATIONAL ACCEPTANCE

6.1. Commissioning

Commissioning of the Sewerage Network shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Engineer-in-Charge, pursuant to DBSS or immediately after issue of the deemed Completion, under DBSS.

6.2. Tests on Commissioning

a. The Tests on Commissioning as set out the Technical Standards Schedule, and repeats thereof, shall be conducted by the Contractor during Commissioning of the Sewerage Network and all allied works to ascertain whether the Sewerage Network or the relevant part can attain the technical standards as required in the contract. The Contractor's and Engineer-in-Charge's advisory personnel shall attend the Tests on Commissioning, and shall advise and assist KMDA. KMDA shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Tests on Commissioning, and any repeats thereof.

b. If for reasons not attributable to the Contractor, the Tests on Commissioning of the Sewerage Network cannot be successfully completed within 21 days after the period from the date of Completion specified in the SCC or any other period agreed upon by KMDA and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Tests on Commissioning.

6.3. Operational Acceptance

a. Operational Acceptance shall occur in respect of the Sewerage Network when the Tests on Commissioning have been successfully completed.

b. The Contractor shall be responsible to obtain consent to operate in compliance to consent to establish from WBPCB / CPCB.

c. At any time after the successful completion of the Tests on Commissioning, the Contractor may give a notice to KMDA requesting the issue of an Operational Acceptance Certificate in respect of the Sewerage Network.

d. KMDA shall, after consultation with ULB, and no later than 30 days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

e. If within 30 days after receipt of the Contractor's notice, KMDA fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why KMDA has not issued the Operational Acceptance Certificate, the Sewerage Network shall be deemed to have been accepted as of the date of the Contractor's said notice.

ARTICLE 7. REPORTING DURING THE DESIGN-BUILD PERIOD

7.1. Design-Build Progress Reports

a. The Contractor shall prepare monthly progress reports of the Design-Build Services during the Design-Build Period and submit six copies of the reports to the Engineer-in-Charge. The first report shall cover the period up to the end of the calendar month after that in which the Design-Build Starting Date occurred and reports shall be submitted monthly thereafter, each no later than 14 days after the last day of the month to which it applies.

b. The Design-Build Services monthly reports shall include the following information:

1. photographs and detailed descriptions of progress, including each stage of design, procurement, manufacture, delivery to the Sewerage Network site, construction, laying, erection, testing and commissioning;
2. charts showing the status of Design-Build Documents, purchase orders, manufacture and construction;
3. for the manufacture of each main item, equipment, machinery, floor or component of the Sewerage Network, the name of manufacturer, manufacture location, percentage progress, and the actual or expected dates of commencement of manufacture, Contractor's inspections, tests and delivery relating thereto;
4. detailed records of the Contractor's Personnel and Contractor's Equipment (Design- Build) on the Sewerage Network and the actual usage of the Contractor's Equipment (Design- Build) during the reporting period and the tasks performed by the Contractor's Personnel;
5. copies of quality assurance documents, test results and certificates of the Plant and Equipment;
6. all monitoring results;
7. safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations;
8. percentage completion achieved compared with the planned percentage completion for each activity; and
9. Where any activity is behind in the scheduled completion, comments and likely consequences and a description of the corrective action being taken.

7.2. Replacement of Key Staff to be deployed by the Contractor during the Design build period.

If replacement of any Key Staff during design & build services period becomes necessary, the Contractor shall submit a proposal for KMDA's approval, advising therein the name of the replacement staff of equivalent or higher qualifications duly supported by his CV.

The overlap period of the new key staff and the staff to be replaced shall be minimum of one month.

Schedule 3
SITE AND SITE AREA

1. INTRODUCTION : The Khardah Municipality

The Khardah town is situated 24 km North of Kolkata and falls within the extended urban region of Kolkata Metropolitan Area (KMA), is presently populated by about 141 thousand people (projected 2011). This is an old town and has historical & religious significance. It is located in the northern fringe of the district of North 24 Parganas. Khardah Municipality constituted in 1920, is one of the oldest Municipalities in West Bengal. The town also has cultural heritage linked with river Hooghly.

In proposed system, laterals are proposed along the roads to connect sewage from Individual houses and it is connected to branch sewers. Branch sewers are joined to trunk sewers.

The municipality initially established in 1920, started with an area of 0.95 sq. km and a population of 6000 only. At present with a total area of 6.87 km², Municipality serves an approximate population of 116470 (2001 census) and 111130 (2011 census). The area is divided into 22 municipal wards.

Geographical Location

Khardah is located at 22°43′7″ N to 88°22′41″E. It has an average elevation of 6.7 meters (20 feet). It is located at a distance of 24 km from Kolkata proper and north of Sealdah Ranaghat main line of Eastern Rly. The administrative boundaries of Khardah are as follows:

- In West : River Hooghly
- In East : Bandipur & Patulia GP
- In South : Panihati Municipality
- In North : Titagarh Municipality

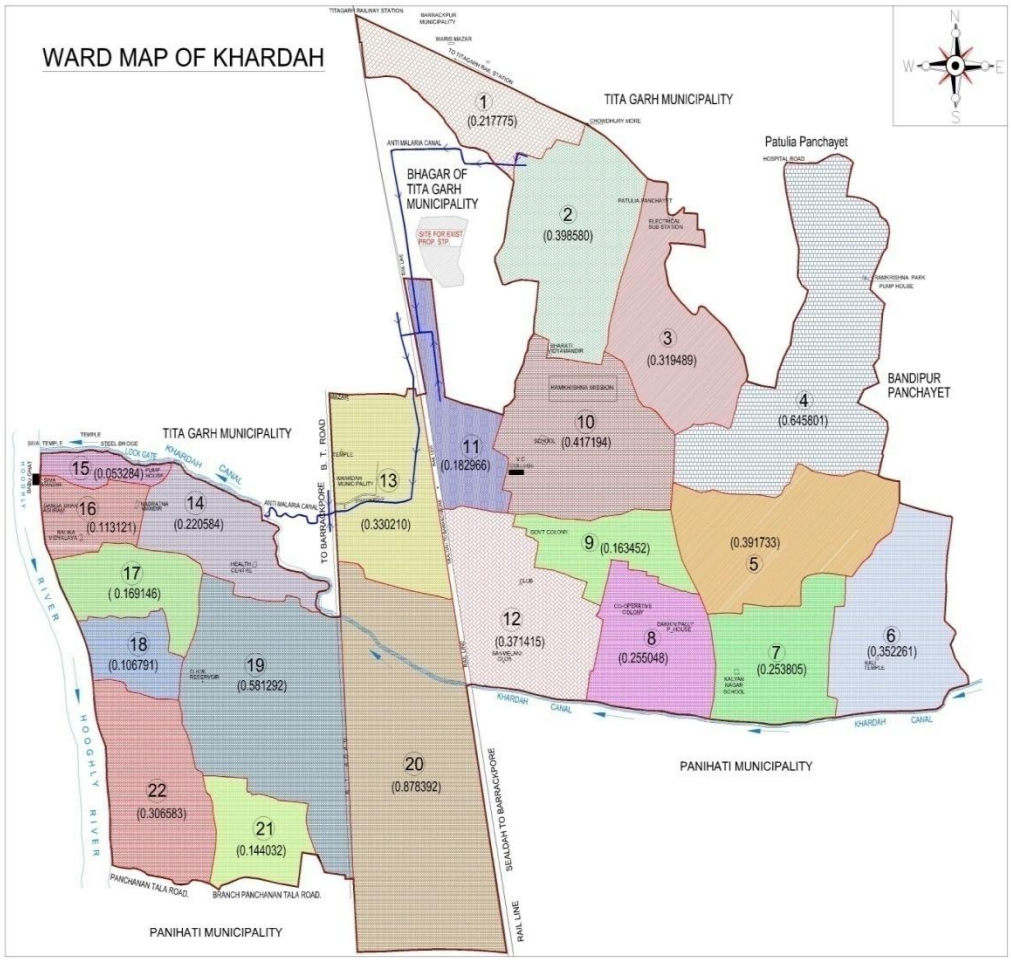
Anti-malaria Khal and Khardah Khal are receiving water body which in turn drains to river Hooghly (Ganga). The terrain of the entire town is of flat nature.

Khardah is a town within the Kolkata Metropolitan area and is well linked by rail and road with the metro core. The town has direct railway links with its region in north and south. The Eastern railway Sealdah – Ranaghat section passes through Khardah railway station. The major road links viz. B.T.Road directly connects this town with the region. Completion of DumDum – Barrackpore Expressway and Belghoria Expressway will open up further linkage significantly. Introduction of Belghoria-Expressway will make the connectivity between Netaji Subhash International Airport and Khardah much easier and quicker.

Topography

The town is almost plain in general, gently sloping towards railway line. The levels in the town range from 6 to 9 m above MSL. The town is divided in two zones. The Eastern Zone is to the east of Sealdah to Barrackpore Railway line and the Western Zone is to the west of same railway track

to river Hoogly. The eastern zone slopes towards the railway line from east and the western zone slopes from River Hoogly to same railway track.



Projected Population & Sewage Loads

As suggested by the implementing agency, the expected year of commissioning of the project is considered as 2016. The population is projected for the next 30 years (the design period of sewer lines) and the sewage load is calculated with an interception factor of 80% of the per capita daily water supply of 135 litres.

Population:

Base Year	2016	120984
STP Design	2026	140691
Mid-Year	2031	150544
Design Year	2046	180105

The expected sewage generation is as below:

Sewage:

Base Year	2016	13.07mld
STP Design	2026	15.20mld
Mid-Year	2031	16.30mld
Design Year	2046	19.45mld

Existing Sewerage System

The one treatment unit was introduced in the town under Ganga Action Plan for Interception & Diversion (I&D) of city drains with the view to stabilize the sewage BOD loads before it goes to river Ganga. In Ganga Action Plan around 4.15 Kms of interception and diversion sewer line of 300 to 600 mm dia NP3 pipe were laid in Khardah Municipal area. Apart from that there are one Main Pumping station and one STPs; One Oxidation pond of 3.0 MLD is fed by MPS in Titagarh municipality.

Proposals

The Khardah town has been divided in 6 sewerage zones and 2 sewerage districts A and B. Sewerage District – A covers the zones 1&2. It is left side of railway line. Sewerage District B covers zones 3, 4, 5. It is right side of railway line.

The wastewater of District A & B is collected at proposed MPS with the help of 3nosnew lifting stations LS-1, LS-2, LS-3, one existing LS and 5 underground L.S and 1 MPS on the existing STP site in Titagarh Municipality area. The sewage of this district is treated in a proposed compact STP of 16 MLD (2031) proposed at existing STP site. And the effluent is disposed of in Anti Malaria Khal. Since the 1.0 Ha land is occupied by the existing 3 MLD STP at Titagarh Municipality. The proposed STP of 19.45 MLD (2046) will be constructed at this land with the help of higher technology that required less place.

The wastewater of district A, covering zone 1 & 2, is collected at LS-1 and LS-2 and crossed the BT road and railway line by forced main.

The wastewater of district B, covering zone 3, 4, 5 are collected at proposed MPS with the help of LS-3, LS-4(ext) and 4 underground L.S.

The present location of STP is almost in north part of the city and sewers from south areas are to be carried to the STP. The sizes vary from 150 to 1000 mm in shallower depths up to 6.0 meters in general.

Under Ganga Action Plan, KMWSA implemented some interception and diversion sewer with sewage pumping stations to tap some major drains discharging to Kharda Canal and a low cost STP of WSP type. Length of such network is about 4.15km.

Sewerage district A covers the zone 1 & 2. The wastewater of zone 1, covering wards from 14,15,16,17,18,19,21 & 22, is collected at UGLS 1 and LS-1 located at ward no 19 adjacent and then pumped to zone 2 by pumping main. Wastewater of zone 2, covering wards 13 & 20, is collected at LS-2 located at ward no 20 adjacent to railway line/ Khardah Khal and pumped by forced main crossing the railway line and finally discharged in manhole (right side of railway line) of

trunk line in ward no 12. The flow of zone 3 is collected at UGLS2/LS-3 located at ward 9 and beside the Old Kolkata Road. The waste water flow of zone 4 is collected at Existing LS-4 with help of three underground lifting stations and pumped further to nearest manhole. Utilization of existing asset by proposed another deeper sump and screen chamber in the boundary of existing L.S. The combined flow of zone 1 & 2 along flow of zone 3, 4 is collected at existing MPS site located at existing STP site.

Schedule 4

PRICE SCHEDULE

To be filled up by the bidder which is attached separately.

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

Schedule 5
TERMS AND PROCEDURE OF PAYMENT

1. 1 Mobilisation Advance:

Mobilisation advance, not exceeding 10% of the contract value, may be given if requested by the Contractor in writing within one month of the order to commence the work. Such advance shall be paid in two equal installments. The first installment of such advance shall be released on a request made by the contractor to the Engineer-In-Charge in this behalf. The second installment shall be released by the Engineer-In-Charge only after the Contractor furnishes proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer-In-Charge. Before any installment of advance is released, the contractor shall furnish Bank Guarantee Bonds aggregating to 110% of the installment amount and not exceeding three in numbers from any Nationalized/schedule Bank. The Bank Guarantee Bonds furnished shall be initially valid for the full contract period. If the contract period gets extended due to any reason, the Bank Guarantee Bonds shall be kept renewed from time to time to cover the balance amount to be recovered together with interest @ 10% and valid for the likely period of complete recovery. The Bank Guarantee Bonds shall be discharged progressively depending upon the amount of mobilization advance along with interest.

- **Interest & Recovery**

The mobilization advance bears simple interest @ 10% per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by deduction from the Contractor's bill commencing after first ten percent of the gross value of the work is executed and paid on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time 8% of the gross value of the contract is executed and paid together with interest due on the entire outstanding amount up to the date of recovery of the instalment. Recovery of advance at any intermediate stage shall be affected, if necessary, by encashment of part bank Guarantees if the appropriate pro-rata amount of advance is not available from the work done by the Contractor.

1.2 Secured Advance:

Secured Advance for the following non-perishable materials brought to site:
Network – pipes, transformers, motor, starters, and DG Set;

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

a. STP – DG Set, pumps, motors, and transformers subject to acceptance of the rate by the Engineer-in-Charge; and

b. SPS - DG Set, pumps, and motors subject to acceptance of the rate by the Engineer-in-Charge.

Secured advance will be limited to 75% of invoice value or market value whichever is lower and will be subject to following conditions:

a. The quantities of materials are not excessive and shall be used within a reasonable time (not exceeding 3 months) as determined by KMDA.

b. The materials are in accordance with the specifications.

c. The materials have been delivered to site and are properly stored and protected against damage or deterioration to the satisfaction of KMDA.

d. The Contractor's records of the requirement, orders, receipt and use of materials are kept in a form approved by KMDA and such records shall be available for inspection by KMDA.

e. 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 KMDA, for the purpose of valuation of material and providing evidence of KMDA-ship and payment thereof.

f. KMDA-ship of such materials shall be deemed to vest in KMDA for which the Contractor has submitted an indemnity bond in an acceptable format.

1. Repayment of Secured advance:

The secured advance shall be repaid from each succeeding monthly payments to the extent the materials (for which advance was previously paid) have been incorporated into the works.

2. Payment of Design-Build Price (Network)

a. The Contractor shall submit to the Engineer-in-Charge monthly statements of the value of the work completed less the cumulative amount certified previously along with details of measurement of the quantity of works executed in a tabulated form as approved by the Engineer-in-Charge. The Engineer - in - Charge will follow respective State's Public Works Department procedures such as measurement, check measurements, approving deviations etc. and certify such invoices for payment. Further, a third party QA Consultants will also review invoices, photographic evidence for all the works, more importantly for shuttering, bedding, manholes, depth of cutting etc. that are not visible for future verification; conduct tests where required and certify the invoices.

The Contractor shall include in the Monthly Statements only such items of works which are described in the 'Payment Break-up Schedule' appended at the end of this Schedule 6, provided such items have been completed during the month.

b. The Engineer-in-Charge shall check the details given in the Contractor's monthly statement and certify the amounts to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amount and under conditions set forth in Bid Document above, deductions for advance payments, secured advance,

other recoveries, and other adjustments in terms of the contract and deduction of taxes at source, as applicable under the law.

c. The value of work executed shall be determined by the Engineer-in-Charge-in-charge after due check measurement of the quantities claimed as executed by the Contractor, and only such items of works included in the Monthly Statement will qualify for verification/payment if these have been identified as such in the 'Payment Break-up Schedule' appended at the end of this Schedule. For items of works not covered in the said 'Break-up Schedule', payment as per rate quoted and quantity executed shall be verified for payment.

d. The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.

e. The value of work executed shall include the valuation of Variations.

f. The Engineer-in-Charge-in-charge 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.

3. Payment of Electricity Dues

a. KMDA shall assist the Contractor on best effort basis in obtaining such electricity required for the implementation of the Project (including Construction Period and Operation Period) and such assistance shall be subject to the terms and conditions as provided in this Clause.The security deposit for power connection to relevant utility shall be paid by the Contractor and it will be reimbursed by KMDA after producing the original receipt of the same.

b. The Parties hereby agree that the Bill for electricity usage by the Sewage Treatment Plant and SPSs (if applicable) during the Operations Period (the "Electricity Dues"), shall be paid by the Contractor to the relevant utility.

4 Right to withhold:

The Engineer-in-Charge / KMDA may refuse to approve any such payment, because of subsequently discovered evidence as a result of subsequent inspections or tests, nullify any such payment previously approved and pay to such extent as may be necessary in the opinion of the Engineer - in - Charge because (a) the work is defective (b) third party claims have been filed or there is reasonable evidence indicating probability of such claims (c) of the Contractor's failure to make payment properly to sub-contractors or for labor, materials or equipment (d) of damage to another Contractor or to the property of others caused by the Contractor (e) of the Contractor's neglect or unsatisfactory proceeding of the work (f) Contractor owes a liability or a sum to KMDA.

When the grounds for withholding payments are removed, payments shall be made for amounts withheld to the extent the Contractor is entitled to payment.

FOR NETWORK

PAYMENT BREAK UP SCHEDULE OF CIVIL WORKS (EXECUTION)

NOTE: THE FOLLOWING IS A TENTATIVE BREAKUP AND SHOULD BE FINALISED BY AS PER REQUIREMENT

PART – I, SEWERAGE NETWORK : DESIGN & DRAWING

Sl. No.	Description	Percentage payment
(A)	Review the client's proposal and design, Redesign the entire Sewerage Network including preparatory Survey and Geotechnical investigation and also design all Sewage Pumping Station.	
1	Site investigation and data collection	**4%**
2	Investigation and assessment of the Asset Condition Assessment Study	
	Undertaking condition assessment of existing Sewerage network i.e. gravity sewers, rising main, Manholes and other appurtenant structures, complete as per specifications and directions of Engineer-in-charge	**4%**
	Undertaking condition assessment of existing Sewerage pumping station including civil & electro-mechanical equipment complete as per specifications and directions of Engineer-in-charge	**2%**
3	Topographical Survey & review the client's proposal	**20%**
4	Design & redesign the entire sewerage network	**40%**
5	Soil testing in proposed network alignment(selected portion) and all proposed SPS	**15%**
6	As build (completion) drawing after execution of the work	
(i)	Sewerage Network and appurtenant structure	**10%**
(ii)	SPS and appurtenant structure	**4%**
(iii)	Operation & Maintenance Manual	**1%**

PART – II, GRAVITY SEWERS LAYING OPEN CUT METHOD/ANY OTHER APPROVED METHOD

Sl. No.	Description	Component wise Percentage payment per linear meter
(A)	PROVIDING SEWER BY OPEN EXCAVATION	
1	Approval of Design & Drawing	2%
2	Dewatering where required, barricading, traffic diversion, Excavation, (excluding back filling), Timbering/Sheet piling, Bedding of pipes, Supply, laying & jointing of pipes	60%
3	Manholes	10%
4	Interconnecting of newly laid sewer with existing sewerage network if required, otherwise that percentage will be given after reinstatement of road.	3%
5	Back filling, disposal of surplus earth and Temporary reinstatement of roads	5%
6	Temporary shifting and restoration of water mains/ sewer lines & Telephone lines/ cables and other utilities	5%
	Sub-Total(A)	**85**%
(B)	TESTING & COMMISSIONING	
1	Sectional Testing	5%
2	Final Testing & Commissioning sewer	10%
	Sub: Total (B)	**15**%
	Grand Total A+B	100%

PART III SUPPLY & LAYING OF RISING MAIN BY OPEN CUT METHOD/ANY OTHER APPROVED METHOD

Sl. No.	Description	Component wise Percentage payment per linear meter
(A)	SUPPLY & LAYING OF RISING MAIN BY OPEN CUT METHOD	
1	Approval of Design & Drawing	2%
2	Supply & Laying of rising main including excavation laying jointing etc. all complete.	70%
3	Supply & Fixing of sluice valve and air valves	10%
4	Refilling of trenches with full compaction	3%
5	Disposal of surplus earth including side cleaning including temporary restoration of roads etc.	5%
	Sub-Total(A)	90%
(B)	TESTING & COMMISSIONING	
1	Final Testing & Commissioning sewer	10%
	Sub: Total (B)	10%
	Grand Total A+B	100%

Sl. No.	Description	Component wise Percentage payment per linear meter
(A)	PROVIDING SEWER BY TRENCHLESS METHOD	
1	Approval of Design & Drawing	2%
2	Supply & Laying of sewer line all complete.	70%
3	Refilling of trenches with full compaction	3%
4	Disposal of surplus earth including side cleaning including temporary restoration of roads and utility if any etc.	15%
	Sub-Total(A)	90%
(B)	TESTING & COMMISSIONING	
1	Final Testing & Commissioning sewer	10%
	Sub: Total (B)	10%
	Grand Total A+B	100%

PART IV SEWAGE PUMPING STATION

I. CONSTRUCTION OF WET WELL BY WELL SINKING METHOD

i	Approval of design & drawing	3%
ii	Initial open excavation	1%
iii	Erection & fixing of cutting shoe	5%
iv	Construction of well staining and its sinking up to 50% depth BGL	25%
v	Construction of well staining & sinking upto 100% depth BGL	26%
vi	Plugging of well, boulder filing etc.	5%
vii	R.C.C. work in bottom of well including bottom finishing with required slopes with cement concrete.	5%
viii	Walkway and plate form	5%
ix	Beam, column including fixing of gantry girder	7%
x	Stair case, M.S. ladder, grill & other miscellaneous work	3%
xi	water tightness test	5%
xii	After commissioning & trial rum	10%
	Total	100%

II. SCREEN CHANNELS

i	Approval of design & drawing	2%
ii	Construction of supporting columns	5%
iii	Constructions of base slab	18%
iv	Construction of side walls including partition wall	25%
v	Interconnection with incoming gravity sewer	5%
vi	Construction of Walkway, plate form and RCC stair case for accessibility	30%
vii	water tightness test	5%
viii	After commissioning & trial run	10%
	Total	100%

iii. VALVE CHAMBER

i	Approval of design & drawing	3%
ii	Initial open excavation	2%
iii	M-15grade -concrete	5%
iv	Construction of RCC Raft	20%
v	Construction of RCC side walls	35%
vi	Construction of cover blocks.	10%
vii	Supply and fixing of M.S. plate form for operation of sluice valve & other miscellaneous work	10%
viii	water tightness test	5%
ix	After commissioning & trial run	10%
	Total	100%

iv. INLET CHAMBER

i.	Approval of designs and drawings	2%
ii.	Excavation	2%
iii.	M15 grade concrete	5%
a	Construction of Raft footing/ pile foundation	20%
b	Construction of RCC side wall	35%
c	-Interconnection with incoming sewer	5%
d	Construction of walkway, plate form. MS ladder/Stair case for accessibility	15%
e	Water tightness test.	5%
f	After commissioning & trial run and Misc. finishing items	15%
	Total	100%

v. DISTRIBUTION CHAMBER

i	Approval of design & drawing	3%
ii	Initial open excavation	2%
iii	M-15grade concrete	5%
iv	Construction of RCC foundation	25%
v	Construction of RCC side wall	35%
vi	–Water tightness test.	15%
vii	After commissioning & trial run and Misc. finishing items	15%
	Total	100%

vi. MISC.BUILDINGS

i.	Approval of designs and drawings	2%
ii.	Excavation	2%
iii.	Sub Structure & Super structure construction	
a	Raft footing/ pile foundation/footing	7%
b	Wall up to plinth level including plinth beam	3%
c	Wall up to lintel level including lintel beam	10%
d	Wall up to slab level	5%
e	Roof slab	10%
iv.	Doors / Windows/Ventilators/Rolling shutter	
a	Supply at site	3%

b	Fixing in position	2%
v	Flooring/ cable trunk	5%
vi	Plastering	5%
viii	Painting/ varnishing	5%
ix	Water supply & Sanitary fittings.	12.50%
x	Stair case	6%
xii	Internal electrification.	12.50%
xiii	Commissioning including site clearance & Misc. finishing items	10%
	Total	100%

PART- V ROAD REINSTATEMENT

A. Bituminous Roads

1. Up to WBM /WMM level 55%
2. WBM to load bearing crust level 35%
3. Testing of road after one year maintenance 10%

B. Cement Concrete Roads

1. Up to BOE level 15%
2. Up to M 10 grade Base Concrete 30%
3. Up to finished level with M20 grade cement concrete 45%
4. Testing of road after one year maintenance 10%

C. Interlocking tiles of Cement concrete blocks

1. 90% Payment will be released only against completed part of BOE roads on square meter basis & rest 10% after one year maintenance.

D. Brick on edge (BOE) Roads

1. 90% Payment will be released only against completed part of BOE roads on square meter basis & rest 10% after testing of roads after one year maintenance.

PART- VI BREAK UP OF PAYMENT FOR ELECTRO MECHANICAL WORKS

i.	Payment to be made against supply & installation	85%
ii.	Payment to be made after testing at Site	5%
iii.	Amount to be paid after commissioning and three months of trial run	10%
	Total	100%

Station discharge capacity of Sewage Pumping Station (SPS) / Lifting Station (LS) may vary during design of re-design of the network. Price is to be quoted with respect to the tentative quantity of sewage flow as provided in the bid document of each SPS. However, during review and re-designing, keeping the total quantity of sewage flow of all 4 Nos. SPS intact, variation of discharge of individual SPS may be allowed, if necessary. In that case, payment will be adjusted proportionately within those 4 Nos. SPS for both Civil, Electro-mechanical and other relevant works.

Schedule 6
SCHEDULE OF PERFORMANCE GUARANTEE

Form of Performance Guarantee

_____*[Bank's Name, and Address of Issuing Branch or Office]*

Beneficiary:_____*[Name and Address of KMDA]*

Date: _____

PERFORMANCE GUARANTEE NO.: _____

We have been informed that _____*[name of Bidder]* (hereinafter called "the Bidder") has entered into Contract No. _____*[reference number of the contract]* dated _____ with you, concerning a contract to design, build, refurbish and operate a Sewerage Network in *[Name of Location]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we _____*[name of Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of _____*[amount in figures]* (_____)*[amount in words]*, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contract is in breach of its obligations under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire no later than the earlier of:

(a) six months after the End Date, as defined in the Contract; or

(b) six months after the date of termination of the Contract pursuant to its terms.

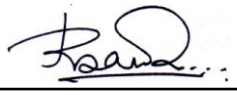
Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

Yours truly,

[Name of Bank]

_____

Authorised Signature



Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority

FORM OF BANK GUARANTEE – ADVANCE PAYMENT

[Name of Contract]

To: *[Name and address of KMDA]*

Dear Ladies and/or Gentlemen,

We refer to the Contract Agreement ("the Contract") signed on *[date]* between you and *[name of Contractor]* ("the Contractor") concerning the Services set out in the Contract to Design, Build, Refurbish a Sewerage Network.

Whereas, in accordance with the terms of the Contract, KMDA agreed to pay or cause to be paid to the Contractor an advance payment in the amount of *[number]* percent (____%) of the Contract Price for the Design-Build, Refurbish, Commission, Sewerage Network, namely a payment of: *[amount of foreign currency in words], [amount in figures]*, and *[amount of local currency in words], [amount in figures]*.

By this letter we, the undersigned, *[name of Bank]*, a Bank (or company) organised under the laws of *[country of Bank]* and having its registered/principal office at *[address of Bank]*, do hereby jointly and severally with the bidder irrevocably guarantee repayment of the amounts upon the first demand of KMDA without cavil or argument in the event that the bidder fails to commence or fulfil its obligations under the terms of the Contract, and in the event of such failure, refuses to repay all or part (as the case may be) of the advance payment to KMDA.

Provided always that the Bank's obligation shall be limited to an amount equal to the outstanding balance of the advance payment, taking into account such amounts that have been repaid by the Bidder from time to time in accordance with the terms of payment of the Contract as evidenced by appropriate shipping documents or payments certificates.

This Guarantee shall remain in full force from the date upon which the advance payment is received by the bidder until the date upon which the bidder has fully repaid the amount is advanced to KMDA in accordance with the terms of the Contract. At the time at which the outstanding amount is nil, this Guarantee shall become null and void, whether the original is returned to us or not.

Any claims to be made under this Guarantee must be received by the Bank during its period of validity.

Yours truly,

[Name of the Bank] & Authorized Signature

Signature of Tenderer	**Signature of Tender Inviting Authority**	**Signature of Tender Accepting Authority**

Schedule 10
TECHNICAL SPECIFICATIONS FOR CONSTRUCTION

Documents Comprising the Technical Standards Appendix

The Technical Standards Appendix consists of Technical Specification to be followed for during Construction of Sewage treatment Plant and other ancillary/ allied works for all Civil, Mechanical, Electrical, Instrumentation required to be executed under this Contract. Notwithstanding to the said specification, the Contractor is instructed the adopt and follow necessary standard and approved Codes /specification wherever required for fulfillment of all the works under this contract.

Supplementing the General Conditions and Design – Appendix.

The Technical Standards specified in schedule 7 shall be read along with the GCC / SCC and Design-Build Appendices for the purpose of providing greater specificity of the technical standards which the Contractor is required to meet.

Design-Build Appendix Description

The descriptions contained in the Technical Standards Appendix Chart entitled, "Description of Service" are for the convenience of the Contractor and do not supersede the actual wording of the Design-Build Appendices.

General Quality Standards

The term "General Quality Standard" means a standard of performance which,

(a) is competent, efficient, economical and in accordance with internationally accepted techniques used in the sewer disposal and civil works construction industries;

(b) is in accordance with professional engineering, accounting and consulting standards, as applicable, recognized by national or international professional bodies;

(c) is in accordance with sound management, commercial, technical, design and engineering practices;

(d) employs appropriate technology and safe and effective equipment, machinery and methods;

(e) is in accordance with national and local standards and codes in KMDA's Country;

(f) protects the interests of the Authorities;

(g) is in accordance with the Applicable Law

(h) is in accordance with the technical specifications and design standards of KMDA as provided to the Contractor;

(i) is in accordance with the applicable Environmental Assessment and Environmental Management and Mitigation Plan; and

(j) is in accordance with the Design-Build Documents as approved by KMDA.

In the event of any conflict or inconsistency between any standards that comprise the General Quality Standard, local and national standards in KMDA's Country shall prevail over international standards.
The Contractor shall, at all times, carry out the Services in accordance with the Technical Standards as specified and, where a specific technical standard of quality of performance has not been specified, the Contractor shall perform the Services to the standard of "General Quality Standards.".
If KMDA is subjected to fines or penalties as a result of the contractor's breach of these Technical Standards, such fines or penalties shall be paid by the Contractor

Third Party Inspections
The Contractor shall, at his own or manufacturer's cost, at manufacturers premises, provide the necessary gauges, supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary for carrying out the tests as required as per relevant latest Indian Standard for all materials specified.
KMDA appointed Third party inspection agency will inspect and certify the quality of specified materials as per relevant latest Indian Standard with all amendments. The inspection and certification charges will be paid directly from KMDA /Contractor's Bill to the Third Party Inspecting and certifying Agency. The Contractor shall be responsible to obtain permission and provide all facilities to carry out such testing as required.

CIVIL WORKS for SPS

1 Specific Civil/Structural Work Requirement

1.1 Design Submissions:

Complete detailed design /hydraulic calculations & drawings of foundations and superstructure together with general arrangement drawings and explanatory sketches including vetting from any IIT / Jadavpur University / IIEST (Formerly Bengal Engineering and Science University) shall be submitted to KMDA. Separate calculations for foundations or superstructures submitted independent of each other shall be deemed to be incomplete and will not be accepted. Though no GA drawings of all units are required along with the bid, a schematic layout /GAD shall be submitted along with the bid. The design considerations described herewith establish the minimum basic requirements of plain and reinforcement 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. The Contractor shall also take care to check the stability of the structure.

1.2 Design Standards

All designs shall be based on the latest International or Indian Standard (IS) Specifications or Codes of Practice. The design standards adopted shall follow the best modern engineering practice in the field based on any other international standard or specialist literature subject to such standard reference or extract of such literature in the English language being supplied to and approved by KMDA or KMDA's Representative. In case of any variation or contradiction between the provision of the IS Standards or Code and the specifications given with the submitted bid document, the provision given in the Specification shall be followed.

1.2.1 Design Period

Sl. No	Design Component	Design Period
1	Sewer network (laterals, Trunk mains, Outfall etc)	30 Years
2	Pumping mains	30 Years
3	Pumping Stations-Civil Work	30 Years
4	Pumping Machinery	15 Years

1.2.3 Peak Factor

As per CPHEEO Manual.

1.3 Design Loadings

All buildings and structures / underground structures shall be designed to resist the worst combination of the following loads/stresses under test and working conditions these include dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials, dynamic loads and uplift pressure.

i. Dead Load: This shall comprise all permanent construction including walls, floors, roofs, partitions, stairways, fixed service equipment and other items of machinery. In estimating the loads of process equipment all fixtures and attached piping shall be included, but excluding contents shall be considered. The following minimum loads shall be considered in design of structures:

S.No	Parameter	Load
1	Weight of water	10.0 KN /m3
2	Weight of soil (irrespective of strata available at site and type of soil used for filling etc.) However, for checking stability against uplift, actual weight of soil as determined by field test shall be considered	20.0 KN/m3
3	Weight of plain concrete	24.0 KN/m3
4	Weight of reinforced concrete	25.0 KN/m3
5	Weight of brickwork (exclusive of plaster)	22.0 KN/m3
6	Weight of plaster to masonry surface	18.0 KN/m3
7	Weight of granolithic terrazzo finish or rendering screed, etc.	24.0 KN/m3
8	Weight of sand (filter media)	25.0 KN /m3

ii. Live Load: Live loads shall be in general as per IS 875. However, the following minimum loads shall be considered in the design of structures.

S.No	Location	Live Load
1	Floor supporting Pumping Machinery	1000 kg/sq.m
2	Storage, Maintenance Bay, Air Blower	750 kg/sq.m
3	Platform, Staircase, Corridors, Walkways	500 kg/sq.m
4	Toilet	200 kg/sq.m
5	Roof Slab	150 kg/sq.m

In the absence of any suitable provisions for live loads in IS Codes or as given above for any particular type of floor or structure, assumptions made must receive the approval of KMDA's Representative prior to starting the design work. Apart from the specified live loads or any other loads due to material stored any other equipment load or possible overloading during

maintenance or erection/construction shall be considered and shall be partial or full whichever causes the most critical condition.

iii. Wind Load: Wind loads shall be as per IS: 875- 2002 Part-III.

iv. Dynamic Load: Dynamic loads due to working of plant items such as pumps, blowers, compressors, switchgears, traveling cranes, etc. shall be considered in the design of structures.

v. Other Loads: In addition to earth pressure and water pressure etc., the surcharge of 1 Ton/sq.m shall be taken into account in the design for channels, tanks, pit etc.

vi. Earthquake Load: This shall be computed as per IS: 1893 – 2000.

1.4 Joints

Movement joints such as expansion joints, complete contraction joints, partial contraction joints and sliding joints shall be designed to suit the structure as per relevant IS code provisions. Expansion joints of suitable gap at intervals not more than 30 m shall be provided in walls, floors and roof slabs of water retaining structures.

Construction joints shall be provided at right angles to the general direction of the member. The locations of construction joints shall be decided on convenience of construction. To avoid segregation of concrete in walls, horizontal construction joints are normally to be provided at every 2 m height, GI 18 guage/PVC water stops of suitable type and minimum 230 mm width, 6 m thick shall be used for walls and base slabs.

1.5 Water 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:

- Liquid depth up to full height of wall: no relief due to soil pressure from outside to be considered.
- Structure empty (i.e. empty of liquid, any material, etc.) full earth pressure including saturated condition and surcharge pressure wherever applicable to be considered.
- Structures shall be designed for uplift in empty conditions as per water table indicated in the geotechnical report or high flood level, whichever is maximum. No reduction factor for the uplift force shall be considered.
- The dead weight of the empty structures should provide a safety factor of not less than 1.2 against uplift pressures during construction and in service.
- Wall shall be designed under operating conditions to resist earthquake forces from earth pressure mobilization and dynamic water loads;

- Underground or partially underground structures shall be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures from below to base slab
- The walls and base slabs shall be designed for saturated earth/water pressure corresponding to high flood level or finished plot level whichever is higher.
- For design purpose, sub soil water level is to be considered as 1.0meter below the average natural ground level or as per soil report which is higher. (Uplift pressure on the foundation shall be considered as per water table at site, in the rainy season. However, for design purpose, minimum water table shall be considered at 1.0m below the average ground level.

1.6 Foundation

- The minimum depth of foundations for all structures, equipment's buildings and frame foundations and load bearing walls shall be as per IS: 1094.
- All structural member i.e base slab, column, load bearing wall, Liquid retaining/conveying structures etc. shall be rested on concrete pile having diameter not less than 450 mm.
- The 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
- 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 KMDA.
- Special attention is drawn to danger of uplift being caused by the ground water table
- Plinth level of all structures/top of tanks shall be at least (1000) mm above high flood level.

1.7 Design Requirements

a) Preparation of detailed Shop drawings for Civil Works including all structural details, cutouts, sleeves and puddle flanges, as per architectural requirements. Supply, Installation, Testing of the mechanical and electrical equipment's, pipes, fittings & other accessories.

b) Internal Roads, Storm Water Drainage (wherever required), Plant Pathways, Plinth Protection & Roads.

c) Water distribution network for drinking purpose/service water within SPS premises and sewage disposal

d) Compound wall with necessary gates of length to cover the battery limit of SPS as per approved layout. .

e) Plantation and landscaping within SPS battery limit.

f) Earth filling, leveling and dressing around the treatment unit including cutting of trees, removal of debris, shrubs, etc. within the premises of treatment plant & filling, to bring the site up to formation level, landscape, tree plantation, shall be included in the scope of work of this contract.

g) All interconnecting pipes, channels, valves, fixtures, appurtenances.

h) Any other item not indicated above but necessary, essential or incidental to the completion of the above works and making them operational.

The following are the design requirements for all reinforced or plain concrete structures:

- All blinding and leveling concrete shall be minimum 100 mm thick in concrete grade M15 for Building & 150 mm thick in concrete grade M20 for Water Retaining Structures as per IS -3370 (Part- 1)-2009 latest version.
- All structural reinforced concrete shall be with a maximum 25 mm aggregate size for footings and base slabs and with a maximum 20 mm aggregate size for all the Water Retaining Structures & other structural members.
- All liquid retaining structures shall be designed as per IS: 3370. The minimum grade of concrete shall be M30 using - PPC/PSC.
- All Buildings, Pipe Pedestals, Thrust Block, Pump Foundation & other structures shall be designed as per IS-456. The minimum grade of concrete shall be M20.
- The maximum free water cement ratio shall not exceed 0.5 for all liquid retaining structures.
- The amount of reinforcement in each of the two directions at right angles within each surface zone should not be less than the minimum specified as IS: 3370 or IS:456 whichever is applicable for the type of structure.
- Use of pressure relief valves to reduce uplift pressure due to ground water table shall not be allowed.
- All buildings shall have a minimum 1.0 m wide, 100mm thick plinth protection paving in M15 grade concrete or stone slabs/tiles. All plinth protection shall be supported on well-compacted strata.
- The following minimum thickness shall be used for different reinforced concrete members irrespective of design thickness.

S.No	Civil Member	Width(mm)
1	Walls for liquid retaining structures	200
2	Base Slab of liquid retaining structures	350
3	Wall foundation (At Junction of Base Slab & Wall) of liquid retaining structures	400
4	Roof Slab of liquid retaining structures	150
5	Walls of Launders	150
6	Base slab of Launders	125
7	Floor slabs including roof slabs, walkways canopy slabs	100
8	Walls of cables/pipe trenches, underground pits, etc.	125
9	Footing – Edge Thickness	250
10	Footing – At the Face of Column	450
11	Column	230 (width) 300 (depth)
12	Parapets, chajja	100
13	Precast trench cover	75
14	Beam	230 (width) 300 (depth)

1.8 MINIMUM COVER TO MAIN REINFORCEMENT

S.No.	Member	Details	Cover (mm)
1	Slab	Free Face	20
		Face in contact with earth	30
2	Beam	Top /Bottom	40
		Side	30
		Face in contact with earth	40
3	Column and pedestal	Super Structure	40
		Face in contact with earth	40
4	Retaining wall, Basement and Pit wall	Free side	30
		Face in contact with earth	30
5	Liquid Retaining Structure	Face in contact with liquid	40
		Face in contact with earth	40
		Free face	40
6	Foundation	Bottom	60
		Top	60

1.9 Minimum Bar Diameter

S.No	Member	Diameter (mm)
1	Major Foundation	10
2	Block Foundation Main Bars	8
3	Block Foundation – Tie Bars	8
4	Minor Foundation (Local Foundation etc.)	8
5	Column, Pedestal – Main Bars	12
6	Column, Pedestal – Ties	8
7	Beam – Main Bars	12
8	Beam – Anchor Bars	10
9	Beam – Stirrups	8
10	Slab – Main Bars	8

S.No	Member	Diameter (mm)
11	Slab – Distribution Bars	8
12	Wall – Main Bars	10
13	Wall – Distribution Bars	8
14	Minor elements such as chajjas, Lintel Beams etc.	8

1.10 Bar Spacing

S.No	Member	Minimum (mm)	Maximum (mm)
1	Foundations	125	200
2	Slabs	100	300
3	Stirrups for Beams	100	300
4	Ties for Columns, Pedestals	100	300
5	Walls	100	300

- Bar spacing shall be provided in multiple of 25 mm.

The design submitted by the contractor shall be proof checked from the nearest any IIT / Jadavpur University / IIEST (Formerly Bengal Engineering and Science University) as Approved by the competent authority, for which the scrutiny/ proof checked charges shall be borne by the contractor. The delay in checking designs by the third party as mentioned above shall be treated as the delay on the part of the contractor for operation of the Contract clause.

2 MATERIALS IN GENERAL

The term "materials" shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment and plant of every kind to be supplied by the Contractor for incorporation in the Works.

Expect as may be otherwise specified for particular parts of the works the provision of clauses in "Materials and Workmanship" shall apply to materials and workmanship for any part of the works. All materials shall be new and of the kinds and qualities described in the Contract and shall be at least equal to approved samples.

As soon as practicable after receiving the order to commence the works, the Contractor shall inform KMDA's Representative of the names of the suppliers from whom he proposes to obtain any materials but he shall not place any order without the approval of KMDA's Representative which may be withheld until samples have been submitted and satisfactorily tested. The Contractor shall thereafter keep KMDA's Representative informed of orders for and delivery dates of all materials.

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

Test certificate from Approved Manufacturer is necessary.

2.1 Cement

The Cement shall be Sulphate Resistant Cement grade – 43/ PPC/PSC in all water retaining structures and PPC/PSC grade cement for other structures, confirming to the relevant B.I.S. codes and approved by KMDA's Representative. Manufacturers Test Certificate shall have to be furnished. Minimum cement consumption for RCC M20 shall be considered as 350 kg/cum and for RCC M25 shall be 380 kg/cum. Mixing of fly ash in the concrete shall not be considered. Approved Manufacturers of Cement of reputed firm with ISO certification shall be used

2.2 Reinforcement Steel

Reinforcement Steel shall confirm to BIS Specification 432-1966 (with up to date revision) and B.I.S. Specification 1786-1985 (with up to date revision). All Reinforcement Steel will be TMT Grade approved by KMDA.

3 SAMPLES AND TESTS OF MATERIALS

The contractor shall submit samples of such materials as may be required by KMDA and shall carry out the specified tests directed at the site or at the supplier's premises or at the laboratory approved by KMDA or KMDA's Representative. Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by KMDA.

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

The contractor shall in any case submit to KMDA within seven days of every test such number of certified copies (3) of the test results as KMDA's Representative may require.

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

4 ORIENTATION

The works shall be laid out within the confines of the site in order to be compatible with the existing infrastructural facilities, inlet and outlet pipe work/channels and nearby water bodies. Underground services requiring to be relocated in order to accommodate the proposed site layout shall be relocated by the contractor to alignments approved by KMDAs Representative.

4.1 Buildings and Structures

All the building and structure works shall generally comply with the following KMDA's Requirements unless otherwise specified elsewhere:

All building works shall be of reinforced concrete framework.

All external walls shall be in 230 mm thick brick masonry built in cement mortar (1:5). Transoms and mullions of 115 mm x 230 mm size with four numbers 6 mm bars and 6 mm links at 150 mm c/c shall be provided to form panels not exceeding 3,500 mm x 3,500 mm in size. All internal partition walls except for toilets shall be in 230 mm thick brick masonry built in cement mortar 1:5 with transoms and mullions as in (b) above. Toilet partition walls shall be in 115 mm thick brick masonry built in cement mortar 1:4 and shall have transoms and mullions as in (b) above and shall form panels not exceeding 1,200 mm x 1,200 mm in size.

Finishes to concrete liquid retaining structures shall be:

a. F1 - External surfaces, buried

b. F2 - External surfaces exposed and up to 300 mm below ground level

c. F2 - Internal surfaces

Finishes to other concrete structures shall be:

a. F1 – Buried

b. F1 - Exposed, where plastering is specified

c. F2 – Exposed

All internal masonry surfaces finish shall have 12 mm thick plain faced cement plaster in cement mortar (1:4) with neat cement finish on top. Over this, one coat of primer and two coats of plastic emulsion paint of approved quality and shade shall be provided.

All external masonry and concrete with rough board finish shall have 20 mm thick sand faced cement plaster in two coats, base coat 12 mm thick in cement mortar 1:4 and finishing coat 8 mm thick in cement mortar 1:4. Waterproofing compound of approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.

All external surfaces above ground level shall have one coat of primer and two coats of waterproof cement based paint of approved quality and shade. A coat of silicone water repellent paint shall also be applied thereon.

Toilet areas, walls and ceilings, shall have one coat of primer and two coats of plastic emulsion paint. Toilet floor slab shall be filled with brick bat coba (broken bricks in lime) and provided with waterproofing as per the specifications of an approved specialist waterproofing company. The finished floor level in toilet areas shall be 25 mm below general finished floor level elsewhere in the building.

The flooring in all areas except toilets and staircases, pumping stations, disinfection units, centrifuge building, workshop, store room D.G. room shall be in 250 mm x 250 mm x 20 mm thick marble mosaic tiles of approved make unless otherwise specified, shade and pattern and placed in cement mortar 1:4 to give overall thickness of 50 mm. Half tile skirting shall also be provided in these areas.

The flooring in the pumping stations, chlorination building, centrifuge building, workshop, D.G. room shall be 60mm thick cement flooring with metallic concrete hardener topping, under layer of 42mm thick cement concrete 1:2:4 (1 cement : 2 coarse : 4 graded stone aggregate 16mm thick nominal size) and top layer of 18mm thick metallic concrete hardener consisting of mix 1:2 (1 cement : 2 stone aggregate 6mm nominal size) by volume & mixed with metallic hardening compound of approved quality @ 3 kg/m2 including cement slurry and rounding off edges.

The flooring in Contractor's room, loading/unloading bay, MCC cum Panel room shall be in 25mm thick Kota stone slab of approved shade and pattern and placed over 20 mm thick base of cement mortar 1:4 to give overall thickness of 45 mm. Half tile skirting shall also be provided in these areas.

Toilet areas shall have 450 mm x 450 mm x 25 mm thick polished Kota stone tiles placed in cement mortar 1:4 to give an overall thickness of 50 mm. 2100 mm high dado, in 150 mm x 150 mm x 6 mm thick glazed tiles (approved make, shade and pattern) placed in cement mortar 1:3 shall also be provided in these areas.

The flooring along with skirting in administration cum laboratory building shall be 20 mm thick mirror polished, machine cut granite slab of approved shade and pattern placed in cement mortar (1:4). 150mm high skirting shall be provided in these areas. Granite stone shall be provided for laboratory platforms fixed over double sandwiched cuddappa support as directed and the edges of granite is to be embedded into the wall.

The toilet facilities shall include at least:

a. 3 Nos. Water closets with white porcelain Orissa pan minimum 580 mm long with low level flushing cistern of 10 litres capacity.
b. 4 Nos. urinals of sizes 600 mm x 400 mm x 300 mm flat back type in white porcelain separated by a marble partition of size 680 mm x 300 mm.
c. 3 Nos. wash basins of size 510 mm x 400 mm in white porcelain with inlet, outlet and overflow arrangements.
d. 3 Nos. mirror of size 400 mm x 600 mm wall mounted type fitted over wash basins.
e. 2 Nos. plastic liquid soap bottles
f. 2 Nos. chromium plated brass towel rails minimum 750 mm long.
g. All stopcocks, valves and pillar cocks shall be heavy duty chromium plated brass.
h. All fittings such as `P' or `S' traps, floor traps, pipes, down take pipes etc.

The sewage from toilet blocks shall be led to the wet well of terminal sewage pumping station if present or included under this contract or to the closest gravity sewer.

All staircases shall have 25 mm thick chequered mosaic tiles for treads and 25 mm thick plain mosaic tiles for risers of approved make and shade and half tile skirting set in cement mortar in 1:4 to give an overall thickness of 50 mm.

All concrete stairs shall have aluminum nosing over 2 mm thick rubber strip of width same as nosing for the full length of the tread. Nosing shall be fixed with countersunk screws. Stairways shall be provided to permit access between different levels within buildings. Staircase shall be minimum 1000mm wide unless specified otherwise. Staircases in general shall not be steeper

than 40°. Staircases having space constraints may be steeper than 400. The maximum vertical run for a single flight of stairs shall be 3.0 M.

All roof tops and overhead tanks shall be made accessible with ladder provision. Vertical step ladders fitted with landing point extensions will be permitted where considered appropriate by the Engineer to access areas not frequently visited.

Steel staircases shall be constructed of standard channel stringers with M.S. grating treads 25mm thick with non- skid nosing. Steel Ladders shall be minimum 600mm wide and shall not exceed 6m of straight run. The ladders shall be painted with epoxy paint.

All hand railing shall be provided with G.I "C" Class Pipe confirming to latest Indian standards. The minimum height of hand railing shall be 1m.

The reinforced concrete roofs shall be made waterproof by application of an approved roof polythene / bitumen membrane / brick bat coba. The finished roof surface shall have adequate slope to drain quickly the rain water to R.W down take inlet points.

All roof floors shall have minimum 750 mm height solid concrete block parapet wall where accessible is provided and shall have minimum 300 mm height solid concrete block parapet wall where accessible is not provided.

For roofing drainage, cast iron or uPVC rainwater down takes with C.I. bell mouth or u PVC bend and C.I. or uPVC grating at top shall be provided. For roof areas up to 40 sq m minimum two nos. 100 mm diameter down take pipes shall be provided. For every additional area of 40 sq m or part thereof, at least one no. 100 mm dia. down take pipe shall be provided.

Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rain water.

Building plinth shall be minimum 450 mm above average finished ground level around building or high flood level whichever is more.

All doors, windows, rolling shutters shall have lintels above. Chajja protection to lintels on external walls shall be such as to prevent the rain water splashing into the building. Chajja projection of minimum 750 mm for rolling shutters, 600 mm for doors and 450 mm for windows shall be provided to prevent the rain water splashing into the building. Chajja shall be projected 150 mm on either side from size of doors/windows/rolling shutters. All windows and ventilators shall have 25 mm thick Kota stone sills bedded in cement mortar (1:3).

All doors and windows shall be painted with two coats of synthetic enamel paint over a priming coat (ready mixed Zinc Chromate Yellow primer of approved brand and manufacturer confirming to I.S.: 127-106, 341 and 340).

All doors, windows and ventilators shall be made of aluminum confirming to latest version of IS: 1948. All fixtures for doors, windows and ventilators shall also be of aluminum. Aluminum grills shall be provided in all the windows. Doors shall be in two panel and both panels shall be glazed/unglazed. Minimum weight of aluminum doors & windows shall be as follows

1. Single Glazed Window : (Weights indicated shall be aluminum)
    - Open able Outer Frame: Weight 0.70 kg/Rmt
    - Shutter Frame: Weight 0.97 kg/Rmt
    - Intermediate Mullion: Weight 0.97 kg/RMt.

- Beading: Weight 0.31 kg/Rmt
- Fixing Louvers windows/ventilators
- Outer Frame: Weight 0.46 kg/Rmt

2. Double Glazed Window
   - Outer Frame: Weight 0.72 kg/Rmt
   - Shutter Frame: Weight 0.97 kg/ Rmt
   - Intermediate Mullion: Weight 0.98 kg/ Rmt
   - Beading: Weight 0.31 kg/ Rmt
3. Sliding Windows
   - Bottom & Top Frame: Weight 0.70 kg/m
   - Shutter Frame: Weight 0.42 kg/m
   - Interlocking Section: Weight 0.47 kg/m
4. Aluminum Door
   - Outer Frame: Weight 2.508 kg/Rmt
   - Shutter Frame: Weight 2.508 kg/Rmt
   - Bottom Stile: Weight 2.508 kg/Rmt
   - Glazing shall be 5.5 mm thick glass.

a) Openings of the windows & ventilators shall be minimum 25% of the external wall area.

b) Ventilator shall be provided where height of floor is more than 3m.

c) All windows and ventilators shall have wire mesh. Frame of doors, windows and ventilators shall be of aluminum of standard rolled section. Doors, Windows and Ventilators shall be of size as per schedule to be submitted by the Contractor for approval of Engineer. The minimum size shall be as per below:

   i. Door of opening size 1.2m x 2.1m
   ii. Door of opening size 0.75m x 2.1m for toilets
   iii. Glazed widows of minimum size 1.2m x 1.2m
   iv. Ventilators of minimum size 0.6m x 0.6m

d) Rolling shutters shall be made of 80 x 1.25 mm MS laths. Rolling shutter shall be of minimum size 3m wide x 3.0m high. Rolling shutter shall be provided in MCC cum panel room, chlorine toner shed, at entry and exit of the pump house for access to pumps, motors, valves, panels and as wherever required.

e) All concrete channels and ducts used for conveying liquid shall have inside finish of type F2. The width of concrete channels shall not be less than 500 mm. All open channels shall be provided with Stainless Steel Type 304 hand railings or concrete walls to a minimum height of 1 m from the access surface elevation. All concrete surfaces of structures conveying raw sewage or primary effluent shall be protected with Epoxy Coating as specified in Clause 12.15 Section 3.

f) Kerbs to be provided below the hand railing on the catwalks/pathways should be as per relevant sections of Factory Act. It shall not be less than 150mm.

g) All exposed surfaces of inserts embedded in concrete shall be painted with two coats of enamel paint over one coat of red oxide zinc chrome primer. Surfaces in contact with concrete shall not be painted.

h) All structural steel members shall be painted with two coats of enamel paint over one shop and one field coat of red oxide zinc chrome primer.

i) All rooms in the treatment plant buildings shall be provided with appropriate sign boards indicating the function of the rooms involved written in Marathi and English Languages.

j) The design of buildings shall reflect the climatic conditions existing on site. Process buildings shall as far as is possible permit the entry of natural light , and the use of glazed panelling shall be kept to a minimum and preference given to wall openings protected by weather canopies.

k) Emergency exit doorways shall be provided from all buildings in order to comply with local and international regulations .Stairways and paved areas shall be provided at the exit points.

l) Toilet blocks in process buildings and control blocks shall be provided with a sink with two drinking water taps of 20 mm size with adequate inlet and outlet connections.

m) All the walkways in shall have minimum 1 m width and shall be covered with mosaic tiles.

n) Hand railings shall be made up of G.I "C" Class Pipe confirming to latest Indian standards.

o) For structures containing water or process liquid, the top of the wall shall be at least 0.5m higher than the maximum water surface level calculated at high flood level and peak plant flow. The top level of internal plant roads and approaches shall be at least 0.5m above the site High Flood Level.

p) If the High flood level is more then Ground Level then road shall be constructed on the earthen embankment. Earthen embankment shall be constructed with side slope of at least 2 horizontal to 1 vertical. Stone pitching shall be provided at both sides of the embankment as per IS: 8237. Top width of embankment shall be taken as 6.0m. Top level of embankment shall be 0.5m above high flood level. Excavated earth from the plant can be used for embankment construction and if required, extra earth can be borrowed from the borrow pit as approved by Engineer.

4.2 Roadways, Pathways & Hard standings

a. Internal roads shall be provided around the treatment plant to link in with the existing units and the approach road and permit access to the plant for necessary maintenance, delivery of consumables and personnel access. All roads shall be of asphalt macadam and minimum 3.75 meters wide. Vehicular access shall be provided for all Plant structures and buildings. All roads shall be provided with drainage and shall be constructed to prevent standing water.

b. Hard standing areas with shading facility shall be provided to permit the parking of vehicles involved in the delivery of consumables from blocking site roadways during unloading or loading..

5 Site Drainage

The contractor shall provide a site drainage system. The system shall comprise of the following:

- Storm Water Drainage

- Foul Drainage (if any)

5.1 Storm Water Drainage

(a) Storm water drains adjacent to the existing and proposed roads (under this Contract) shall be sized for a rainfall intensity of 50 mm/hr, allowing for 100% runoff. Drains adjacent to roads shall be in stone masonry in CM (1:4) of appropriate thickness, topped with 75 mm thick M10 concrete and internally flush pointed in cement mortar (1:4), 20 mm thick. The minimum width of drain shall be 450mm.

(b) The storm water drainage system shall also be designed to cater the run-off from the existing plot areas and structures, if necessary depending upon the site topography.

5.2 Foul Drainage

(a) The foul drainage system shall accept discharge from toilets, washrooms, offices and the laboratory. The foul drainage system shall be conveyed to the nearest public sewer wherever exist or to a pumping station.

6 Cable and Pipe work Trenches

(a) Cable and pipe work trenches shall generally be constructed in reinforced concrete. However, 500 mm x 500 mm size or smaller trenches, not on fill may be constructed in 200 mm thick solid cement concrete blocks over 150mm thick M 15 PCC base. The trenches will be 20mm thick plastered internally with cement mortar (1:4) and externally in cement mortar (1:3).

(b) All floor cut-outs and cable ducts, etc. shall be covered with M20 precast concrete covers (Heavy Duty) or MS grating as per direction of Engineer in outdoor areas and M.S. chequered plates, suitably painted of adequate thickness in indoor areas. All uncovered openings shall be protected with hand railing. The pipe, cable trenches shall be suitably sloped to drain off rainwater to a suitable location.

(c) Layout of trenches outside the buildings shall allow space for construction of future trenches where necessary with due consideration for planning for future developments. This aspect shall be brought to the notice of the Engineer while planning the works.

7 Pipes and Ducts

(a) R.C.C ducts for drainage shall have minimum 1 metre pre-cast cover (M20 concrete, Heavy duty) while laid under roads. Access shafts of size not less than 600 mm x 1000 mm shall be provided.

(b) All drains (except storm water drains adjacent to roads) shall be covered and designed structurally for appropriate loads.

8 Main Gate

(a) Proposed Sewage pumping station shall have minimum one main gate to access the plant irrespective of existing gate at the premises of existing site. Minimum width of main gate shall be

4.5m. Main gate shall have 1.5m wide wicket gate. Main gate shall have as external framework of GI pipes and internal framework of MS flats. Gate shall be fixed on RCC columns. The design and pattern of gate with drawing shall be submitted for approval of the Engineer. The gate shall have all necessary hinges, locking arrangement, rolling arrangement and painting complete, as approved by the Engineer.

9 Earth Work and Excavation

9.1 General

Applicable provisions of Conditions of contract shall govern work under this section. The Contractor shall report any water conditions encountered and will be given directions as to the type of procedure to be adopted in such cases. The Indian Standards wherever referred to herein shall be the latest edition of such Standards.

9.2 Excavation for Foundation, Trenches, Pits, etc.

All foundation trenches shall be excavated to the full-widths and depths shown on the drawings or to such greater or smaller depths as may be found necessary or so ordered to him.

Should any excavation be taken down below the specified levels, the contractor shall fill in such excavation at his own cost with concrete as specified for foundations, well rammed in position until it is brought up to the level. The contractor shall notify to KMDA when the excavation is completed and no concrete or masonry shall be laid until KMDA has approved of the soil for each individual footing, rafts, etc.

The contractor shall keep the site clear of water at all times and operate pumps or other suitable equipment of adequate capacity for de-watering as required. All foundation pits shall be refilled to the original surface of the ground with approved material, which shall be suitably consolidated. No extra will be paid for bailing out water collected in excavation due to rains, ordinary spring sets. Removal of all surface obstructions including shrub, jungle, etc.; Carrying out all necessary excavations; Providing for uninterrupted surface water flow during progress of work; Arrangement for diversion of flows from storm drains, valleys or other sources. The existing drainage facilities that are diverted shall be restored after the work to the satisfaction of the Engineer In-charge. All costs for diverting surface water and restoring storm water facilities disturbed or damaged by the construction for keeping the excavation free of water during construction shall be included in the price bid for the various classes of excavation.

9.3 Trial pits

Trial pits may be dug by the contractor, without being directed to do so, along the lines of the trenches/location of structures in advance of the excavations for the purpose of satisfying himself as to the location of underground obstructions or soil conditions. Nothing extra shall be paid on account of this.

9.4 Stacking of excavated material

The excavated material shall be stacked without any hindrance to the traffic and at least 600 mm away from the side of the trench of structures. In case the excavated trench sides collapse or get refilled with excavated materials due to any reason whatsoever, the same shall be made good and brought the necessary depth, width and levels by the contractor without any extra claim.

9.5 Overhead Wires and Poles

If the method of operation for the construction requires removal and replacement or protection of any overhead wires or poles the contractor shall make satisfactory arrangement for such work with KMDA of such wires and poles. In this regard KMDA will assist the contractor in getting approval/permission. However the entire work will be the responsibility of the contractor.

9.6 Earth Filling

The space around the foundations in the trenches or sites shall be cleared of all trash and loose debris and filled with approved excavated earth, all clods being broken. Filling shall be done in 200 mm layers; each layer to be moistened and well rammed. This shall be done in step with the foundation masonry or foundation concrete work the difference between the tops of masonry and filling not exceeding a day's work. The top of filling shall be finished off 150 mm above ground level to allow for settlement only pit or depressions occurring within twelve months of completion shall be filled up and rammed by the Contractor or his own expense.

The backfill material shall be tamped with mechanical tamping equipment like plate vibrator, after moistening the backfill by sprinkling with water to obtain maximum compaction. Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

9.7 Disposal of Surplus Excavated Material

The excavated material which is in surplus to the requirements after backfilling shall be disposed off as directed by the Engineer-in-Charge, with all lead and lift from the site for which no extra payment shall be made. The landfill site or disposal site is to be assessed by the Contractor and got approved by the Engineer-in-Charge.

9.8 Shoring, Planking & Shuttering

The contractor shall supply, fix and maintain necessary sheathing, shoring, strutting and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer In-charge may agree that such sheathing, shoring and bracing be left in

place, at the contractor's request. In any case, the contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

All sheathing, shoring and bracing which is to be removed under the foregoing provisions shall be removed in a manner so as to not endanger the completed work or other structures, utilities or property, whether public or private.

9.9 Wet Foundation:

As soon as water is encountered in foundations, a sump shall be dug for removing the water. The bottom level of this sump shall be kept 500 mm or more below the lowest level of the excavation. The difference between the levels of the bottom of the excavation and of the sump shall be kept constant as excavation depth is increased. If the excavation is to be taken to a substantial depth and a large quantity of water is encountered, two sumps shall be excavated and deepened alternatively so that the pump does not require to be stopped whilst the sump is deepened.

9.10 Earthwork in Site Leveling

All materials required for the purpose of filling shall be taken from high areas and stockpile, which are to be leveled to specified reduced level as required. Roots, sods, wood or other organic matter shall not be placed in the fill. Before a new layer is laid the existing ruts or other unevenness in the surface of the layer shall be removed and the surface of the layer shall be scarified and roughened by borrowing and ploughing to obtain bond with the material to be placed. The materials shall be placed continuous horizontal layers not greater than 200 mm thickness. The earth fill shall be kept slightly sloping from center to the edges to avoid formation of pools during the rain.

In case of non-compliance to the to the provisions of Technical Specification under schedule 10 and the Special Conditions of the Contract, for three consecutive interim payments, the payment against item of works in the respective interim payment or 0.5% of the Accepted contract Amount, whichever is higher shall be deducted from the payment that is due to the contractor.

10 Concrete

10.1 General

Applicable provisions of Conditions of Contract shall govern work under this section.

All concrete work, plain or reinforced shall be carried out in strict accordance with this specification and any working drawing or instructions given from time to time to the contractor. The contractor's rates shall allow for wastage in all materials as well as for all tests of materials and for concrete. No concrete shall be cast in the absence of KMDA's representative or any other person duly authorized by him. The contractor's Engineer shall personally check that both the formwork and reinforcement have been correctly placed and fixed, and shall satisfy himself that all work preparatory to the casting is completely ready, before calling KMDA's representative for final inspection and approval and for which purpose at least 24 hours' notice shall be given by

the contractor. The Indian Standards wherever referred to herein shall be the latest edition of such Standards.

10.2 Cement

Cement shall be Sulphate Resistance Cement as per IS 12330 / PPC/PSC in all water retaining structures and PPC/PSC grade cement for other structures. Cement tests shall have to be carried out at contractor's expense as and when directed.

10.3 Aggregate

The fine and coarse aggregate shall conform to IS: 383 & IS: 456. The necessary test indicated in IS – 383 and IS – 456 shall have to be carried out to ensure the acceptability and shall meet prior approval of KMDA.

10.4 Reinforcement

The reinforcement shall be bent to the shapes shown on the drawings prior to placing and all bars must be bent cold. The Steel shall be placed in such a way that it is rigidly held in position while concrete is being cast. The correct clearance from the form shall be maintained by either precast mortar blocks or by metal supporting chairs to be supplied by the contractor free of charge. The intersections of rods crossing one another shall bound together with soft pliable wire No. 16 S.W.G. at frequent intervals so that reinforcement will not be displaced during the process of depositing concrete. The loops of binding wire should be tightened by pliers.

10.5 Water

Water shall conform to IS: 456, clean and free from alkali, oil or injurious amounts of deleterious material. As far as possible, the water should be of such quality that is potable. If any chemical analysis of the water is necessary and ordered the same shall be got done at approval laboratory at the contractor's expense.

10.6 Concrete Proportioning

The concrete proportion shall be as indicated on the approved drawings and shall conform to IS: 456.The minimum cover to main reinforcement shall be 25 mm or the diameter of the bar whichever is greater. In the case of surfaces exposed to corrosive action as in sumps, the cover shall be increased up to 50 mm as directed.

Type of joints, spacing of joints, use of all jointing materials and other features pertaining to the provision of movement joints in liquid retaining structures shall be got approved prior to commencement of construction. All reinforced concrete work shall be thoroughly and efficiently vibrated during laying by use of vibrators.

For liquid retaining structures M:30 grade (SRC/PPC/PSC) shall be used, the same shall be deemed to be satisfactorily watertight if the external faces show no signs of leakage and remain apparently dry over the period of observation of 7 days after allowing a period of 7 days for absorption after filling. Covered tank, where all faces are not accessible for inspection, shall be

kept filled with water for 7 days and thereafter the drop of water over the next 7 days shall not exceed totally a depth of 12.5 mm per day. Approved corrective measures, if necessary, shall be undertaken by the Contractor at his own expense. The contractor shall use appropriate water proofing compound during the process of pouring of concrete in required proportion.

10.7 Workmanship

All concreting work shall be carried out according to the IS: 456 'Indian Standard Code of Practice for Plain and Reinforced Concrete for general Building Construction'. It should, however, be note that for Over 60 m3 of concrete placed or for every one day's work a minimum of 6 (six) cubes shall be cast for test purposes and tested at the contractor's expense in an approved laboratory.

10.8 Formwork

The formwork shall conform to IS: 456. Centering; only steel / plywood centering shall be used

10.9 Curing

The concrete shall be cured according to IS: 456 or as directed.

10.10 Concrete Finish

The concrete surface on removal of form work shall be such that no finishing is necessary. If however the surface is not satisfactory, the contractor shall, if so instructed, remove unwanted projecting parts by chipping and smoothening the surface with cement at his own expense and coated with corrosion resistance epoxy paint. .

10.11 Construction Joints / Water Stops

These shall be in accordance with IS: 456 or as shown on the approved drawings.

The centering for forming, the construction joint shall be firmly fixed and adequately slotted for reinforcement extending beyond the joint. If any concrete has set, care shall be taken not to disturb the reinforcing steel in casting the second half of a member with a construction joint and thereby crack the concrete previously placed. The PVC joints shall be of the 'rebated' or 'keyed' type and shall have a minimum width of 300 mm inclined 'feather' or 'straight joints' shall not be permitted. The Joints/Water stops shall be got approved by the Engineer before their placement into the structure.

10.12 Expansion Joints

Expansion joints shall be provided at positions shown on the approved drawing or as directed and shall comply strictly with the details shown on construction drawings. Reinforcement shall not extend across any expansion joint and the break between the two sections MUST be complete. Unless otherwise specified, the gap shall be filled with an elastic joint filler consisting of the following ingredients (by weight), preheated to a temperature of 190 (375 F).

a) Very find sand 60%

b)	Hot bitumen emulsion	33%
c)	Cement	5%
d)	Fine chopped hemp	2%

10.13 Contractor's Supervision

The contractor shall provide constant and strict supervision of all the item of construction during progress of work, including the proportioning and mixing of the concrete and bending and placing of reinforcement. Before any important operation such as concreting or stripping of formwork is begun, adequate notice shall be given.

10.14 Laying Cement Concrete in Foundations & Under Floors

Before laying the concrete, the bottom and sides of the trench up to the proposed height of the concrete shall be moistened. The concrete shall be tamped immediately after laying.

10.15 Protective Epoxy Paint Treatment

Coal Tar Epoxy Paint of standard specifications manufactured/purchased from a reputed firm approved by IS shall be applied to the Concrete surface coming in contact with sewage, Underground sump etc. Epoxy Paint of standard specifications manufactured/purchased from a reputed firm approved by IS shall be applied to all mild steel works within and near the sump and STP. The coverage capacity of layers shall be at 125 Microns D.F.T. 7.60 sq. mt./Litre. (Exposed steel inserts, embedded in concrete and ladders, submerged in water shall be provided with epoxy paint 360 microns)

10.16 Chases, Holes, Recesses and Inserts

All chases, holes and recesses for foundation bolts, various services and other requirements must be formed as shown on the drawings or as directed by KMDA's Engineer during the execution of the work, without extra charge. The contractor shall fix all necessary inserts in the concrete for support of hangers for pipes and cables, ceiling clamps for lights and fans or for duct etc. If any of the inserts are to be supplied by other agencies, no extra payment will be made to the Contractor for placing the inserts in position.

10.17 Load Testing of Structures

Load tests shall be carried out in accordance with IS: 456, if required by the Engineer-in-Charge.

10.18 TESTING AND COMMISSIONING

Testing at site

All water retaining structures shall be tested before commissioning and trial run as per the specifications in CPHEEO Manual on Sewerage and Sewage treatment (latest edition) and as per relevant IS Code. All the structures are to be checked for water tightness and the sole responsibility of arranging the necessary equipment's and apparatus lies with the Contractor at

his own cost. Any damage during testing shall be Contractor's responsibility and shall be rectified by him free of cost. Water for testing shall be arranged by the Contractor at his own cost.

Section 3. BRICK WORK

11 Brick Work

11.1 General

Applicable provisions of Conditions of Contract shall govern the work under this section. The contractor shall build the whole of brickwork shown on the drawings with first-class bricks in cement mortar. The Indian Standard wherever referred to herein shall be the latest edition of such Standards.

11.2 Materials

Bricks	The bricks used shall generally conform to IS: 1077
Cement	The cement used shall conform to IS: 269,IS: 455, IS: 1489(Part 1)
Sand	The sand used shall conform to IS: 1344
Water	The water used shall be clean and free from injurious amounts of deleterious materials. As far as possible, the water should be of such quality that it is potable

11.3 Mortar Proportion

Unless otherwise specified, the proportions of cement-sand-mortar by volume for various classes of work shall be as under:

Type of work	Cement	Sand
Ordinary brickwork for building	1	5
Brickwork in pillars	1	4
Half-brick thick or brick-on edge partition wall	1	4

11.4 Workmanship

The cement and sand shall be thoroughly mixed dry in specified proportions. Water shall then be added by a sprinkler just sufficient to make a stiff and workable paste. The mortar shall be used within half an hour of mixing. The mortar, which is unused within half an hour of mixing, shall be removed from the site.

11.5 Brick-work

All the bricks shall be kept in water till they are completely soaked & only thoroughly soaked bricks shall be used in the work. The contractor shall set out & build all brickwork to the respective dimensions, thickness and height, as shown on the drawings.

The contractor shall build all brickwork uniformly, no one portion being raised more than 1 meter above another at one time. The contractor shall keep wet all brickwork for at least 10 days after laying. The surface of unfinished work shall be cleaned and thoroughly wetted before joining new work to it.

In curved brickwork, the bricks shall be dressed to shape obtain joints redial to the curve. The joints shall not exceed 12 mm in thickness and should extend the full thickness of the curved brickwork.

11.6 Damp-proof Course

Damp-proof course shall be provided at positions where ever necessary. In masonry walls of buildings, it shall normally be placed above the external ground level. It shall be laid for the full width of solid walls and shall be prepared as specified.

A layer of cement concrete 1:2:4 (cement: sand: coarse aggregate) mix, and of specified thickness shall be provided. If a damp-proof course requiring the use of bitumen felt is specified, bitumen used shall conform to IS: 1322 and workmanship shall conform to IS: 1609. All exposed surface of the damp-proof course shall be finished fair and smooth. The external edge shall be chamfered if specified, and shall be finished flush with masonry surface.

Section 4. FLOORS AND PAVEMENTS

12 General

Applicable provisions of Conditions of Contract shall govern work under this section. The Indian Standards wherever referred to herein shall be the latest edition of such standards.

12.1 Types of Floors and Pavements

The principal types of floors and pavements considered in this specification are as under:

a) Cast-in-situ artificial stone flooring (plain)
b) Natural stone slab flooring
c) Pre-cast artificial stone flooring (Plain/Textured)

12.2 Materials

- Cement

  PPC/PSC and white and colored cement shall conform to IS: 269,IS: 455, IS: 1489(Part 1).
- Lime

  Where lime is required to be used, it shall conform to IS: 712 and slaking of lime shall be done according to IS: 1635.
- Aggregates

  The aggregates shall conform to IS: 383. Fine aggregates shall range in size from 1.5 mm to 6 mm. unless specified otherwise. Not more than 5 percent of grains shall pass IS sieve 15 (0.151 mm mesh) and not more than 10 per cent shall pass IS sieve 30 (0.296 mm mesh). Coarse aggregate shall all pass through 19 mm mesh, unless specified otherwise and shall be graded as directed. The coarse aggregate for concrete pavements for approaches and driveways shall all pass through 25 mm ring and shall be formed by mixing 80% of 25 mm to 12 mm size and 20% of 12 mm to 6 mm size. The above proportion shall be altered to suit workability if so approved.
- Natural Stone Slabs

  The stone slabs if used shall be best quality obtainable from Neemuch, Kotah, Shahabad, Tandur or other places as specified and shall be hard, even durable, uniform in color and free from cracks, flakes and other defects. No stone shall be thinner at its thinnest part than 25 mm. unless otherwise specified; the stones shall be 300 mm x 300 mm in size dressed square and with straight edges. The top surface of stones shall be smooth or polished as specified and edges dressed to a true fir or chisel dressed as directed.
- Water

  Water shall be clean and free from injurious amounts of deleterious materials. As far as possible, water shall be of potable quality.

12.3 Cast in situ Artificial Stone Flooring

Grey and colored artificial stone is to be composed of 4 parts of fine stone chips 12 mm and below 2 parts of sand and properly screened to one part of cement. The topping in all cases and to consist of clean and fine sand and cement (2:1) and sufficient skin thickness to be kept and finally trowelled with neat cement finish perfectly smooth to satisfaction. In the case of dados and skirting the total thickness is to be 19 mm of which the bottom layer is to be 12 mm and the toping 6 mm thick in all cases both the layers are to be laid simultaneously without hiatus so that it will in effect be one complete layer; the mixing be made in two different lots.

12.4 Natural stone slab flooring

The stone slabs shall be evenly and firmly bedded to the required level and slopes as directed. Unless otherwise specified, the thickness of joints shall not exceed 6 mm for unpolished stone slabs and 1 mm for polished stones. The joints shall be raked out to an adequate depth and pointed flush or slightly sunk, as directed, with cement-sand mortar of 1:2 proportions. The stone slabs shall be laid to pattern which shall be approved prior to ordering the stones. The flooring

shall be kept wet with wet sand or water for at least seven days. The flooring shall be well washed and shall be perfectly clean and free from all mortar stains etc. when completed.

Section 5. PLASTERING AND POINTING

13 General

Applicable provisions of Conditions of Contract shall govern work under this section. The Indian Standards wherever referred to herein shall be the latest edition of such Standards.

13.1 Cement Plaster Materials

Cement shall confirm to PPC/PSC and Sand shall confirm to IS: 1542. Other materials, tools and Accessories, they shall confirm to relevant IS codes listed above and to the requirements specified in IS: 1661.

13.2 Proportioning and thickness of Cement Plasters:

The proportions of materials, number of coats and thickness of each coat shall be as a specified or as directed.

13.3 Workmanship

Unless otherwise specified, all plasterwork shall be carried out as per IS: 1661 "Code of Practice for Cement and Cement-Lime Plaster Finished on Walls and Ceilings". Special finishing textures to the plaster shall be executed according to Clause 16 of IS: 1661 and/or as directed.

13.4 Curing

After the completion of the work, the pointed face shall be kept well wetted for at least for 10 days in the case of Cement Pointing.

Section 6. PAINTING AND GLAZING

14 General

Applicable provisions of Conditions of Contract shall govern work under this section. The Indian Standards wherever referred to herein shall be the latest edition of such standards.

14.1 Painting of Iron and Steel Work

Painting of iron and steel work shall generally be carried out as per IS: 1447 (Part I).

14.2 Preparation of Surfaces:

The surface to be painted shall be cleaned free of dirt, oil rust, mill scale and be thoroughly dry before painting. Cleaning, degreasing, and descaling wherever necessary shall be carried out as

specified in IS: 1477 (Part I) and the method adopted for surface preparation shall have prior approval.

14.3 Primer Coat:

Unless otherwise specified, the primer coat for steel and iron work shall be of Red Lead paint, conforming to IS: 102. The Red Lead primer shall be applied by means of approved brushes. The Red Lead paint shall be allowed to dry sufficiently hard before the application of the succeeding coat A red lead painted surface shall not however be left exposed permanently, as it is liable to heavy chalking. The primer coat shall be applied as specified in IS: 1477 (Part-I) and the number of coats shall be as necessary for as directed.

14.4 Finish Coat

The type of intermediate and finish coat and the number of coats to be applied shall be as necessary or as directed. Intermediate and finish coats may be oil bound bituminous, aluminum or other types of paints. Aluminum conforms to IS: 165. The intermediate and finish coats for structural steel work, sheet metal work and cast iron work shall be applied as specified in IS: 1477 (Part-I).

Section 7. Glazing Materials

15 Glass

All glass used in the work shall be best quality glass free from specks, bubbles, smokes, wanes, air holes and other defects, Unless other-wise specified, sheet glass shall be transparent and of the following weights. For panes up to 600 mm x 600 mm in size, glass weighing not less than 7.97 kg/sq.m. shall be used for panes 750 mm x 750 mm to 900 mm x 900 mm size, the weight of glass shall be 9.76 kg/sq.m. Unless other-wise specified, for sizes of glass above 900 mm x 900, plate glass shall be used.

15.1 Putty

Putty for use on wooden frames shall conform to IS: 419 and on metal frames to IS: 420.

15.2 Workmanship

All glass is cut according to the sizes required as per drawings. Glazing of metal doors, windows and ventilators shall conform to IS: 1081 and glazing of timber doors, windows, and ventilators shall conform to IS: 1003, unless specified otherwise. For glazing wooden doors and windows, the wooden frame, particularly the rebate, shall be well oiled to prevent oil from putty being sucked in by wood. The Contractor shall thoroughly clean all glass and replace all putty or glass damaged during the work.

Section 8. MISCELLANEOUS STEEL AND IRON WORK

16 General

Applicable provisions of Conditions of Contract shall govern work under this section.
The Indian Standards wherever referred to herein shall be the latest edition of such Standard.

16.1 Iron Grills

The grills for Windows, verandahs, balconies, etc. shall be of mild steel or wrought iron as specified for the work. The design of grills and shapes and sizes of various components shall be as approved. The edges, angles and corners shall be clean and true to shape. The joints shall be mechanically inter-locked and overlapping areas spot welded in such a way that the grill is rigid.
Where moulded grills are specified, the moulded work shall be as approved, and shall have clean, straight and sharply defined profiles. The contractor shall do the necessary cutting, fitting, drilling, tapping, scribing etc. required to fix grills to adjacent surfaces. The grills shall be fixed plumb, in line and level. Unless otherwise specified, grills shall be painted with two coats of red lead paint conforming to IS: 102 before they are fixed.

16.2 Rolling Shutters

Rolling shutters, where specified shall be of the size to suit the openings and shall be positioned as shown on the drawings and/or as directed.
The rolling shutter shall be fabricated from 18 B.G. Steel and machine rolled with 75 mm rolling contras with effective bridge depth of 12 mm lath sections, interlocked with each other and ends locked with malleable cast iron. The guides shall be either rolled or pressed deep channel sections 75 mm deep and 25 mm wide fitted with necessary fittings and fixtures.
The suspension shaft shall be formed from solid drawn seamless tubes 60 mm O.D. of wall thickness of 25 mm in 3 segments coupled 2 with 2 pairs C.I. dog-tailed flange coupling forming one complete unit eliminating deflection in the center to a minimum.
The springs shall be imported high tensile English flat springs 50/60 mm breadth and 1.6/1.8 mm thickness hardened and tempered. These shall be fitted inside the fabricated housing on either ends, which counterbalance the shutter curtain. The ball bearings shall be double row self-aligning ball bearing fitted inside C.I. housing fixed on side brackets holding the suspension shaft at either end
The suspension of the curtain shall be belted in specially fabricated cages formed from MS flats, and plates all are welded. The hood cover shall be made of 20 gauge G.P. sheets with necessary stiffeners and framework to prevent sag, the bottom lock plate shall be made of 3 mm thick M.S. plate and 95 mm wide reinforced with angle/T iron of suitable section with 6 mm dia. M.S.rivets interlocked with last stride of curtain.
The locking arrangement shall consist of hasp and staple on the bottom plate, lockable from both sides. Unless otherwise specified, for overall area of rolling shutters up to 9 sq. m. pull and push type hand-operated shutters shall be used, for area between 9 and 12 sq. m. Pull and Push type

shutters shall be provided with ball bearings; for area larger than 12 sq. m, Mechanical Gear type shutters shall be supplied.

16.3 Collapsible Gates

Collapsible gates shall be of the size and type as specified by KMDA's Engineer. The gates shall be manufactured out of M.S. channel pickets of size 20 mm x 10 mm and flats 20 mm x 6 mm. The top runner flat shall be at least 50 mm x 12 mm in section. The bottom guide shall consist of a channel or two angles of specified size laid in the flooring to guide the free movement of the gate. The gate shall move in the guide channel on rollers of adequate size fixed at the top and bottom of the gate as specified. The gate shall be painted with one coat of red lead paint conforming to IS : 102 before fixing in position.

Section 9. WOODWORK AND JOINARY

17 Wood:

All wood required to be used, shall be dry, well-seasoned, Bulsar teak wood and shall be free from knots, cracks or any other kind of defects frames for doors and windows.

17.1 Jointing Materials:

All nails, screws, fixtures shall be of standard quality as approved by KMDA.

17.2 Cutting Edges:

Cutting edge for well to be fabricated as per the drawing approved by KMDA's engineer The structural steel to be used, should confirm to IS: 226-1961 and IS: 2062-1962. The steel shall be free from defects as mentioned in IS: 226-1962 and shall have a smooth uniform finish. Material shall be free from loose mile scale, rusting or other defects affecting its strength and durability. The test certificates shall have to be submitted for the structural steel used in cutting edge.

18 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 recommendations of lux level are not covered above, illumination level in such areas shall be finalized in consultation with KMDA.

KMDA 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.

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 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.

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 contractor, controlled by photocell/ clock switch and shall also have a manual by pass switch.

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 KMDA

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 substation 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 Receptacles (Lighting & Small Power) :

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.

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.

Section 10. PIPING WORK

20 Cast Iron Pipes & Fittings

20.1 All protection and bedding of sewers work shall be carried out in strict accordance with the specification and methods laid out in the CPHEEO manual or as specified in schedule 10.

20.2 Applicable Codes

The manufacturing, testing, supplying, jointing and testing at work sites of cast iron pipes and fittings shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of this specification conflict with the requirements of the code of standards, this specification shall govern.

- IS:210 - Specification for grey iron casting
- IS: 290 - Specification for coal tar black paint.
- IS: 638 - Specification for sheet rubber jointing and rubber insertion jointing.

- IS:782 - Specification for caulking lead
- IS:1387 - General requirements for the supply of Metallurgical material
- IS: 1537 - Specification for vertically cast iron pressure pipes for water, gas and sewage.
- IS:1536 - Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage
- IS: 1538 - Specification for cast iron fittings for pressure pipes for Water, gas and sewage.
- IS: 1500 - Method for Brinell hardness test for grey cast iron.
- IS: 2078 - Method for tensile testing of grey cast iron.
- IS:5382 - Specification for rubber sealing rings for gas mains, water mains, and sewers
- IS: 6587 - Specification for spun hemp yarn.
- IS: 3114 - Code of practice for laying of cast iron pipes.

21 Mild Steel ERW Pipe

The manufacturing, testing, supplying, jointing and testing at work sites of mild steel pipes and fittings shall comply with all currently applicable status, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of this specification conflict with the requirements of the code standards, Engineer-in-Charge decision shall be final.

Materials

a. IS:226 : Specification for structural steel (standard quality).
b. IS: 2062 : Specification for structural steel (fusion welding quality).
c. IS: 6631 : Specification for steel pipes for hydraulic purposes.
d. IS:3589 : Specification for electrically welded steel pipes for water, gas and sewage (150 mm to 2000 mm nominal dia).
e. IS:6392 : Specification for steel pipe flanges
f. IS:814 : Specifications for electrodes for metal arc welding of structural steels: Part 2 welding sheets.

Code of Practice

a. IS: 5822 : Code of practice for laying of electric welded steel pipes.
b. IS: 11906: Recommendations for cement mortar lining for mild steel pipes and fittings for transportation of water.
c. IS:10221 : Code of practice for coating and wrapping of underground mild steel pipelines.
d. IS: 816 : Code of practice for use of metal arc welding for general construction in mild steel.

22 DWC HDPE Pipes

These pipes shall meet specifications as per BIS 16908- part 2-2013.

22.1 Jointing

HDPE pipe shall be jointed properly with HDPE socketed specials to get smooth inner side surface without any extrusion to avoid any obstruction to the flow of wastewater. If in any particular case butt welding has to be done, smooth inner surface of pipe without intrusion inside shall be ensured.

23 VALVES

23.1 Gate (Sluice) Valves

Gate Valves shall be either solid wedge or knife gate unless specifically defined on the drawings. The materials used for the manufacture of each component shall be the best available for the specific purpose and shall not, in any case be inferior to the following:

Cast Iron	IS. 210 Grade 20
Stainless Steel	IS. 1570 Grade, B.S. 970 Type EN, ASTM A 473.
Gun Metal	BS.1400 LG 2 C or the equivalent Indian Standard.
Cast Steel	Plain Carbon Steel complying with IS. 1570 Grade or BS: 970 Grade 431 S 29.

Valve Bodies shall be in cast steel for sewage treatment plants, Spindle shall conform to Stainless Steel and Valve Gates shall conform to Stainless Steel

24 Specifications Referred

The specifications contained herein are not exhaustive and for such items of works which may arise and which are not covered by this specification, or by the relevant Indian Standards, the provisions in the P.W.D. Schedule of Rates (Buildings, Roads) shall apply. A list of few important Indian Standards is given below: Wherever reference to the Indian Standards mentioned below or otherwise appears in this specification, it shall be taken as a reference to the latest version of the standard.

IS No.	Description
General	
IS : 456	Code of Practice for Plain and Reinforced Concrete for General Building Construction
IS 3764	Safety code for excavation
IS : 1200	Method of measurement of building and engineering (Part 1 to 28) works
IS : 3385	Code of practice for measurement of Civil Engineering works.
IS : 1642	Fire safety of buildings (General): Details of Construction Code of Practice.

IS No.	Description
IS : 4082	Recommendations on stacking and storing of construction materials at site.
Sand	
IS: 2116	Sand for Masonry, Mortar
IS: 1542	Sand for Plaster
Aggregates	
IS: 383	Aggregates, Coarse and fine from National Sources for Concrete.
IS: 515	Aggregates for use in Mass Concrete Natural and Manufactured.
Cement	
IS : 12330	Specification for sulphate Resisting Portland cement.
IS : 1489	Specification for Portland pozzolana cement
IS : 12269	Specification for 53 grade ordinary Portland cement.
Concrete Plain & Reinforced	
IS : 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
IS: 3370	Concrete Structures for the Storage of liquids (Part I & Part II, III & IV)
IS : 432	Specification for mild steel and medium tensile steel (Part 1 and 2) bars and hard drawn steel wires for concrete reinforcement
IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS : 4326	Code of practice for earthquake resistant design and construction of building.
IS : 10262	Recommended guidelines for concrete mix design.
Code for Construction safety	
IS : 3696	Safety code for scaffolds and ladders. (Parts I and III)
IS : 7969	Safety code for handling and storage of building materials.
IS : 8989	Safety code for erection of concrete framed structures.
Brickwork	
IS : 1077	Common Burnt Clay Building Bricks.
Paving and Floor Finishes	
IS : 1237	Flooring Tiles, Cement Concrete
IS : 1443	Cement Concrete Flooring Tiles, Laying and Finishing of
Plastering & Pointing	
IS : 1661	Cement and Lime, Plaster Finishes on Walls and Ceilings
Roof Coverings	

IS No.	Description
IS : 459	Asbestos Cement Sheets, Unreinforced Corrugated Sheets
IS : 730	Fixing Accessories for Corrugated Sheet Roofing
Steel & Iron Work	
IS : 226	Structural Steel (Revised)
IS : 800	Use of Structural Steel in General Building Construction, code of Practice for Pipes& Fittings Pipes
IS : 3486	Cast Iron Spigot & Socket Drain Pipes
IS : 1538	Cast Iron fittings for Pressure pipes for water, Gas & Sewage
IS : 1536	Centrifugally Cast Iron Pressure Pipes for water, Gas & Sewage.
IS : 458	Concrete pipes with or without reinforcement
IS : 783	Code of practice for laying Concrete pipes.
IS : 3114	Code of practice for laying of C.I. Pipes
IS : 1726	C.I. Manhole covers and frames intended for use in drainage works.

This list does not necessarily cover all the Standards referred to.

25 Technical Specifications for Electrical Works

All works shall be carried out in accordance with the requirements of:

i. IE Rules
ii. State Electricity Board
iii. Rules and regulations of Local authorities, and
iv. The standards in this specification

The Contractor is responsible for applying and obtaining necessary statutory approvals and shall ensure workmanship of good quality and shall assign qualified supervisor / engineers and competent labour who are skilled, careful and experienced in carrying out similar works.

2. General engineering specifications and practice for Electro-mechanical Works.

The following General engineering specifications and practice shall be adopted/adhered to for the Sewage Pumping Station and Sewage treatment plant:

a) Superstructure shall be provided for Transformer, electrical switchgears , contractor and DG room. The design, manufacture and performance of all the equipment used in the Pumping stations shall confirm to the latest applicable Indian and International standards.

i. IS 5120: Technical requirements for roto-dynamic special purpose pumps.
ii. IS 5600: Sewage and drainage pumps
iii. IS 9137: Code for acceptance tests for centrifugal mixed flow and axial flow pumps- class "c"
iv. HIS: Hydraulic Institute Standards

- Inlet chambers shall be provided at inlet, and connected to screen channels through sluice gate openings. Over-flow having capacity to discharging average inflow to be arranged from inlet chamber.
- Screen channel shall be in two parallel streams, with provision of sluice gates of cast iron as per IS 13349 at the starting of channels.
- Inlet chamber shall be 300mm below the invert level of sewer with gradual slope towards wet well.
- Mechanically raked screens with conveyor shall be provided at the inlet screen channels for the pumping stations.
- All pumps shall be of the same capacity, manufacture, model, speed or other parameters, such that operation & maintenance is standardized.
- The capacity of the wet well is to be so kept that with any combination of inflow and pumping the cycle of operation for each pump shall not be less than 5 minutes and the maximum detention time in the wet well shall not exceed 30 minutes of the average flow. The capacity required between 'start' and 'stop' levels in the sump depends on the extent of inflow rate variations and the need to prevent pumps from starting with greater frequency than the rating of the electrical equipment shall tolerate.
- The lowest 'start' level should be such that the pump body is below the water level so that there is no air pocket within the pump volute. This is to prevent cavitations on starting.
- The lowest 'stop' level should be such that it does not allow air to be entrained by vortex into the pump suction.
- The pumping station design shall meet the pump's NPSH requirement to operate without risk of cavitations.
- The total head shall be calculated at low level in wet well for satisfactory operation.
- Starting level of last pump shall be minimum 150 mm below the expected maximum sewage level in sewer, to avoid surcharging of sewer. This shall ensure free flow of sewage to wet well at all flow conditions .
- Flanged Ductile iron pipe fittings as per standard BS 4504 or ISO 2531 shall be provided for pump suction and delivery piping. Restrained dismantling joints of ductile iron shall be provided for ease of installation and dismantling. The delivery pipe shall be connected to header from side. Gaskets material of construction to be EPDM, BS681-1. Natural rubber, NBR or SBR material for gasket shall not be accepted
- Pump delivery sluice valves shall be with electric actuators as these are to be opened and closed when pump is started and stopped.
- Quick closing spring controlled non-slam type swing check valve shall be provided at pump delivery to prevent back flow of wastewater
- Rising mains up to 1100mm shall be ductile iron class K-9 with cement mortar lining.
- Larger rising mains shall be Mild steel with inside mortar lining. For calculation of friction loss in rising mains "C" value of 140 for DI pipes with lining shall be considered as per Hazen Shalliams formula. $Q = (1.292\times10-5)\times C \times D2.63S0.54$

- Ultrasonic level measuring system shall be provided for proper operation of the plant
- A pressure gauge / transmitter complete with isolation valve shall be mounted on the delivery pipe of each pump set upstream of the non return valve. The tapping shall be on the centre line of the pipe and the instrument shall be calibrated to measure a pressure range of 0 to 100 meters of water
- The ladders, platform, covers and handrails to be supplied and fixed under this Contract shall be supplied in accordance with the standard specification. Provide suitable corrosion lining in wet well. Access hatches shall be provided through the cover as necessary to facilitate personnel access, inspection and removal of submersible pumping units and instrumentation.
- Lifting equipment shall be provided for pumps and screens. Capacity of lifting equipment shall be 1.5 times of the heaviest piece to be handled.

b) Supply, Installation, Testing of the mechanical and electrical equipment, pipes, fittings & other accessories.

c) Adequate measure shall be taken to prevent dry running of the pump. Low level to trip the pump shall be above the top of pump casing. The sump floor shall have slope towards suction pit / channel. Care shall be taken especially for underground sludge sumps to provide suction pit of adequate size for emptying the sump for ease of maintenance.

d) Effective liquid depth of units shall be considered between levels corresponding to lowest level switch and highest level switch. Flooded suction requires that lowest level switch shall not be lower than the elevation of discharge flange of pump.

e) Monorail and chain pulley block (manually operated) shall be provided for all pump houses (both underground and above ground), Blower room, etc. as required of adequate capacity (minimum 1.5 times the weight of the heaviest equipment). Monorail shall be extended outside pump house / building to facilitate loading / unloading of equipment directly on vehicle, for which ramp approach shall be given.

f) All pump areas / pedestals shall be provided with kerb walls and suitable arrangement for collection of leakage and connection to the nearest piping/unit, keeping in mind the process requirement, shall be provided. In dry wells necessary drain collection pit and dewatering pump of sufficient capacity and head requirement having auto operation with low and high level switches shall be provided in all pump houses, especially underground pump house for this purpose.

g) All motors shall have running indication.

h) The clear distance between adjacent pump / blower pedestal shall be minimum 1000mm. The clear distance from pedestal to internal face of walls shall not be less than 1500mm. The clear distance from pedestal to internal face of walls on motor side of the pumps shall not be less than 2000mm.

i) Minimum clearance of 500mm shall be provided around pumps, blowers, equipment pedestal for paving etc.

j) Operation Maintenance of the entire system including consumables for the specified period. Supply, erection, testing, commissioning of various mechanical, electrical & instrumentation

equipment required for the smooth working of the Sewage pumping station and Sewage treatment plant , including O & M during guarantee period.

2.1 General Mechanical Equipment's

Design, supply, erection, commissioning and testing of all mechanical equipments based on chosen technology of Sewage treatment process, shall generally comprise of:

a) Bar Screen with frame and scrapper
b) CI Sluice Gate
c) Drainage sump pumps
d) Loading/Unloading System for Pump House
e) Flow measuring System
f) Level measuring System for well and Tank.
g) All Pipe-works and valves
h) DG Set for Power back-up.
i) Firefighting system.
j) Ventilation inside the Pump & Control room, as per requirement.
k) Any other equipment required.

2.2. Technical specifications of Mechanical Works

2.2.1 Screening System.

- All Sewage Pumping Stations shall be provided with Mechanical screens as working and Manual Screen as Standby with conveyor system.
- The screens shall be made with welded stainless steel (AISI410) frame.
- Bye bass arrangement shall be provided on the upstream side, to avoid overflow of the screen channel in case of sudden power failure.
- Drainage facility shall also be provided in the individual screen channels to empty these channels for maintenance purposes.
- Individual screen channel should be designed to provide a velocity of min. 0.6 m/sec at average design flow.
- The effective area of opening of the screen should be such as to produce a velocity through the screen opening not exceeding 0.9 m/sec. at maximum expected flow.
- The top of the screen shall be at least 500 mm above the expected highest flow level.

2.2.2 Sluice Gate

- The gates shall be as per IS:13349/AWWA C 501 or relevant BS/DIN/ISO at their Latest revision.
- The gates shall be CI with rising type spindles.
- The unbalanced head shall never be more than 15 m.
- The gates shall be manually/Electrically operated.

- The gates shall be installed primarily in the screen chambers for isolation of flow for maintenance purposes.

2.2.3 Submersible Motor Sewage Pump

1. General

The pump shall be vertical, submersible, non-clog, single stage, bottom suction, monoblock type driven by single speed submersible motor suitable for pumping all kinds of sewage / sludge / storm water containing plastics and fibrous materials. The pumps must have fitted with in-built cutting and tearing system for foreign matters. The speed of the pump should not be more than 1450 r.p.m. The motor output power must have at least 15% margin over pump input power at duty point and the motor will never be overloaded throughout the entire pump operating range as shown in the performance curve. The pump performance must be stable from zero discharge to run out condition.

The design, manufacture and performance of the submersible pump-motor sets shall comply with the latest applicable Indian / International Standards. In particular, the equipment must conform to the latest revision of applicable specification. The pump shall be capable of developing the required total dynamic head at rated capacity and will be suitable for parallel and continuous operation. The head-capacity curve of the pump shall be continuously rising towards the shut-off with highest head at shut-off. The impeller of the pump shall preferably be of non-overloading type. The pump shall be designed to be protected against reverse direction of rotation due to the sewerage returning through the pump. The set rotor assembly weight and unbalanced hydraulic thrust of the impeller shall be carried out by the thrust bearings provided in pump assembly. The pump shall operate trouble free, smooth and without any undue noise and vibrations. The magnitude of peak-to-peak vibration at shop and at site installation will be limited to 75 microns and 50 microns respectively at the bearing housing.

The pump installation design should be such as to facilitate automatic installation and removal of pumps without having entry into the sewage pit. Profile gasket should be provided in automatic coupling system so as to avoid metal-to-metal contact between pump and delivery pipe bend to ensure leak proof joint.

2. Constructional Features

Casing

The pump casing, made of cast iron shall be hydrostatically tested at 1.5 times the shut-off head with maximum impeller size. The pump casing shall be of robust construction and the liquid passage in the casing shall be finished smooth.

Impeller

The non-clog, semi open / vortex type impeller will be both statically and dynamically balanced and will be keyed and positively held on the motor shaft. The impeller will also be secured against damages, if the direction of rotation should reverse due to liquid flowing backward through the pump. The impeller shall be capable of handling soft solids of minimum diameter

100 mm. The leading edge of the vanes shall be rounded and cut back to prevent rags, stringy materials etc. from impinging on the impeller vanes.

Shaft

The shaft, made of stainless steel shall be finished to close tolerance at the impeller and bearing diameters. The impeller shall firmly be secured to the shaft by key and / or nuts. The size of the shaft shall be calculated on the basis of maximum combined stresses. While designing the shaft the critical speed of the shaft must be taken into account which shall be at least 20% above / below the operating speed. The rotor shall be dynamically balanced to avoid any vibration during operation.

Seal

The pump shall have two mechanical seals in tandem arrangement. The lower mechanical seal shall have SiC / SiC face combination. Upper mechanical seal shall have with Carbon / TC face combination.

Bearing

Maintenance free antifriction deep grooved, permanently grease filled ball / roller bearings should be provided and this should take care of axial and radial thrust at any point of operation.

Motor

The motor should be dry, squirrel cage type, suitable for 3 ph, 415 ± 10% volt, 50 Hz supply, designed, manufactured and tested conforming to IS: 325. The motor should be rated for continuous duty with IP68 protection and class 'F' insulation or better. However, the motor frame size shall be liberally designed to restrict the temperature rise as per class 'B' insulation.

All squirrel cage induction motors shall be provided with electrolytic grade copper winding for stator and the rotor of the motor shall be of copper bars only.

3. Internal Protection Features for Pump sets (above 15 KW motor)

The pump sets shall at the minimum be provided with the following internal protections. The leads of all the protecting sensors shall be brought out from the motor with separate control cables.

Winding Temperature

The motors shall be provided with 3 sets of PT 100 type thermostats embedded in the winding to protect it from getting overheated.

Bearing Temperature

For detection of mechanical faults, both bearings, at drive end and non-drive end shall be provided with PT 100 type temperature sensors for monitoring the bearing temperature, protection and annunciation.

Moisture Sensors

The motors shall be provided with a resistance type sensor to sense entry of any moisture in the motor chamber. It shall operate on 230 V AC supply.

Monitoring Seal Leakage Chamber

The pump set shall be provided with a float switch type sensor assembled in the seal leakage collection chamber. In the event of any leakage this sensor will give the tripping signal. The contacts of the float switch shall be rated for operation on 230 V 6A AC.

4. Material of Construction

Casing	:	Cast Iron, IS : 210, FG 260
Impeller	:	2.5% Ni-Cast Iron, IS : 210, FG 260
Shaft	:	Stainless Steel, AI SI : 410
Motor housing	:	Cast Iron, IS : 210, FG 260
Stator/Rotor core	:	CRGO Steel
Stator/Rotor winding	:	Electrolytic grade copper wire/bar
Fastners	:	Stainless Steel, AISI : 316
Auto coupling system	:	Cast Iron, IS : 210, FG 260
Lifting chain, Guide pipe	:	Stainless Steel, AISI : 410

5. Scope of Supply

The scope of supply will include Submersible Pump set along with Automatic coupling, Delivery bend and Cable, Guide pipe & chain of required length.

6. Painting

The pump set shall be painted with zinc rich epoxy primer plus two coats of epoxy paint. The paint shall be spray applied and dried in a painting booth to avoid ingress of foreign particles especially when the painted surface is not completely dry.

7. Inspection & Testing at Manufacturer's Works

The manufacturer will submit their QAP for Engineer's approval including the following inspections and testings which will be carried out at the manufacturer's works.

8. Hydrostatic Test

The pump casing will be hydrostatically tested for any leakage, with water at a pressure 1.5 times of closed valve pressure with maximum impeller size or 2.0 times of pump duty point pressure whichever is higher. Unless otherwise stated the minimum duration of testing will be 30 minutes.

9. Statically Balancing

All major rotating components must be statically balanced individually.

10. Dynamic Balancing

In addition to static balancing of individual component the whole rotor assembly of pump must be dynamically balanced at rated operational speed.

11. Performance Test

Each assembled pump shall be shop tested by the manufacturer to determine the following characteristics as furnished in the characteristics curve.

i) Capacity Vs. Total Dynamic Head Curve
ii) Capacity Vs. Brake Horse Power (KW) curve
iii) Capacity Vs. Efficiency (%) curve
iv) Capacity Vs. NPSHR curve

And also recording of

v) Vibration level
vi) Bearing Temperature

The above tests for each pump for its full operating range at rated speed shall be conducted in accordance with the latest revision of IS/BS/DIN/ISO specifications and/or Hydraulic Institute Standards USA.

During pump testing, reading to the extent possible, shall be taken correspond to its full working range from its closed valve condition to 30% increase of the rated output or corresponding to the output at its minimum head specified, whichever is higher.

Each pump performance shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump suction head, pump discharge head, pump discharge etc. Such readings shall be documented for at least seven pumping conditions including one at the shut-off head and each power load shall be checked for proper current balance.

The curves produced from the above readings shall be used to determine the capability of pump sets to meet the guaranteed performance at site.

Bearing temperatures shall be determined by PT 100 or equivalent type temperature detector. A running time of at least 30 minutes shall be maintained for this test at shut off head if sufficient water is not available for a complete test.

After the test runs have been performed to the satisfaction of the Client or his representative that the pumping equipment complies with the stipulated specifications the Client shall be provided with the Manufacturer's Test Certificates.

All instruments and equipment required for such test shall be provided by the manufacturer and the instruments shall be calibrated and certified by an approved independent testing authority not more than 15 days prior to the test in which they will be used.

In the event of any pump failing to meet the specified test requirements, it shall be modified and retested until the requirements are attained.

12. Non-Destructive Tests

Physical and Chemical tests of the major components of each pump must be done. These tests shall be conducted in accordance with relevant IS/BS/DIN/ISO standard. Prior to testing the tests and major components' identifications along with the actual standard to be followed, shall be submitted for Client's approval and only those, which will pass the tests successfully, shall be used for the manufacture of end product. All material test certificates to be submitted before

machining operation to the Client for his approval and finally these 'Approved' test certificates will be produced during pump performance testing.

13. Visual Inspection

Pumps shall be offered for visual inspection to the Client before despatch. The pump assembly/ any component shall not be painted before inspection.

Testing At Site

All pump sets shall be tested at site in the presence of manufacturer's expert. The QH parameters can be measured, if space permits.

2.2.4 Monorail Crane With Chain Pulley Block

- Monorail Crane shall be used for lifting of Submersible motor pumps as and when required for maintenance.
- Monorail mounted hand operated chain pulley block shall be as per the requirement of BS:3243/ Equivalent.
- It shall be of required capacity having adequate chain length.
- The load chain shall conform to BS:2902/Equivalent.
- Guide shall be provided for effective guidance to the load chain and a stripper for effective disengagement of chain from wheel.

2.2.5 Pipe Works

- Pipes carrying sewage shall be of ductile iron with flange or spigot and socket joints according to individual circumstances.
- Pump delivery line flow velocity shall be set at < 2.1 m/sec and individual delivery pipe & common header diameters shall be selected accordingly.
- All pipe work and fittings etc. shall conform to the appropriate Indian Standards and shall be to a class in excess of the maximum pressure they shall attain in service including any surge pressure and shall be supplied by an approved manufacturer. All pipelines shall be tested at 1.5 times the design working pressure.
- The pipe works shall include all pipes and fittings for connection to the rising main upto the stipulated length outside the pump house building. The pipes and fittings shall be as per latest revision of IS:1536/IS:1537/IS:1538/BS:4622/ IS 8329/ IS 9523 / Equivalent and must be suitable to withstand the pressure tested to at least double the close valve pressure.
- The diameter and length of the pipes shall be determined from the specified velocity of the sewage water and size of the pump house. The delivery pipe of the pump shall be connected with the pump through enlarger immediately after the pump so as to restrict the velocity of sewage water in the pipe line at delivery side.
- Each delivery pipe line shall include one puddle collar at the exit of the wet well.
- All the pipe lines shall be protected with anticorrosive paints of required quality to suit the site climatic condition.

- Necessary rubber insertion of suitable thickness shall be provided at all the flanged joints complete with supply and erection of necessary number of bolts, nuts, washers of suitable sizes.

2.2.6 Valves

- Each Sewage pump shall be fitted with a reflux valve and a sluice valve on the delivery side of the pump.
- All the sluice valves shall be as per IS:14846/BS 5150/DIN 3352 at their latest revision and rising spindle type, flat face, bolted bonnet with solid wedge disc .
- The valves above and including 400 DN shall be provided with spur/bevel gear arrangement for operation and be fitted with by-pass arrangement.
- The pressure rating of the valve shall be as per the Design working pressure. Wherever specifically mentioned the valve shall be fitted with extended spindle, head stock along with hand wheel for easy operation from the operating platform.
- The reflux valve ensures that backflow, from the rising main through the pump, does not occur when the pump is not operating. The Reflux valves shall be of Double flanged with hinged single/multi swinging disc complete with bypass arrangements. The reflux valve shall be of flat face bolted cover and shall be fitted with renewable body and disc seat. The reflux valve shall be as per IS:5312/BS:5153/ISO 2531 at their latest revision. The pressure rating of the valve shall be as per Design working pressure.
- The valves on the discharge pipe work are to be mounted in a separate Valve Chamber. This allows the contractor in operation and maintenance of valves easier to carry out. The separate valve pit also allows a suitable accessible point for the attachment of pressure gauges to check the performance of the pumps.
- The Air Release Valve shall be Single air valve (Large Orifice) confirming to IS-14845/2000 for automatically releasing/admitting air that may accumulate under pressure in a section of pipe line at the time of initial charging or draining of main.
- The pressure rating of the valve shall be as per Design working pressure and end connections shall be flanged as per IS specifications. The Air release valve shall be fitted with isolating sluice valve of same size.

2.2.7 Diesel generating set

The Diesel Generating set shall be of A.C type with totally enclosed air cooled multi cylinder, AMF Panel, alternator, 3 Phase, 415V, 50 Hz 0.8 p. f. for developing suitable BHP at 1500 rpm.The DG shall be designed with 10% overload with standard accessories, self excited self regulated, screen protected alternator with static excitation system running at 1500 RPM as per IS 4722:1968 with voltage regulation +/- 5 %.

Both the engine and alternator shall be directly coupled on a common fabricated steel base plate with anti-vibrating pad with control panel comprising of standard meters, switchgears, indicators connected with suitable wires/cables. The complete set shall be enclosed in acoustic enclosure made of 18 SWG CRCA Sheet, sound absorbing material, Rockwool covered from inside with ¾ mm holes perforated sheet to restrict sound level upto 75 dB at 1.0 m

The engine shall be supplied with first filling of oil, diesel etc. obtaining necessary approval from Electrical Inspector as per specification.

2.2.8 Wheel Barrow

Wheel barrows of Polyethylene moulded construction shall be supplied for carting up screenings. The wheel barrows shall have rubber tyred wheels. The moulded units shall be bought out items from ISO : 9000 certified manufactures.

2.2.9 Screenings Container

Portable galvanized steel container shall be provided to store the screenings until the time of pick up. The container shall have a capacity of approximate 2.5 m3 and shall be of a convenient height to permit the discharge of screenings manually. The container shall have hinged covers and its design shall permit their being lifted by an overhead hoist or packer truck. The container shall have four wheels of about 200 mm diameter and two of which shall be swivel castors. The maximum height of a container including wheels shall not be more than 660 mm. The sides shall be fabricated of 12 gauge H.T. steel and the bottom of the container shall be of 5 mm plate steel. The container shall be reinforced with 50 x 50 x 6 angle.

2.2.10 Exhaust Fan

Exhaust fans shall be provided at the places specifically mentioned for ventilation purpose. The cast aluminum alloy blades shall have high efficiency aerofoil section. Blades shall be directly mounted on motor shaft, dynamically balanced and shall conform to IS:2312. The means provided for securing the fan mounting or fan casing to the wall shall be such as to provide a secure fixing without damage to the fan or wall.

The drive motors shall be TEFC, squirrel cage, induction type suitable for 240 Volts + 10%, 1 phase OR 415 Volts + 10%, 3 phase, 50 Hz AC supply with IP54 enclosure and class B insulation.

Suitable designed guards shall be provided at the inlet and outlet side to prevent accidental contact. No inflammable material shall be used in the construction of fan. Moulded parts, if used, shall be of such materials as to withstand the maximum temperature attained in the adjacent component parts.

The fan shall have protective insulation may be of all insulated construction or have either double insulation or reinforced insulation. Each fan should be provided with a 10 sq.mm mesh bird screen. The sheet used for the cowl shall be 14 gauge.

The finish will be stove enameled glossy paint/epoxy paint with specially pre-treated components to enhance corrosion resistance.

The number and size of exhaust fan will be determined taking into account 12 complete changes of air per hour to the service area.

2.2.11 Technical specifications of Electrical Works cope

This specification is intended to cover complete installation, testing and commissioning of electrical equipments i.e. motor control centres, power control centres, control panels, switch gears, motors, push button starters, transformers, etc.

2.2.12 Code and standards

The installation, testing and commissioning of all electrical equipments shall comply with all currently applicable states, regulations, fire insurance and safety codes in the locality where the work will be carried out. Nothing in this specification shall be constructed to relieve vendor of his responsibility.

Unless otherwise specified, the work, material and accessories shall conform to the latest applicable Indian British of IEC standard. All items of switch starter panel shall confirm to their relevant specifications as under or its latest revision.

IS: 4237: 1982 General requirements of switch gear and control gear voltage not exceeding 1000 volts.

IS: 2959 : 1982 contactors

IS: 4064 (Part I): Isolators

IS: 3842 (Part- IV) Overload Relay

IS: 8544 Motor Starters

IS: 10118 Code of practice for installation and maintenance of motor starter.

IS: 1248 Indicating installments

IS: 2705 Current transformers

IS: 2147 Degree of protection for starters.

Good workmanship shall be in accordance with best engineering practices to ensure satisfactory performance and service life.

2.2.12.1 Switch gear, Control panel, etc.

a) All alignment, leveling, grouting, anchoring, adjustments shall be carried out in accordance with manufacturer's instructions and or as directed by the purchaser.

b) All modules shall be taken out and shall be cleaned preferably with vacuum cleaner.

c) All connections of fixing of equipments in switch gear control panels etc. shall be completed, checked and adjusted to ensure safety and satisfactory operation of the equipment.

d) In some cases, minor modifications may have to be carried out at site in the wiring and mounting of the equipment to meet the requirements of the desired control scheme and the Concessionaire shall have to do the same.

2.2.12.2 Motors

a) The installation of motors shall be carried out in accordance with manufacturer's instructions and / or as directed by the Purchaser.

b) Checking and cleaning of bearings and charging / filling of lubricants whatever necessary.

c) Cleaning of core and winding, varnishing and drying but the windings and measurements of air gap for motor assembly at site if demanded.

d) Motors shall be run on un-coupled condition for few hours before coupling them with the drive equipment.

e) Motors shall be coupled with drive, adjusted and shall be tested on load.

2.2.12.3 Miscellaneous Items

a) The Contractor shall install miscellaneous items such as motors starters, local start / stop push button starters etc.

b) These equipments will be generally wall, column or stand mounting. The exact location will be as shown in the final drawing.

c) All supports or brackets needed for installation shall be fabricated and painted by the Contractor.

d) All welding, cutting, chipping and grinding as and when necessary shall be carried out by the Contractor.

2.2.12.4 Cable termination

Cable Termination shall include the following

a) Making necessary holes in bottom / top plates for fixing cable gland / box.

b) Fixing cable gland / box, connecting armour clamp to cable armour.

c) Dressing cable, pouring, compound etc. wherever necessary to make termination complete.

d) Putting cable lugs, crimping them on to cores of cable, taping bare conductors upto lugs, wherever necessary.

e) Termination to equipment terminals.

f) Supply and fixing of cable and core identification ferrules.

Wherever purchaser has not provided MS plates for fixing cable tray supports, Contractor shall install approved concrete fasteners for fixing cable tray supports.

2.2.12.5 Inspection

a) After completion of the erection / installation, each equipment shall be thoroughly inspected in presence of purchaser for correctness and completeness of installation.

b) A check list may be furnished by the purchaser wherein all details to be checked and necessary instructions shall be listed. The inspection and checking shall strictly follow the check list.

c) On completion of the inspection two (2) copies of the check list duly filled in shall be jointly signed by Concessionaire and the purchaser, such endorsement, however, shall not relieve the Concessionaire of his obligation under the contract.

2.2.12.6 Testing and commissioning

a) After completion of erection work tests shall be conducted by the Concessionaire on each piece of the equipment as per list be supplied by the purchaser or his authorized representative.

b) The Contractor shall provide all tools, instruments; materials labour supervisory personnel for carrying out tests on the equipment and materials under his scope of work.

c) The Contractor shall record the test results on approved Proforma and furnish four (4) copies of the results to the purchaser for his approval within a week form the date of test completed.

d) Before commissioning of the equipment, the Concessionaire shall set the relays to their recommended values.

e) On successful inspection and testing, the equipment shall be commissioned and put on trial run along with other equipment in a manner mutually agreed upon.

2.2.12.7 Rectification

The Contractor shall carry out all rectifications, repairs or adjustment work found necessary during testing, commissioning and trial run.

Unless otherwise specified the work, material and accessories shall conform to the latest applicable Indian, British of IEC Standards, some of which are listed below:

IS 3043 Code of Practice for earthing.

2.2.12.8 Installation of cables

1. The Contractor's scope of work includes, unloading, laying, fixing, jointing, bending and terminating of cables. Concessionaire shall also supply all the necessary hard-wares for jointing and terminating of cables. Cables shall be laid directly buried in earth, on cable trays and support in conduits and ducts or bare on walls, ceiling etc as shown in the approved Drawings.
2. All cable work and the allied apparatus shall be designed and arranged to reduce the risk of fire and any damage that may cause in the event of fire. Wherever cables pass through any floor or wall opening suitable bushes shall be supplied. If required by the Engineer – in – charge,, the bushes shall be sealed using fire resisting materials to prevent fire spreading.
3. Standard cable installation tools shall be utilized for cable pulling. Maximum pull tension shall not exceed manufacturers recommended value. Cable grips, reels or pulleys used shall be properly lubricated. The lubricant shall not injure the overall covering and shall not set up undesirable conditions of electrostatic stress. Cables pulling shall permit performance of collateral work without obstruction.
4. Sharp bending and kinking of cables shall be avoided. The bending radius for various types of cables shall be more than those specified by manufacturer.
5. Power and control cables shall be laid in separate cable trays. The order of laying of various cable in trenches and overload trays shall be as specified below:
6. Cables of highest system voltage at the top most tier with second highest voltage on the second tier from top, third highest on the third tier from top etc. with control instrumentation and other service cables in bottom most cable tier.
7. Where groups of HV and LV and control cables are to be laid along the same route, suitable barriers to segregate them physically shall be employed.
8. Where cables cross roads and water, oil gas or sewage pipes the cables shall be laid in reinforced spun concrete pipes of 15 mm minimum diameter, also 50% space shall be kept as space for future, if more than one cable is to be laid through pipe. For road crossing the pipe for the cable shall be buried at not less than one metre depth. Cable less than 15 mm unless otherwise

approved by the Engineer. Cable shall be protected at all times from mechanical injury and from absorbing moisture.

9. Some extra length shall be kept in each cable run at a suitable point to enable one or two straight through joints to be made at a later date, if any fault occurs.
10. To facilitate visual tracing, cables in trays shall be laid only in single layers where design, permits. Cables shall be laid in proper sequence so as to avoid unnecessary crossing of other cables upon entering or leaving a run of tray. Cable splices shall not be permitted.
11. Cable jointing shall be in accordance with relevant Indian Standards Codes of Practice and Manufacturer's special instructions. Materials and tools required for cable jointing work shall be supplied by Concessionaire. Cable shall be firmly clamped on either sides of a straight joint at not more than 300 mm away from the joints. Identification tags shall be provided at each joint and at all cable terminations. Single core cable joints shall be marked so that phase identify at each joint can be determined easily. The joints shall be located at most suitable places. When two or more cables are laid together, joints shall be arranged to be staggered by about three meters. Before jointing insulation resistance of both sections of cables to be jointed shall be checked.
12. Contractor shall install and connect the power, control and heater supply cables, for motors. Concessionaire shall be responsible for correct phasing of the motor power connections and shall interchange connections at the motor terminal box if necessary after each motor is test run.
13. Metal sheath and armour of the cable shall be bonded to the earthing system of the station.
14. Cable clamps shall be minimum 3 mm thick and 25 mm wide galvanized MS flat spaced at every 1.0 m interval.

2.2.12.9 Cable trays, accessories and tray supports

Cable trays shall either be run in concrete trenches or overload supported from building steel, floor slab etc.

Cables shall be clamped to the cable trays in both horizontal runs and vertical runs by suitable site fabricated clamps.

Cable trays supporting system shall be adequately designed so as to keep maximum deflection within permissible limit.

2.2.12.10 Conduits and pipes

Contractor shall supply and install conduits, pipes as specified and as shown in drawings all accessories / fittings required for making installation complete shall be supplied by Concessionaire.

Conduits and pipes shall be of GI and of heavy duty type.

Flexible metallic conduits shall be used for termination of connections to equipments to be disconnected at periodic intervals.

Conduits or pipes shall run along walls, floors and ceilings, on steel supports, embedded in soil, floor, wall or foundation, in accordance with relevant layout drawings. Underground portions of conduit installation to be embedded in the foundation or structural concrete shall be installed in close co-ordination with collateral work. Exposed conduit shall be neatly run and evenly spaced.

Exposed conduit shall be adequately supported by racks, clamps, straps or by other approved means. These fittings shall be of same material as conduits.

Each conduit run shall be marked with its designation as indicated on the drawings. Identification shall be made where possible by means of brass ribbon. So located that each run of conduit is readily identified at each end.

When one or more cables are drawn through a conduit, cables shall fill not more than 50% of the internal cross sectional area of the conduit.

Entire system of conduit after installation shall be tested for mechanical and electrical continuity throughout and permanently connected to earth by means of special approved type earthing clamp efficient fastened to the conduit.

For jointing purpose, Concessionaire shall have available at site, dies for threading pipe or conduit. All such threaded ends shall be reamed after treading and anti-corrosive paint applied.

2.2.12.11 Switch gear control panel / desks

Base of outdoor type units shall be sealed in an approved manner to MS channel concrete to prevent ingress of moisture.

Contractor shall take utmost care in handling delicate equipments and mechanism like instruments, relays, dragging shall be avoided as far as possible. Proper pies shall be provided underneath when dragging for short distance. Wherever the instruments and relays are supplied separately, they shall be mounted only after the associated control panels / desks have been erected and aligned. Any damage to relays and instruments shall be immediately reported to the purchaser.

Concessionaire shall also make all necessary adjustments as specified by the manufacturer for proper functioning of the equipment. The setting of relays shall be carried out.

Outgoing feeders and incoming feeders of cable or bus duct shall be connected at the switch gear panel and as explained in the installation procedures of cables and bus ducts.

After installation of all power and control wiring, Concessionaire shall carry out operating tests, manufacturer's installation tests. Meager tests for insulation, polarity checks on the instrument transformers.

The Concessionaire shall also carry out the drying of equipment in case of low insulation resistance.

2.2.12.12 Transformer

Sleepers shall be provided when unloading on bare ground. After placing on foundation alignment, leveling, etc. shall be carried out in neat workmanlike manner. Dehydration of silica gel rather shall be carried out.

For the power / control cables projecting above the ground the termination of cable box / marshaling box / shall be run in GI conduits of suitable cross section. Ends shall be sealed with bitumen compound.

The cable end box of the transformer of detachable type shall be supported properly enabling the transformer to be taken out for repair without disturbing the cables.

2.2.13 Specifications for erection, testing and commissioning of illumination system

2.2.13.1 Scope

This specification covers complete installation, testing and commissioning of indoor and outdoor illumination system.

2.2.13.2 Scope and standards

The wiring, installation and commissioning of complete illumination system shall comply with all currently applicable statutes regulations. Fire insurance and safety codes in the locality where the work will be carried out. Nothing in this specification shall be construed to relieve vendor of this responsibility.

Unless otherwise specified, the work, material and accessories shall conform to the latest applicable Indian, British IEC Standards.

Good workmanship shall be in accordance with best engineering practices to ensure satisfactory performance and service life.

2.2.13.3 General requirements

Except as specifically approved by the site office installation of conduits and lighting fixtures shall be taken only after all major services such as piping, structural work etc. in that particular area have been completed.

Location of lighting fixtures, switches and receptacles shown on the drawings, are indicative and shall be relocated to suit site condition.

Except as noted mounting height of various lighting equipment from finish floor level shall be as follows:

i.	Lighting Panels	1200 mm
ii.	Lighting control switches	1000 mm
iii.	Receptacle with switch	
a)	For indoor	500 mm
b)	For outdoor	1000 mm

All cables and conduits from lighting panel upto first lighting fixture shall be identified with aluminum tags giving circuit reference number.

Lighting panel number shall be indicated when more than one panel for an area is to be provided.

A number of lighting panels shall be earmarked separately for supplying power to the space heater mounted in various switch gear panels and motors.

Steel surfaces exposed, to weather shall be thoroughly cleaned for removal of rust and shall be given a primary coat of zinc chromate and two finishing coat of paint. All metal parts not accessible for painting shall be made of corrosion resistant material.

Cable / Conduits separators shall be provided at an interval of 500 mm for horizontal runs and 750 mm for vertical runs.

Cable / Conduits shall be kept, wherever possible at least 300 mm away from pipes, heating devices and other equipments.

For the purpose of calculating connected loads of various circuits multiplying factor of 1.25 will be assured to the rated lump voltage for lamp fixtures to take into account the losses in the control gear.

Concessionaire shall supply junction boxes; pull boxes, terminal blocks, glands, conduits and accessories (elbows, tees, bends, etc.) and supporting anchoring materials to make the installation complete.

Concessionaire shall work in co-ordination with the civil Concessionaire when openings, sleeves are required in walls and floors. Holes by Concessionaire shall necessarily be patches in a good and approved manner.

All types of wiring concealed or unconcealed shall be capable of easy inspection. In all types of wiring due consideration shall be given for neatness and good appearance.

In hazardous areas, the founding wire shall run along the conduits throughout the installation and all conduits and fixtures shall be effectively grounded. Conduits shall be grounded at the ends adjacent to switch "Concessioner's" at which they originate.

Wherever specified, DC lighting system shall be installed to provide necessary illumination in case of an emergency. Emergency lighting cables shall run in a separate conduit system.

For street lighting, steel tubular poles complete with fixing brackets shall be used. These poles shall be coated with bituminous preservative paint on the inside as well as embedded outside surface. Exposed outside surface shall be painted.

Before a completed installation, or an extension to an existing installation is put into service, installation test stipulated IS: 2274 and other codes of practices shall be carried out by Concessionaire in the presence of Engineer-In-Charge's / Engineer's representative.

2.2.13.4 Wiring in conduits

Individual lighting circuits inside building shall be wired with 250/440 volts grade copper / aluminium conductor PVC insulated flexible wires cables. The circuit wire shall be colour coded as follows:

White - Phase or DC positive wire

Black - Neutral or DC negative wire

Pull wires in a conduit shall be drawn simultaneously. No subsequent drawings are permissible. Necessary, pull wires shall be provided by the Concessionaire.

The wires shall not be pulled through more than two equivalent 900 bends in a single conduit run.

Wiring shall not be spliced at any place other than junction boxes with approved type connectors of terminal strips, and for lighting fixtures, connection shall be supported through suitable round conduit or junction bars.

For vertical run of wires in conduit, wires shall be suitably supported by means of wooden plays at each pull junction bores.

2.2.13.5 Outdoor lighting

Lighting for all outlying areas shall be carried out using 1.1 Kv grade. Aluminium conductor, PVC insulated steel wire armored cables between lighting panel an junction box near the lighting fixture.

All lighting poles shall be steeped tubular steel poles type ISTP 15 as per ID 2713 and shall be the painted type. length shall be as given in ES-5 c.

Except as noted cables for Road and outdoor lighting shall be directly buried in ground at a depth of 600 mm or routed in available cable trenches.

Lighting cables shall be taken through GI / Hume pipes buried in ground at 1000 mm below the Road / Rail track crossing.

2.2.13.6 Earthing

For outdoor earthing of lighting poles, Masts etc. cut GI wire shall be used. The wire shall be run buried in ground at a depth of 600 mm.

Lighting fixtures, receptacles, junction boxes, switches conduits and handrails shall be earthed using GI wire of minimum size 12 SWG.

The earthing wire shall run over the entire length of the conduit between fixtures and the corresponding lighting panel where it shall be connected to earth grid. For 3 phase power socket, outlets, separate grounting wire shall be provided.

2.2.13.7 Testing and commissioning

After completion of the work complete illumination system shall be thoroughly checked and tested by Concessionaire in presence of purchaser or his representative as per the list.

The Concessionaire shall provide all tools, materials, labour and supervisory personnel for carrying out the tests.

The Concessionaire shall carry out all rectifications repairs or adjustments work found necessary during testing and commissioning.

The Concessionaire shall record the test results on approved Performa and furnish test report / results (4 copies) for approval.

On successful commissioning of the system and on carrying out necessary rectification work, the purchaser will take over the installation either wholly or in parts, as the case may be, where it shall be connected to earth grid, for 3 phase power.

2.2.14 Specifications for earthing and lightening protection

2.2.14.1 Scope

This specification covers requirements of earthing and lighting protection system. The specifications in intended to cover complete supply, installation, testing and commissioning of the above system.

2.2.14.2 General information

The design supply and performance of the system comply with all currently applicable statutes, regulations and safety codes in the locality where the systems will be erected and commissioned.

The earthing and lighting system shall be installed in conformity with the requirement of Indian Electricity Act 1910 as amended and the Indian Electricity Rules, formed there under Indian Standard Code and practice and other statutory regulations that may be relevant to the erection.

Unless otherwise specified, the equipments, materials and accessories provided by Concessionaire shall conform to the latest applicable Indian Standards or Indian Electricity Code standards.

2.2.14.3 Earthing system

Two separate and distinct earth leads shall be used for earthing each equipment / structures enclosing the power conductor and one earth lead for metallic structures adjacent to electrical installation.

Metallic frames of all electrical equipment rated above 250 volts, must be earthed by two distinct connections with earth system.

Earthing cables crossing other metallic structures such as conduits, pipe lines etc. shall be minimum 300 mm away from such structures.

All underground connections and joints in earthing system shall be blazed / welded. Connections with equipments / structures shall be bolted type.

Conducting petroleum jelly shall be applied to contact surface of all bolted joints and joints shall be covered with bituminous compound and taped.

When GI conductors are connected to aluminium conductors the contract surfaces of GI shall be covered with bituminous and taped.

Natural connections shall never be used for the equipment earthing.

Earthing conductors shall be protected against mechanical damage.

Earthing conductors running along the structures, wall etc shall be cleaned at every 750 mm interval.

Minimum size of earth conductor shall be in accordance with IS : 3043. However, sizes of earth conductors for equipments shall be at least half the size of power conductor, limited to maximum of 120 mm2, of aluminium.

All earth lead connection shall be as short and direct as possible and shall be without kink.

2.2.14.4 Earthing and main grid

Adequate number of earthing pits and electrodes as shown in enclosed drawing shall be used in conjunction with earthing grid.

Minimum spacing between two adjacent earth pits shall not be less than size (6) meters and shall be kept sufficiently away from structures to clear footings.

Main grid loop for a building shall be installed outside boundary of the building, buried in backfill. It shall be installed at a minimum depth of 600 mm outside the building wall.

The main earth loop (MEL's) in plant areas shall be generally routed along cables when equipments are located away from MEL's suitable sub-loops may be run upto them for deriving connections for individual equipment.

2.2.14.5 Lightening protection

Tall structures shall be protected from lighting strokes by suitable lighting protection system to be erected and installed.

Down-comer shall not be tapped in between for equipment earthing.

Cable sheaths, metal conduits, casing etc. shall not be connected to lighting protection system.

Down-comers shall be as short as possible. Each down comer shall be provided with a testing point located at a height of about 1000 mm from ground level.

A minimum 2, meter separation shall be maintained between any other electric conductor and lighting protection system.

Earthing and lighting protection system shall be bounded to each other to prevent side flash over. If adequate clearance between two system can not be maintained.

2.2.14.6 Indoor equipment earthing

Each floor of building shall have its own earth bus embedded in concrete.

Earthing grid embedded in the floor slab shall have a minimum concrete cover of 50 mm.

Earth buses on different floor and main grid shall be connected by at least two conductors of main grid conductor size.

Every alternate column (Steel or RCC) of the building housing electrical equipments shall be connected to main earthing grid.

Every conductor shall be welded at interval of 1000 mm along their run on steel structure and shall be at interval of 750 mm along the wall.

2.2.14.7 Outdoor equipment earthing

Each transformer neutral shall be provided with two separate earth leads to two separate earth pits located near transformer.

Wherever earthing conductor crosses the trenches tunnels, railway track, etc., it shall be run below the trench etc.

Equipment structures shall be earthed at two diametrically opposite points.

Each pole of H.V. lighting arrestor and coupling capacitor shall be gounded with minimum one separate earth pit.

CTs secondary winding shall be connected to earthing grid by minimum two earthing conductors. CT and VT secondary neutral shall be earthed at the terminal block where they enter the control panel.

Every alternate post of switch yard fence shall be earthed and gate shall be earthed by flexible GI wire.

Any two diametrically opposite legs of each switch yard tower, without lightening protection shield wire, shall be earthed at the base of tower.

A well distributed earth mat shall be provided below ground on which contractor would stand and operate the HV isolator or circuit breaker.

2.2.14.8 Testing and commissioning

Entire earthing system and lightening protection system shall be tested for continuity by ELV tester after installation.

For the earthing and lightening protection system, the connections shall be thoroughly checked.

The earth resistance shall be checked, recorded and resistance shall be improved in case it is higher than acceptable limits.

The Concessionaire shall carry out all rectifications, repairs or adjustment work found necessary during testing and commissioning.

2.2.14.9 Earthing and lightening protection system

Sizes and number of earth leads for earthing various items and other technical particulars shall be as specified.

Earthing conductors are shown diagrammatically. Exact location of earthing conductors, earth electrodes and test pits and earthing connections may be changed to suit the site conditions.

Earthing conductors in the building, running parallel to walls and columns shall not be less than 150 mm away from the wall / columns. Suitable earth risers shall be provided if the equipment is not available while carrying out earthing connections.

Wherever, earthing conductor passes through walls, galvanized iron sleeves shall be provided for the passage of earthing conductor. Water stop sleeves shall be provided. Water stops shall be provided wherever earthing conductor enters the building from outside.

Wherever the conductors are to be buried, Concessionaire shall co-ordinate with other civil Concessionaires to ensure that the conductors are installed before concreting.

All connection shall be low resistance. Contact resistance shall be minimum.

Steel conductors, above ground level shall be galvanized. All conductors shall be free from any defects.

Earthing conductors shall not run in direct contact with control and other cables. Single core cable armoured shall be earthed at one end. The cable trays shall be earthed to main grid at-least at two points and at every 25 meters intervals.

2.2.14.10 Testing of earthing system

Purchaser may ask to carry out earth continuity tests, earth resistance measurements and other tests in presence of him which in his opinion are necessary to prove that the system is in accordance with design, specification, Indian Code or Practice and Indian Electricity Rules. Concessionaire shall have to carry out all such tests. The lightening protection vertical air terminations and / or horizontal air termination conductors shall remain in their installed position even during severe weather conditions. All joints in the down conductors shall be of welded / brazed type. All metallic structures in the vicinity of down conductors shall be bonded

to the down conductors. The rest joint for down conductors shall be directly connected to the earthing system.

2.2.15 Specifications for Diesel generating set

Supplying, Erecting and Commissioning of Diesel generating set with AMF Panel with alternator of output capacity as given below , 3 Phase, 415V, 50c/s 0.8 p. f. A.C a totally enclosed air cooled multi cylinder diesel engine developing suitable BHP at 1500 rpm with 10% overload for 1 hour in 24 hours with standard accessories, self excited self regulated, screen protected alternator with static excitation system running at 1500 RPM as per IS 4722-1968 with voltage regulation +/- 5 % .Both the engine and alternator direct coupled on a common fabricated steel base plate with anti vibrating pad with control panel comprising of standard meters, switchgears, indicators connected with suitable wires/cables. The complete set enclosed in Acoustic enclosure made of 18 SWG CRCA Sheet, sound absorbing material, Rockwool covered from inside with ¾ mm holes perforated sheet to restrict sound level upto 75 dB at 1.0 m The engine with first filling of oil, diesel etc. obtaining necessary approval from Electrical Inspector as per specification .

2.2.16 Specifications for Power Transformer

Providing, erecting and commissioning out door type copper wound transformer continuously rated for 3 Ph, 50 Hz, at full load and temp. rise not exceeding 45^{o} C by thermometer in oil and 50^{o}C by the resistance in winding after continuous run at full load rating, the transformer should have oil immersed winding having vector group DY 11, HT side connected in Delta and LTside connected in Star with neutral brought out connected to provided separate earthing. Thetransformer shall have power terminal arrangement, bushings / cable end box on HT side and cable end box on LT side. 2 Nos. channels with stoppers shall be provided and fixed on the provided plinth for mounting the transformer. The transformer should have following standard fittings. Transformer shall be of latest manufacturing standards as per amended ISspecifications and the Load & No Load losses shall be limited to the values given below or as per IS.

- Oil conservator with filling hole with cap and plain oil level gauge.
- Silica gel dehydrating breather charged with Silica Gel.
- Oil drain valve.
- Oil filter valve.
- Lifting eyes / hooks.
- Two earthing terminals.
- Diagram and rating plate.
- Air Vent.
- Explosion Vent.
- 100 mm dia thermometer with thermometer pocket
- Four bi directional plain roller.

2.2.17 Specifications for Air Break Star –Delta, Switch Starter Panel with Control Pannel

Supply of fully automatic air break star -delta switch starter panel suitable for submersible motor pump for operation on 415V ± 1.0%, 3 phase, 50 ±3% Hz AC supply. Control panel shall consist of isolator & SFU, HRC fuses, contactors. 0/L relay, single phasing preventer, earth leakage relay, capacitor and accessories.

(a) Enclosure :

Enclosure shall be dust and vermin proof, wall mounting cum pedestal type and having lowers on upper and lower side of panel board. The fabrication box shall be of 16 SWG CR sheet and door shall also be of 16 SWG CR sheet.

All the components inside the control panel shall be mounted on 16 SWG steel base plate. After applying Zinc cromate primer, the control panel shall be stoved enameled with two coats of final paints. The colour shade shall be of 631 of IS : 5.

All bolts, nuts, screw washers shall be galvanized, zinc/cadmium plated and passivated Proper rubber lining shall be provided for protection from dust. There shall be two entry for main cable to the switch and .two outgoing cable entries from the starter. These shall be provided with suitable cable glands made of bi .sss metal.

(b) Isolator SFU:

This shall be of 300A x 415V air break, quick make quick break type confirming to IS : 4064 (Part I) 1978 suitable for AC-23 duty confliction. The operating handle shall be mounted on the door of the panel. The switch shall be interlocked with panel door to prevent opening of the door when the switch is 'ON' position and to prevent switching ON when the door is open.Combination SFU will not be acceptable.

(c) Contactors :

All the three contactors shall be air break type and having rating of minimum 200A for AC-3 duty utilization characteristic Coil voltage of 415V, auxiliary contacts 2 NO + 2 NC.

(d) Overload Relay:

The overload relay shall be 60-100 Amp Rating three element, positive acting, ambient temperature compensated type with adjustable setting range to ensure protection against single phasing and overload. The 0/L relay shall have manual reset facility. The range of the overload relay shall be decided by multiplying minimum .6 of minimum 1.5 times and maximum 1.6 times the HP rating of the motor.

(e) Timer:

Electronic timer for Star to Delta changeover shall be provided of the coil..

(f) Single Phasing Preventer :

(Pump Guard) S.P.P. with 2/3 seconds lag to avoid nuisance tripping shall be provided. SPP shall be of unbalance current operated type. A bypass toggle switch with mechanical Interlocking shall be provided on the door of the control panel to bypass the same in case of emergency. Minllec series 8800 make 40 AMP.

(g) Main Fuses : 3 Nos. knife type HRC fuses of 160A, 415Bshall be provided.

(h) Control Fuses : 3 Nos. 16A HRC fuse fittings with 2A HRC fuse links shall be provided for the protection of the control circuit.

(i) Earth Leakage Relay : An E S R. with C.B.C.T. shall be provided of 10 mA to 600mA range. A bypass toggle sw itch with mechanical interlocking shall be also provided on the door of control panel to bypass the same in case of emergency. The E.L.R. shall have 2/3 seconds time lay to avoid nuisance tripping.

(j) Push Buttons :

Push button of 22.6 dia shall be provided of red green black colors for stop, start and 0/L reset respectively.

(k) Indicating Lamps : LED/filament type indicating lamps of 22.5 0 dia shall be provided for R.Y.B. phases, SPP (healthy), F...R (Fault), 0/L.trip). Star and Delta.

(1) Busbars and Links: Main bus bars and connecting links between, connectors shall be minimum of 1"x 1/8" size tinned electrolytic copper strip.

(m) Wiring and Terminals : Power and Control wiring shall be done with PVC insulated copper conductor having 660/1100V grade; Control wiring shall be done with minimum 1.5 sq. mm. Copper wire and Terminated with compression lugs of proper size. Each wire shall be terminated at both ends with PVC ferrules. Not more than two wires to be terminated at one terminal and 10%

Extra Spare Control Terminals, clip on type shall be provided. For connection of load side terminals, adequate copper bus link, shall be provided on conductor and overload may.

(n) Voltmeter : Sq-96 size, 0-500V voltmeter shall be provided with selector switch to read voltage in each phase.

(o) Ammeter: Sq-96 size, CT operated ammeter of 0-200A, having 6 times suppress scale shall be provided along with selector switch to read current In each phase.

(p) Earthing : Two nos of earthing terminal shall be provided for connecting the oarth, All non-current carrying metallic parts of the equipments shall be earthed. Earth bus of 10 x 3 mm shall be provided through out of the earth.

(q) Name Plates :

Labels shall be provided f or each equipment mounted on the panel.

(r) Accessibility: Checking, Testing, Fault finding and removal of components shall be possible without disturbing the adjusted equipments. Incoming supply terminal shall be shrouded with acrylic covers to prevent accidental contact.

(s) Drawing: The tenderer must submit GA drawing/wiring diagram and bill of material prior to manufacturing.

(t) Approval & Testing : After order and approvals of GA Drawing, wiring diagrams and bill of materials, the tenderer shall manufacture one panel which shall be approved by BUIDCO/Review Cell. Tenderer shall have to give following testing at his works at his own cost and risk.

1) Single Phasing in Each phase.
2) Under voltage cut off at 320V.
3) Over voltage cut off at 480V

4) Leakage Current Test.
5) Unbalance tripping at 10% unbalance voltage
6) H. V. Test at 2.5 KV for power circuit.
7) H.V. Test 1.5 KV for control Circuit.
8) Meggar Test.

(u) Control Pannel

Cabinet height – 5′ width – 4′, depth – 2′, legs – 3′, fabricated from 40 mm x 6 mm size angle and 2.0 mm CRCA sheet of door and enclosure. It also requires following items :

a) 8 lever lock.
b) One lamp holder point and one 3 pin 15 Amp plug point lighting board. .
c) 4 nos. cable gland for 3.5 core x 12 mm2. Alu.cable and double entry cable boxes.
d) Duly painted with 3 coat of light gray semi glossy shade 631.

(v) Capacitor : 30 KVAR capacitor. Capacitor shall be of mixed Dielectric -of polypropylene and paper with internal element fuses completely impregnated type non PCB oil. Capacitor with protection fuse.

(vi). REMARK:

The manufacturer must possess CPRI certificate for IP 55 test as per IS 2147 of 1962, and SOKA short circuit test (IS : 8G23, part I of 1993), for 1 second with Initial pick of 105.00 KA. The offer without CPW certificate or manufacturer who does not posses such certificate shall be straight away rejected.

The contactors used inside the control panel shall be of one make only using of different makes of contactors is not at all permissible.

2.2.18 Technical Specification for 315 Amps, 415 volts, 50 Hz TPN Switch Fuse Unit (SFU)

General Construction:-

1) SFU must confirming to I S 13947-1993 (With latest /revised Amendment)
2) SFU must be dust proof.
3) SFU must be triple pole with solid neutral.
4) SFU with 160 Amp HRC DIN type porcelain fuse links.(DIN-I) and fuse base should be of 400 Amp. (DIN -II)
5) Made from, sheet steel enclosure.
6) Fuse switch unit will not be acceptable.
7) Combination fuse switch unit will not be consider for technical evaluation.
8) Switch should be made from DMC (Dove Mould Compound) insulating material having AC-23 duty category.
9) Switch must be separate unit. Fuse base must be separate unit for each phase for replacement & each fuse base.
10) Switch and Fuse base should be mounted separately & they are interconnected with aluminum links.
11) A separate front door opening should be provided for replacement of Fuse links.
12) The fuse door must be such that, it can not be opened while the SFU is in 'ON' position.

13) Tenderer with deviation in above technical specification will not be consider for evaluation.

2.2.19 Technical Specification of Control Panel for requirement of Motor of LT/H service.

1. The Design of Section pillar must be such that required HT/ L.T. service box and its equipments must be technically fit in it comfortably.
2. It must have double door on front side and on back side.
3. Section Pillar must be fabricated from 40 mm width x 6 mm thick x 7 1/2 ft height size M.S. angle.
4. Enclosure and door must be made from 2.0 mm thick CRCA sheet. Bottom of cabinet must be made from 4 mm thick M.S. plate.
5. Cabinet internal Size must be of 39" width x 30" depth x 60" height.
6. Cabinet must have internal two vertical compartments one side 17"depth and backside 13" depth. Height of compartment 4 ft and separated with wooden plates. In the compartment upper and lower side 6" opening required.
7. It must be Dust pr oof, Rain water proof and Water jet spray proof. It must be as per IP55 test.
8. Hinge of cabinet's door must be welded with angle of section pillar.
9. Door must have internal stoppers to stop first closing door.
10. 3 nos cable gland hole of 51 mm dia required in cabinet as per requirement. (One side one and back side two)
11. Two nos, 6 levers lock must supply with section Pillar.
12. Light board with one lamp holder with switch and one 3-pin, 15 Amp Plug point and switch must be supplied with section pillar.
13. One Main single phase DP switch cut out must supply with section Pillar.
14. Section pillar must be duly painted with one coat Red oxide and two coat light semi glossy shade 631 from internal and outside.
15. On bottom of legs 4" dia 3 mm thick plate must be welded.
16. Four legs of section pillar must be fitted and welded with Tie Roads.
17. Hinges of the door must be heavy and made from the 20 mm width x 6 mm thick strips with 8 mm hinge pin.

2.2.20 ILLUMINATION:

All internal and external areas shall be provided with lighting.

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. Illumination level in such areas shall be finalized in consultation with KMDA.

KMDA 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.

2.2.21 Testing and commissioning

2.2.21.1 Standards:

The testing and commissioning covered by this specification shall, unless otherwise stated, comply with the requirement of the latest editions of applicable Indian Standards and currently applicable regulations. The manufacturer's recommendation for testing and commissioning shall be followed.

2.2.21.2 General:

The following physical tests shall be carried out on all the equipments.
Check for physical damage.
Check name plates as per specification.
Check adequacy in tightness of nuts, bolts, clamps, and other connecting terminals.
Check leakage of oil or air if any, oil level, air pressure wherever applicable.
Check earth connectors.
Check cleanliness and glaze of insulator and bushing surfaces.
Check proper lubrication provided for moving parts.
Any other checks, specified in the relevant code of installation and manufacturer's drawings / catalogues.

2.2.21.3 The test to be carried out on various equipments shall be as follows:

Insulation Resistance Test

The insulation resistance test shall be carried out on the following equipments:

EHV installation	by 5000 V megger
HV installation above 1 KV	by 2500 V megger
Power circuit of voltage up to 1 KV	by 1000 V megger
AC and DC auxiliary circuits	by 500 V megger

The results of all the above tests shall be submitted to the purchaser.

The purchaser may ask for some additional tests to be carried out which in his opinion are necessary to determine that the works comply with the specifications, manufacturer's recommendations or IS standards. The contractor shall also carry out such additional tests. Test and trial of pumping machinery shall be given by contractor after satisfactory commissioning of machinery.

The contractor shall carry out operation and maintenance of sub-station, pump house and the works involved in the technical specifications. The intention of carrying out operation and maintenance through contractor is to operate the pumps as per the requirement of the department, impart training to the department staff in a systematic manner so that the starting

and stopping of pumps is done methodically, the records are maintained, checks, routine maintenance which shall be as under.

3. Liaison with State Electricity Board for Power Supply

The contractor shall be responsible for:-

(a) Confirming short-circuit and earth fault current data.

(b) Finalising supply capacity and supply scheme.

(c) Establishing any special BSEB requirements.

(d) Finalising protection relay characteristics, settings and co-ordination.

(e) Agreeing procedures and responsibility for connection of incoming feeder cables to the metering panel and pre-commissioning testing.

(f) Responsibility of co-ordination with BSEB for overhead line work.

Liaison with the State Electricity Board shall be by the contractor through the Engineer-in-Charge.

Liaison with Electrical Inspectorate

The contractor shall be responsible for all the works required for obtaining all design approvals necessary from the local Electrical Inspectorates Chief Officer as well as obtaining a sanction for energizing the new supplies. All liaison with the Electrical Inspectorate shall be by the contractor through the Engineer-in-Charge.

Operation and Maintenance Manual

4.1. The contractor shall furnish 6 copies of operation and maintenance manual specific for the plant equipment and installation, giving detailed description, as built assembly drawings, part lists, operating instructions, repairs and periodical maintenance. The said manual shall not merely contain manufacturer's literature and brochures, which shall be in addition to detailed manual prepared for the plant. All records drawings, wiring diagrams, curves etc. shall also be a part of the manual.

4.1. The Operation and maintenance manual shall include the followings :

- Schedule of equipment supplied along with manufacturer's name and address, Model No., Catalogue No. etc.
- Schedule of routine maintenance for all the equipment.
- Schedule of spares supplied with their part identification numbers.
- Schedule of tools and tackles supplied.
- Sectional arrangement drawings of major item e.g. pump, valves etc. with part identification list, metallurgy of component and with dismantling procedures.
- General arrangement drawing of whole plant showing the "as built" installation.
- Schematic diagram showing cooling and lubricating system of bearings.

- Full and comprehensive operation and maintenance instructions including fault detection for all equipment supplied.
- Copies of Test Certificates
- Pump performance curves as tested
- System head curves
- Schedule of recommended lubricants and their equivalents, which must be locally available.

Latest applicable standards specified below.

Code No.	Title
IS 13118 / BS 5311 / IEC 56, 694	Circuit Breakers
IS 3427 / BSEN60298 / IEC298	Metal Enclosed switchgear
IS 2705 / BS 7626	Current Transformers
IS 3156/BS 7625/IEC 186	Voltage Transformers
IS 5578, 11353	Arrangement for Switchgear Busbars, Main Connections and Auxiliary wiring
IS 2544 / BS 3297 / IEC 273	Busbar Support insulators
IS 13947 (Part 1) / IEC 947-1 / BSEN 60529	Degree of Protection
IS 3231, 3842 / BS 142 / IEC 255	Electrical Relays for Power system protection
IS 1248 / BS 89 / IEC 51	Electrical Indicating Instruments
IS 9385 / BS 2692 / IEC 282	High Voltage Fuses
IS 722, 8530 / BS 5685 / IEC 145, 211	AC Electricity Meters
IS 613	Specification for copper rods and bars for electrical purposes
IS 6005 / BS 3189	Code of practice for phosphate iron and steel
IS 9920 / IEC 129, 265 & 298	Alternating current Switches for voltages above 1000 V
IS 13703 / BS 1362 / IEC 269	Low voltage fuses
IS 3452 / BS 3676	Toggle switches
IS 10118	Code of practice for selection, installation and maintenance of switchgear and control gear
IS6875/BSEN 60947/IEC 947	Control switches

Title	Code No.
Basic climatic and mechanical durability tests for components for electronic and electrical equipment	IS:9000
Environmental tests for electronic and electrical equipment	IS:9000
Metal clad base material for printed circuits for use in electronic and telecommunication equipment	IS:5921
Transformers and inductors (power, audio, pulse and switching) for electronic equipment	IS:6297
Printed wiring boards	IS:7405
Environmental requirements for semi-conductor devices and integrated circuits	IS 6553
Terminals for electronic equipment	IS:4007
Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC	IS:8623/BS: 5486 /IEC:439
Air break switches	IS : 13947 (Part –3)BSEN60947-3
Miniature circuit breakers	IS 8828/BSEN:60898
HRC cartridge fuses	IS:9224/BS:88
Contactors	IS:13947(Part–3) /BS:775/ IEC:158-1
Control switches/push buttons	IS:6875
Indicating instruments	IS:1248/BC:89/ EC:51
Degree of Protection	IS:13947-(Part1)/IEC:947-1
Climate-proofing of electrical equipment	BSCP:1014
Code of practice for phosphate iron and steel	IS:6005/BS:3189
Semi-conductor converters	IEC:146
Semi-conductor rectifier equipment safety code	IS:6619
Specification for copper rods and bars for electrical purposes	IS : 613

Code No.	Title
IS2026/BS171/IEC76	Power Transformer
IS3639	Fittings and Accessories
IS1180	Auxiliary Transformer
IS6600/BSCP.1010/IEC354	Loading of oil immersed transformer
IS335/BS 148/IEC296	Transformer Oil
IS2099/BS223/IEC137	Bushings for > 1000V, AC
IS7421	Bushings for ≤ 1000V, AC
IS13947 (Part 1) / IEC947-1	Degree of Protection
IS3637	Buchholz Relay
IS 1271/BS2757/IEC85	Insulation Materials for Electrical Machinery
IS 3202/ BSCP1014/ IEC354	Climate Proofing
IS 1886	Installation & Maintenance of Transformers
IS 2705	Current Transformers
IS 375	Marking & arrangement for switchgear, busbars, main connection and auxiliary wiring
IS 2147	Degree of Protection
IS 3202	Climate- proofing of electrical equipment
IS 5082	Aluminum Bus bars
IS 8081	For Non-segregated phase bus-ducts.
IS 3202	Code of Practice for climate – proofing of electrical equipment
IS 2516	Alternating current Circuit Breakers (Relevant part/Section)
IS 3231	Electric Relays for Power System Protection
IS13947	Switchgear General Requirements
IS 3427	Metal Enclosed switchgear and control gear
IS 4237	General requirements for switch gear and control gear for voltage not exceeding 1000 volts
IS 694 Part I & II	PVC insulated cables (for voltages up to 1100V with copper and aluminum conductors)
IS 8623	Factory Built Assemblies of SWGR and Control gear for Voltages up to and including 1000V AC & 1200V DC
IS 13947-P3	Air Break Switches
IS 8828	Miniature Circuit Breakers
IS 13703	Low voltage Fuses
IS13947	Contactors
IS13947	Starters
IS 6875	Control Switches / Push buttons
IS 2705	Current Transformers
IS 3156	Voltage Transformers
IS 1248	Direct Acting Electrical Indicating instruments

Code No.	Title
IS 2147	Degree of protection provided by enclosures for low voltage switch gears.
IS 2959	AC Contactors of voltage not exceeding 1000 volts
IS 11353	Marking and Identification of Conductors and Apparatus Terminals
IS 722	A.C. Electricity Meters
IS 10118	Selection installation and maintenance of switchgear and controlgear
IS : 2834	Shunt capacitors for power systems
IS : 2544	Specification for Porcelain Post Insulators (3.3 KV and above)
IS : 5553	Series Reactors (Part II)
IS : 12672	Internal fuses and internal overpressure disconnectors for shunt capacitors
IS:7098 (Part-II)	Cross linked polyethylene insulated PVC sheathed cables for working voltages from 3.3 kV up to and including 33 kV
IS : 5831	PVC insulation and sheath of Electric cables
IS : 6474	Polyethylene insulation and sheath for electric cables
IS : 8130	Conductors for insulated electric Cables
IS : 3975	Mild Steel wires, strips and tapes for armouring of cables
IS : 10810	Methods of test for cables
IS : 3961 (Part II)	Recommended current ratings for cables PVC insulated and PVC sheathed heavy duty cables
IS : 1753	Aluminum Conductors for insulated cables
IS : 10418	Specification for drums of Electric cables
IS : 2633	Methods of testing weight, thickness and uniformity of coating on hot dipped galvanized articles
IS : 209	Specifications for Zinc
IS : 694	PVC insulated cables (for Voltage up to 1100 V)
IS : 1554 (Part I)	PVC insulated heavy duty electric cables for working voltage up to and including 1100 volts
IS : 5831	PVC insulation and sheath of Electric cables
IS : 6474	Polyethylene insulation and sheath for electric cables
IS : 8130	Conductors for insulated electric Cables
IS : 3975	Mild Steel wires, strips and tapes for armouring of cables
IS : 10810	Methods of test for cables
IS : 3961 (Part II)	Recommended current ratings for cables PVC insulated and

Code No.	Title
	PVC sheathed heavy duty cables
IS : 1753	Aluminum Conductors for insulated cables
IS : 10418	Specification for drums of Electric cables
IS : 2633	Methods of testing weight, thickness and uniformity of coating on hot dipped galvanized articles
IS : 209	Specifications for Zinc
IS2026/BS171/IEC76	Power Transformer
IS3639	Fittings and Accessories
IS1180	Auxiliary Transformer
IS6600/BSCP.1010/IEC354	Loading of oil immersed transformer
IS335/BS 148/IEC296	Transformer Oil
IS2099/BS223/IEC137	Bushings for > 1000V, AC
IS7421	Bushings for ≤ 1000V, AC
IS13947 (Part 1) / IEC947-1	Degree of Protection
IS3637	Buchholz Relay
IS 1271/BS2757/IEC85	Insulation Materials for Electrical Machinery
IS 3202/ BSCP1014/ IEC354	Climate Proofing
IS 1886	Installation & Maintenance of Transformers
IS 2705	Current Transformers
I.S. 3043 – 1987.	Earth Pits

All mechanical equipment such as screens, de-gritting devices, sluice gates, sludge thickeners, centrifuges, belt presses etc. which comes into contact with sewage or sludge shall be fabricated in non-corrosive materials and metallic parts in contact with sewage shall conform to Stainless steel. All walkways shall be in RCC or stainless steel with stainless steel handrails. Provide appropriate explosion proof construction and devices at any enclosed locations components where incoming sewage is exposed to atmosphere.

Mechanical screens shall be operated with Shaft less screw conveyors to transfer screenings to the screw compactor to dewater and compact the screenings. The screen will be controlled by a timer as backup to level control, so that, the cleaning mechanism can run at a set interval.

FOR NETWORK (including Sewage Pumping Station)

Section 11. General

The Sewerage Network to be Designed, Built, refurbished if applicable, operated and maintained, as detailed in the ITB/BDS sections, Tested and Commissioned by the Contractor shall comply with the guidelines contained in "Manuals on Sewerage and Sewage Treatment - Part A - Engineering, Part B - O&M, and Part C - Management" Latest Edition(s) published by the Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India.

The design submitted by the contractor shall be proof checked from the nearest any IIT / Jadavpur University / IIEST (Formerly Bengal Engineering and Science University) as Approved by the competent authority, and for which the scrutiny/ proof checked charges shall be borne by the contractor. The delay in checking designs by the third party as mentioned above shall be treated as the delay on the part of the contractor for operation of the contract clause and new infrastructure components and improvement of sewage collection network, pumping stations, and dovetailing the existing infrastructure for all materials, electro mechanical equipment, labour, temporary works required for the construction, initial site clearance, cutting trees, bushes, site development, access roads, ancillary & allied works, consumables, acquisition of all permits / approvals / licences, duties and taxes and all related items of work as may be necessary for setting up the Network and making it fully functional in compliance with the provisions of the Contract.

Documents Comprising the Technical Standards

The Technical Standards consist of Technical Specification to be followed during Construction of Sewerage Network and other ancillary/ allied works for all Civil, Mechanical, Electrical, and Instrumentation required to be executed under this Contract. Notwithstanding the said Specifications, the Contractor shall adopt and follow necessary standards and approved Codes /specification wherever required for fulfillment of all the works under this contract.

Supplementing the General Conditions and Design-Build The Technical Standards specified in Schedule 7 shall be read along with the GCC / SCC and Design-Build and Operations Services Schedules for the purpose of providing greater specificity of the technical standards which the Contractor shall meet.

General Quality Standards

The term "General Quality Standard" means a standard of performance which,

(a) Is competent, efficient, economical and in accordance with internationally accepted techniques used in the sewer disposal and civil works construction industries;

(b) Is in accordance with professional engineering, accounting and consulting standards, as applicable, recognized by national or international professional bodies;

(c) Is in accordance with sound management, commercial, technical, design and engineering practices;

(d) Employs appropriate technology and safe and effective equipment, machinery and methods;

(e) Is in accordance with national and local standards and codes in KMDA's Country;

(f) Protects the interests of the Authorities;

(g) Is in accordance with the Applicable Law;

(h) Is in accordance with the technical specifications and design standards of KMDA as provided to the Contractor;

(i) Is in accordance with the applicable Environmental Assessment and Environmental Management and Mitigation Plan; and

(j) Is in accordance with the Design-Build Documents as approved by KMDA.

In the event of any conflict or inconsistency between any standards that comprise the General Quality Standard, local and national standards in KMDA's Country shall prevail over international standards.

The Contractor shall, at all times, carry out the Services in accordance with the Technical Standards as specified and, where a specific technical standard of quality of performance has not been specified, the Contractor shall perform the Services to the standard of "General Quality Standards".

If KMDA is subjected to fines or penalties as a result of the contractor's breach of these Technical Standards, such fines or penalties shall be paid by the Contractor

Design-Build Services

In respect of the Design-Build Services, the contractor shall ensure that the design of the Sewerage Network is prepared by qualified designers who are professionally recognized to design the Sewerage Network and allied services.

The Contractor warrants that the contractor and its designers have the experience and capability necessary for the design. 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 the Plant on whole on sustainable basis.

Section 2 SCOPES OF WORK & CONTRACTUAL REQUIREMENTS

The scope of work under this contract shall include but not limited to the following and as specified in Bill of Quantities.

i. Review of KMDA's proposals and designs: The Contractor has to (i) undertake field survey of the entire area proposed for coverage with sewerage, (ii) check the actual levels with the levels used in KMDA's proposal, (iii) review designs of sewerage system provided by KMDA, (iv) re-design the sewers (using CAD Software) and undertake detailed design of sewer network and sewage

pumping systems (v) submit the revised designs & drawings (including vetting from any IIT / Jadavpur University / IIEST (Formerly Bengal Engineering and Science University) and obtain approval of KMDA. The payment will be made as per the quoted rates in bill of quantities for conducting survey, reviewing and redesigning including vetting from any IIT / Jadavpur University / IIEST (Formerly Bengal Engineering and Science University. The Contractor has to consider this aspect and make provision, while quoting the rates for Sewer pipe supply, laying and jointing item in the Bid document.

ii. Conducting Survey for laying of lateral sewers for proposed alignment and levels, at every 30 meters interval and other necessary locations before execution of the work including all data required for generating L section and GIS maps of sewer network. Submission of survey drawings showing L-Sections, ground levels at every 30 meters interval and other necessary locations, detailed strip plans showing adjacent structures etc., in AutoCAD for approval of the Engineer-in-Charge before execution of the work. Also, conducting Survey for laying of sewers for proposed alignment and levels, at every 30 meters interval and other necessary locations before execution of the work including all data required for generating L section and GIS maps of sewer network. Submission of survey drawings showing L-Sections, ground levels at every 30 meters interval and other necessary locations, detailed strip plans showing adjacent structures etc., in AutoCAD for approval of the Engineer-in-Charge before execution of the work. The Contractor shall take prior approval of KMDA before surveying in any changes in locations or alignments from the original proposals.

iii. Earth work excavation for pipeline trenches and manhole chambers including depositing on bank including, danger lighting and using sight rails and boning rods at every 100 meters and wherever necessary, including shoring, strutting, bailing out water, as directed with all lifts etc., complete & lead as per Bill of quantities for different strata and depth ranges.

iv. Up – thrust pressure due to sub - soil water at 1.0 M. below ground level shall be considered while designing the structure and sewer line.

v. Sand boiling is anticipated at places. Measures shall have to be taken by the contractor to tackle the situation within their offered rates.

vi. De-watering for Excavation in all classifications in watery situation or foul conditions towards, including overnight recuperation for all depth ranges, with all lead and lifts etc., complete.

vii. Providing erecting and removing casurina pole three tier Barricading using poles of 7.50 to 10 cms. Dia. and 1.50m height above ground fixed vertically at intervals of 2.0 to 2.5 m C/C and horizontally at 0.50 m, above ground level, including fixing poles in the ground for a minimum depth of 0.30 m and tied with coir rope firmly including cost and conveyance of all materials, labour, lead and lift charges complete.

viii. Carting of excavated Earth of all types to a lead distance detailed in bill of quantities & stacking of earth at identified suitable site and re-carting back the stacked earth to the same site by vehicle, including loading , unloading charges for to & fro, with all lifts, labour, HOM of machinery etc. complete. Lead distance indicated is one side distance only. Contractor shall quote the rate for to & fro lead distance.

ix. Disposing off the excess excavated earth of all types to a distance detailed in bill of quantities by vehicle, including neatly stacking, loading, unloading, with all lifts, labour, HOM of machinery etc. complete

x. Providing and installing steel trench sheeting or sheet piling for both sides of the trench with mild steel sheets not less than 6.5 mm thick, stronger knife edge, recessed spreader sockets, 3" single or double wall shields, to be designed by the Contractor to withstand all types of soils, maximum depths of 6m to 12m, as per the design drawing and or as approved by the Engineer-in-charge. Including labour charges for installing and removing the sheet piling at various reaches of sewer line construction, including loading, unloading, transporting to the suitable location etc. complete as directed by the Engineer-in-charge. (Measurement shall be taken one side only).

xi. RCC NP3 S&S RCC SPUN / VIBRATED CAST PIPES (REINFORCED) as per IS: 458, with latest revisions & amendments, and manufactured using Sulphate Resisting Cement (SRC)/PPC/PSC confirming to IS 12330, with rubber rings as per IS: 5382, and laying as per IS:783 with latest revisions & amendments etc. complete.

xii. DI K-7 class pressure pipes with CM lining using SRC/PPC/PSC as per IS: 8329 with latest revisions & amendments, with rubber rings as per IS: 5382, and laying as per IS: 12288 with latest revisions & amendments, with matching specials, fittings and jointing materials for sewers at road / railway crossings by trench less method etc. complete.

xiii. Double Wall Corrugated HDPE pipes conforming to BIS 16908- part 2-2013Construction of all appurtenant structures such as Wire cut Brick, RCC Cast in-situ / Pre-cast manhole structures, using SRC (sulphate resisting cement confirming to IS 12330 with latest revisions)/PPC/PSC with SFRC / PFRC / PPFRC frames & covers, plastic encapsulated M.S. footsteps, drop manholes, ventilating shafts, pipe supports, drain and road crossings, etc. as per Bill of Quantities, approved drawings and relevant IS codes including all temporary works and safety measures.

xiv. Interlinking the existing sewer lines with proposed lines and vice versa.

xv. The contract covers, Conducting Level Survey of proposed and Existing sewerage system by Collecting ground levels, invert level of sewers, size and type(material of construction) of Sewers and at every manhole, including depth of manhole and measuring length in between manholes and safely closing the manhole cover, preparation and submission of Drawings in AutoCAD with all particulars in complete manner as per specification and as directed by the Engineer in charge for cross verifying the adaptability of existing sewer network with the proposed, which will be verified by KMDA's engineers, and decision will be given to retain or reject the part or whole of the existing sewer network. Levels shall be carried from the nearest Bench mark given by KMDA for conducting this survey.

xvi. Providing DWC HDPE pipes for House Service Connections from Manholes / Sewer lines as per specifications and approved drawings and as directed by the Engineer-in-Charge etc. including all materials such as connecting pipes, earthwork, pipe line laying and jointing, bedding etc. complete as per Bill of Quantities items of work.

xvii. CONSTRUCTION OF BLOCKAGGE WITHIN THE CONDUITS

The contractor shall not construct any masonry wall inside the conduit for segregating the works previously done and / or prevention of ingress of water either from the completed portion of the conduit or from adjacent areas. Such temporary blocking of conduits, if necessary, shall be provided by adopting other suitable methods, as may be directed by the Engineer – in – Charge which can be removed / dismantled after completion of the relevant section of work.

xviii. Construction of sewage pumping stations including Electro mechanical works

xix. Backfilling the trenches in layers of specified thickness, material as per detailed specifications and items in bill of quantities.

xx. Providing Road or Railway crossing by adopting Trench less Method (i.e. pipe ramming method/ manual pipe jacking method/Horizontal Direct Drilling Method/Micro Tunneling method/Jack pushing method) as per items in bill of quantities at locations shown in the approved drawings, specifications and as directed by the Engineer-in-charge.

xxi. Taking all measures for complying to the Environmental Management Plan and monitoring the same as per detailed specifications.

xxii. Contractor shall be responsible for providing insurance as provided in Contract data.

xxiii. Testing and commissioning the sewers after laying and construction of manholes as per detailed specifications.

xxiv. Restoration of Bituminous road as per MORTH specifications and cement concrete roads as per specifications and as directed by the Engineer-in-Charge including preparation of sub-grade, all construction materials, tools and plants etc., complete.

xxv. Phase wise submission of as built drawings i.e completion drawing (5 copies along with soft copy in original format & PDF format) of sewer lines & its appurtenances, including L-sections and plans as per specifications including existing laterals for which the Contractor has conducted the existing system level survey showing the entire sewer network in the scope of this contract. The scope also covers associated civil works including protective works, encasing of pipes with concrete and RCC NP-3 / D.I. and HDPE, pipes at road crossings, all safety measures etc.

xxvi. All works shall be done as per the specifications in Bill of Quantities and in compliance to the Technical, Financial bids and as directed by the Engineer-in-Charge. The work shall be executed on item rate basis. Indicative Drawings related to the works to be done, are given for guidance of the Contractor. For the execution of Works, exact details will be given in construction drawings based on the alignment drawings given by the Contractor. The prospective Contractor is expected to visit the site of works at his own expense to fully study the local conditions and to familiarize with the working area and local conditions and include all such factors in his quoted rates.

xxvii. Trial run of the System:-After commissioning of works or a section of the completed works, the Contractor shall conduct trial run to demonstrate satisfactory performance to the Engineer prior to declaring commencement of O&M.

Contractor's Inspection of Sites

The Contractor is deemed to have visited the sites and familiarized himself of the conditions and restrictions under which the work will be executed. The omission of any details shall not relieve the Contractor of his prima facie obligation and responsibility under the Contract to carry out

and successfully complete the contract. KMDA will entertain no monetary or other claims, made by the Contractor on the grounds of 'want of knowledge'.

Work plan

The Contractor shall prepare the work plan for the execution of works, which includes procurement of pipes before starting of the works. The Contractor shall submit the planning (Survey, reviewing and redesigning, Construction, Quality control, and Commissioning) within 14 days after issue of letter of acceptance and take necessary approvals for the same. The planning's shall be done on MS project and indicate, resources such as material, manpower, cash-flow etc. to complete the works as per agreed time. The planning shall include all allowances to guard against delays caused due to inclement weather or its effects (such as floods or draughts), fire or industrial disputes, unless such events could not reasonably have been foreseen by an experienced Contractor.

Alignment Survey and the L-Sections

The Contractor shall carry out the Survey work for laying of lateral sewers (less than 300 mm diameter) for proposed alignment and levels, at every 30 meters interval and other necessary locations, before execution of the work, including all data required for generating L section and GIS maps of sewer network. Contractor shall submit the survey drawings showing L-Sections, ground levels at every 30 meters interval and other necessary locations, detailed strip plans showing adjacent structures etc., in latest version of AutoCAD for approval of the Engineer-in-Charge before execution of the work. The Contractor shall be deemed to have considered this aspect and made provision, while quoting the rates for Sewer pipe (less than 300mm), supply, laying and jointing item in the tender. If the alignment and flow directions of the sewers are to be changed according to the site conditions and the Engineer-in-Charge agrees to that, the Contractor has to redo the alignment and level survey at every 30 m and junction points, and submit all the details in latest version of Auto Cad in soft form to KMDA, for re-design of that particular stretch and take up the work on receipt of approved designs from KMDA.

Also, the Contractor shall carry out the Survey work for laying of branch/ sub-main /main / trunk sewers (more than 300 mm diameter) for proposed alignment and levels, at every 30 meters interval and other necessary locations, before execution of the work, including all data required for generating L section and GIS maps of sewer network. Contractor shall submit the survey drawings showing L-Sections, ground levels at every 30 meters interval and other necessary locations, detailed strip plans showing adjacent structures etc., in latest version of AutoCAD for approval of the Engineer before execution of the work. The Contractor shall take prior approval for location and length of the survey work for this paid item. The payment will be made as per the quoted rates for conducting survey in bill of quantities. If the alignment and flow directions of the sewers are to be changed according to the site conditions and the Engineer In-charge agrees to that, the Contractor has to redo the alignment and level survey at every 30 m and junction points, and submit all the details in latest version of Auto Cad in soft form to KMDA, for re-design of that particular stretch and take up the work on receipt of approved designs from KMDA. The alignments, L-section and location of manholes may be changed at site if required, and after approval of the Engineer.

The Survey work for all the sewer lines (for all diameters of sewers) alignment shall also include the following:

a) All the Survey works shall be carried out from G.T.S. Benchmarks, using Total Station instrument of standard make, and by qualified survey personnel. The survey shall consist of field data collection and related attribute information collection of all the aspects using GPS and transferring to GIS map of sewer network before and after laying of sewer pipes and allied structures, as required by KMDA.

b) Field attribute collection for Mapping with respect to existing sewerage network does not require any digging in the field. The existing maps / KMDA field staff knowledge can be utilized by the Contractor to provide the data for mapping the said network and it will be paid as per the survey work item in Bill of quantities.

c) Network entity's attribute information like pipe dia, pipe type, ground material, depth of the pipe, manhole type; manhole size, manhole depth etc. shall be submitted.

d) The data pertaining to House Service Connections (connection to consumers) have to be collected up to building footprint and submitted.

e) The Contractor shall communicate regularly, with KMDA regarding the GIS mapping survey data and for clarifications.

Section 3 Technical Specifications

1 Applicable I.S. codes or other Standards

The Technical Standards and Specifications contained in this contract shall be read along with the following standard specifications (latest versions) published by the Bureau of Indian Standards listed below:

IS: 3764 with latest revisions & amendments ~ Excavation work- code of safety

IS: 12330 with latest revisions & amendments ~ Specification for Sulphate resisting Portland cement.

IS: 8112 with latest revisions & amendments specification for 43 grade OPC cement

IS: 651:1992 with latest revisions & amendments ~ Specification for Salt glazed stone ware pipes & fittings.

IS: 4127:1967 with latest revisions & amendments ~ Code of practice for Laying of Glazed Stoneware Pipes

EN: 295 with latest revisions & amendments ~ Specification for GSW pipes with rubber gasket joints.

EN: 681 & ASTM C-425 with latest revisions & amendments ~ Specification for Rubber gaskets and jointing of GSW pipes.

IS 458-1988, IS4350-1967 with latest revisions & amendments ~ Specification for pre-cast Concrete Pipes.

IS: 783-1959 with latest revisions & amendments ~ Code of Practice for Laying of Concrete Pipes

IS: 8329:2000 with latest revisions & amendments ~ Specification for Ductile iron Pipes

IS: 12288 with latest revisions & amendments ~ Code of practice for use &laying of ductile iron pipes

IS: 4984:1995 with latest revisions & amendments ~ Specification for HDPE Pipes

IS: 16098 (part 2): 2013 - Structured wall piping system for non-pressure drainage & sewerage

IS: 4111 (Part 1 to 4) with latest revisions & amendments ~ Code of practice for ancillary structures in sewerage system.

IS: 10910 with latest revisions & amendments ~ Specification for polypropylene & its co-polymers coatings.

IS 12592 with latest revisions & amendments ~ Specification for manholes covers and frames.

IS: 3597 with latest revisions & amendments ~Method of tests for concrete pipes.

IS: 5382 with latest revisions & amendments ~ specification for rubber sealing rings for gas mains, water mains and sewers.

IS: 383-1970 with latest revisions & amendments ~ Aggregates of Concrete

IS 456:2000 with latest revisions & amendments ~ Code of practice for Plain & reinforced concrete.

IS: 516 with latest revisions & amendments ~ Methods of test for strength of concrete

IS: 2212-1962 with latest revisions & amendments ~ code of practice for Brickwork

IS: 1957 (Part-I) with latest revisions & amendments ~ Construction of Rubble Stone Masonry.

IS: 1957 (Part-II) with latest revisions & amendments ~ Construction of Ashlar Stone Masonry.

IS: 2250 with latest revisions & amendments ~ Code of practice for preparation and use of masonry mortars

IS: 73 with latest revisions & amendments ~ Specification for Paving Bitumen.

IS: 215 with latest revisions & amendments ~ Specification for Road Tar.

IS: 217 with latest revisions & amendments ~ Specification for Cutback Bitumen.

IS: 460 (Part 1 to 3) with latest revisions & amendments ~ Specification for Test Sieves.

IS: 2386 (Part 1 to 8) with latest revisions & amendments ~ Methods of test for aggregates for concrete.

IS: 2720 with latest revisions & amendments ~ Method of Test for soils.

IS: 6241 with latest revisions & amendments ~ Method of test for determinations of stripping value of road aggregates

IRC: 16 with latest revisions & amendments ~ specification for priming of Base course with Bituminous Primers.

IRC: 17 with latest revisions &amendments ~ Tentative for single coat Bituminous surface Dressing.

IRC: 19 with latest revisions & amendments ~ Standard specification and code of practice for water bound macadam

IRC: 29 with latest revisions & amendments ~ Specification for bituminous concrete for road pavement

IS 6280 – 1971 – Sewage Screens

IS 8413 – 1982 – Biological Treatment Equipment – Part II and its modifications

IS 10037 – Part I – 1981 & Part II & III – 1983 – Sludge dewatering equipments

IS 10261 – Requirements for settling tank for waste water
IS 105533 – Part I, II, III – Chlorination Plants
IS 5600 – 1970 - Sewage and Drainage Pumps
IS 6279 – 1971 – Grit Removal devices
The list is not exclusive and the contractor shall be responsible to follow the appropriate standards.

Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national, or relate to a particular country or Region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

2 Samples and Tests

a) The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities, and qualified staff for sampling, testing and quality control of all the materials used for the works under this Contract.

b) The Contractor shall obtain the approval of the Engineer for the quality control programme developed by him and incorporate any modifications suggested by the Engineer at no extra cost. Without limiting the generality of the foregoing, the Contractor shall either –establish a testing laboratory at the site of works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the Specifications and /or these Special Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and/or any Tests on Completion, or arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory approved by the Engineer.

c) All costs of such sampling, testing and reporting of test results will be borne by the Contractor, and the Contractor shall include sufficient provisions in his tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer of the required tests at no additional cost. The Contractor shall furnish certified copies of all test reports to the Engineer within 5 days of completion of the specified tests (The tests shall be conducted immediately prior/after delivery at site as directed by the Engineer In-charge / on due date of sample testing, as per relevant IS for In-situ items.)

d) The Contractor shall, within 21 days after the date of the Letter of Acceptance, submit to the Engineer for his consent a detailed description of the arrangements for conducting the quality

control program during execution of the Works, including details of his testing Laboratory, equipment, staff and general procedures. If following submission or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control programme is not adequate to ensure the quality of the Works, the Contractor shall produce a revised program as desired by the Engineer, which will be adequate to ensure satisfactory quality control.

e) **Tests during Construction**

For ensuring the requisite quality of construction, the Materials and Works shall be subject to the quality control tests as described in relevant IS as specified /applicable and as directed by the Engineer. The testing frequencies set forth are desirable minimum and the Engineer shall have full authority to get the additional tests carried out by the Contractor as frequently as he may deem necessary, to satisfy himself that the Materials and Works comply with the appropriate Specifications. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering practices as per the directions of the Engineer.

f) **Third Party Inspections**

The Contractor shall, at his own or manufacturer's cost, at manufacturers premises, provide the necessary gauges, supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary for carrying out the tests as required as per relevant latest Indian Standard for all materials specified.

KMDA appointed Third party inspection agency will inspect and certify the quality of specified materials as per relevant latest Indian Standard with all amendments. The inspection and certification charges will be paid directly by KMDA/Contractor to the Third Party Inspecting and certifying Agency. The Contractor shall be responsible to obtain permission and provide all facilities to carry out such testing as required.

A mutually agreed quality assurance plan with, minimum requirements as specified below will be developed which provides for inspection and certification by the Third party inspection agency at specified times during the manufacture, fabrication and installation at site of such items.

List of Items, which will be subject to, third party inspection and stages of inspections are as tabulated below:

Sl. No.	ITEMS	STAGES OF INSPECTION
1).	RCC Pipes & rubber rings.	Visual and dimension check. Quality of raw materials as per IS: 458 with latest revision and amendments. Physical requirements as per IS: 458 with latest amendments. Hydrostatic Test Three edge bearing Test & permeability test as per IS: 458 with latest amendments. All other Tests as may be found necessary as per relevant Indian standards.

Sl. No.	ITEMS	STAGES OF INSPECTION
		Rubber ring for corrosion/elongation as per relevant IS Code and All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
2).	Stoneware Pipes, specials & rubber rings.	General Quality, Visual and dimension check as per as per IS: 651 with latest revision and amendments. Hydraulic and water Absorption test as per as per IS: 651 with latest revision and amendments. Acid and Alkali resistance test as per as per IS: 651 with latest revision and amendments. Crushing strength test as per as per IS: 651 with latest revision and amendments. EPDM Rubber rings for Elongation and other test as per relevant standard. All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
3).	PVC pipes and Specials	1. General Quality, Visual and dimension check as per as per relevant IS with latest revision and amendments. 2. Hydraulic test as per relevant IS with latest revision and amendments. 3. Acid and Alkali resistance test as per as per relevant IS with latest revision and amendments. 4. All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
4).	DI Pipes, rubber rings & Specials.	Visual and Dimensions Check Review of Chemical and Physical test certificates as per relevant IS standards. Hydraulic Test Checking of Cement Mortar lining/ coating for strength, thickness, cracks etc., Rubber Ring for Corrosion / Elongation as per IS code Three edge bearing test / Bursting Test and All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
5).	HDPE Pipes, Corrugated HDPE pipes& Specials	1. Visual and Dimensions Check 2. Review of Chemical and Physical test certificates as per relevant IS standards. 3. Hydraulic Test and

Sl. No.	ITEMS	STAGES OF INSPECTION
		4. All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
6).	SFRC / PFRC /PPFRCmanholes covers and frames (Heavy Duty)	1. Tests conforming to IS 12592 part I-1989 and part II-1991 with latest amendments, Load test etc. and 2. All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.
7).	Valves.	1. Visual and dimension check 2. Review of material test certificate for valve body and internals. 3. Operational Smoothness. 4. Hydraulic test / leakage test as per applicable codes. and 5. All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.

3. Sign Board

The Contractor shall provide sign boards at the sites of the Works of approved size and design as directed by the Engineer, which provides (i) the name of the Project and the financing agency (World Bank loan); (ii) the names and addresses of KMDA, Contractor and Consultants; (iii) short description of the Project, (iv) the Contract amount (v) the starting and completion dates.

Such sign boards shall be located at specified places in the project coverage area as directed by the Engineer. Contractor shall take care of signboard and replace it in case of loss, damage, theft etc., the sign boards may be in English or Hindi/ local language or in both as directed by the Engineer.

4. Protection of Utilities

a. The Contractor is required to examine carefully the locations of the works and their alignments. Contractor is to make enquiries and co-ordinate with all the departments /authorities concerning all utility lines such as water pipes, sewers, gas pipe, telephone (underground and /or overhead) lines, optic fibre cables, electric and telecommunication cables (underground and /or overhead) , any other utility lines etc.; to determine and verify to his satisfaction the character, sizes, position and lengths of such utilities from authentic records.

b. The Contractor shall be wholly responsible for the protection of such utilities as may be required, and shall not make any claim for extra work or extra time that may be required to protect such utilities. Any damage, to the Utilities shall be restored/ repaired at Contractor's own cost. Shifting of any utilities if required will be taken up by KMDA or any other agency separately after site inspection.

c. In case of water supply house Service connections, if the connections encountered in the corridor of execution of the Bill of Quantities item of work of this package is damaged even after taking all

precautions by the Contractors for the safety of the structures, the cost of the item shall be paid to the Contractor as per approved Bill of Quantities item rates in the contract.

d. In case the alignment of the pipeline crosses the high tension electrical transmission lines belonging to the other authorities/ departments, the Contractor shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Contractor will be responsible to carry out all construction activities in such reaches in consultation with KMDAs of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Contractor.

e. The foregoing will not absolve the contractor of his responsibility in the matter. The contractor should include in his rates the cost of works to be done properly aligning, supporting and adequately protecting of all underground services, utilities and structures.

f. If the Engineer – in – Charge think it necessary to put permanent support under gas / water mains, cables etc. he will order the contractor to do so. In case of any damage of the utility services, the contractor shall make good damage as per instruction of the Engineer – in – Charge.

g. No claim of idle labour or delay in completion of the work within the specified period on this account will be entertained under any circumstances whatsoever.

5. Performance Requirements:

The performance requirements have been spelt out in various parts of the Contract specification. The Contractor shall ensure that, he fully understands and complies with all the requirements specified in the Contract. However, in the event of any conflicting performance requirements spelt out in the documents, the Contractor shall promptly bring such matters in writing to the attention of the Engineer for Engineers decision. The Engineer's decision will be conveyed to the Contractor in writing and which is final. The Contractor shall fully comply with Engineer's decision on the matter. The Contractor is deemed to have read and understood all performance requirements before bidding and he shall have no claim whatsoever with respect to the Engineer's final decision on the matter.

6. Contractor's Obligations:

The Clauses in this section are meant to provide general guidelines and Compliance requirements to the Contractor. It does not however relieve the Contractor from taking every other step and precautions as deemed necessary to complete the works successfully within the specified Contract period and bid amount. Also, compliance to the approved Environmental management plan and monitoring the same is part of the contract.

Environmental Management Plan and Monitoring

The Contractor shall be responsible for the mitigation measures to be taken for complying to the Environmental management plan and monitor as described below.

7. PENALTY ON ACCOUNT OF NON-COMPLIANCE

If the contractor in the opinion of the engineer in-charge does not comply to the environmental management plan and monitoring, the engineer in-charge reserves the right to stop the work and

any delay on account of this will be on the part of the contractor and penalty as per liquidated damages clause in conditions of contract and contract data shall be imposed upon approval by the concerned engineer, KMDA.

8. Confined Space Safety Procedure:

The Contractor shall implement a well-prepared Space Entry Safety Procedure to work in Confined areas / Elevated areas. Such procedures shall incorporate all aspects of staff work activities, internationally adopted best practices, site staff and workmen training, hazard awareness, first aid procedures, particularly applicable to workmen in Elevated / Confined space, provision and use of appropriate safety equipment's, personal hygiene, safety / emergency procedures, method of easy evacuation of workers etc. The Contractor has to develop and implement his own safety procedures. He should also provide necessary insurance to the workers involved in the execution of work.

9. Special Traffic Precautions

Contractor's Attention is specially drawn to the requirements by the traffic police and road authorities and specification regarding traffic control, access and reinstatement of road surface. It is necessary to obtain permission from traffic Inspector of Police prior to taking up any stretch of road for excavation and sewer laying. It is necessary to carry out the work in such a manner as to cause minimum interference with the public use of roads, footpaths and other thoroughfares.

10. Working in Restricted areas

In addition to the clause stated in other section of the special specification the Contractor shall determine prior to constructing the lengths of sewers where access to properties commercial, domestic and institutional will be restricted.

The identification of these areas shall be agreed in consultation with the Engineer, Police and Urban local body. In this case it may be necessary to operate one-way traffic system or to close roads. The Contractor shall be responsible for liaising with the police and other local representatives to obtain permission to close roads or restrict traffic movement. No additional time will be allowed for these pre-construction activities. Where roads are closed alternative routes are to be determined in conjunction with the authorities. Sign Boards are to be placed at both junctions of the route indicating "ROAD CLOSED & WORK UNDER PROGRESS". The expense for the same shall be borne by the Contractor. The Contractor shall discuss these arrangements with the occupants of houses affected to ensure that their disruption is kept to a minimum. The Contractor is to offer assistance to residents who are infirm or need special arrangements for access during construction.

In narrow roads and streets it may not be possible to operate excavation machinery in such cases hand excavation is to be done. The method of operation, length of sewer to be excavated, method of barricading, property access, dewatering, shoring, pipe laying, backfilling and road reinstatement shall be stated in a 'Method Statement' to be submitted at least 4 weeks before work is scheduled to commence in a particular location. The written agreement of the Engineer

shall be obtained to the method statement. If any additional safeguards are required by the Engineer these shall be incorporated in the method statement at no extra cost and the method statement is to be resubmitted.

The Contractor will ensure that the noise created by his activities is suppressed. Adequate silencers fitted to construction machinery, particularly compressors and drills. Dust is to be kept to a minimum by using water sprinklers. Utility service connections shall be maintained to every property throughout the construction phase and thereafter. If any defect/ damage is caused it shall be repaired immediately and at the Contractor's expense. The disruption to the normal activities of residents and other members of the public is to be kept to an absolute minimum. Providing adequate noise control and other nuisances are kept to a minimum, extended working hours may be permitted with the agreement of the Engineer and local residents. No additional payment shall be made for any of these arrangements unless otherwise specified. Adequate lighting shall be provided by the Contractor at his cost if night working is adopted.

11. Interfaces with other packages

If this contract Package will have interface with other contracts, the Contractor shall only undertake the end connections of sewers at the interface points, after the sewer has passed the hydraulic test on completion of end connections. The Contractor shall lay the bedding and backfill for sewers in normal manner.

12. MEASUREMNTS & PAYMENTS

a. MEASUREMENTS

i. Quantities

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

ii. Works to be measured

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the works in accordance with the contract and the Contractor shall be paid that value in accordance with applicable clauses of this contract. The Engineer shall, when he requires any part of the works to be measured, give reasonable notice to the Contractor's authorized agent, who shall:

Forthwith attend or send a qualified representative to assist the Engineer or his representative in making such measurement, and supply all particulars required by the Engineer or his representative.

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or his representative or approved by him shall be taken to be the correct measurement for such part of the works. For the purpose of measuring such

Permanent Works as are to be measured by records and drawings, the Engineer shall prepare such records and drawings as the work proceeds as he deems necessary or appropriate and the Contractor, as and when called upon to do so in writing, shall within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

iii. Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

13. Earthwork excavations

a. General

The Earthwork Excavation for laying of sewers shall be carried out as per applicable IS specifications, specification in the Bill of quantities and applicable clauses in this specifications.

The Contractor shall make all excavations required for laying and jointing of the pipeline and construction of pertinent structures as required by the project. Except where otherwise required by the project or instructed by the Engineer, all excavation shall be in open cut, to the specified widths and depths with shoring, strutting and bracing. The Contractor is advised to satisfy himself and shall be deemed to have quoted rates accordingly with regard to the likely conditions that may be met with during the execution of the works, with regard to the underground obstructions or conditions, necessary dewatering requirements including well point system or other means of dewatering the trenches before, during and after excavation, laying of bedding material, laying and jointing sewers, hydraulic testing and till backfilling, construction of manholes, pipe supports etc., in sub terrain underground water, rain water, sewage and waste water etc.

Earth work excavation for pipeline trenches and manhole chambers including depositing on bank including, danger lighting and using sight rails and boning rods, including shoring, strutting, bailing out water at every 100 metres wherever necessary as directed in the various strata with lead upto 30 meters and all lifts etc., complete. A minimum of three numbers of sight rails are to be maintained at all times during pipe laying between manholes, including barricading as per directions of Engineer In-charge of work. (The Excavation cost should include the cost of shoring, strutting to facilitate for laying, jointing & testing of sewers, manholes).

Classification of Excavation

All Soils includes the following,

(a) Soft clay, soft murrum, gravel shale etc. including. Stiff heavy clay, hard shale or compact murrum requiring drifting tool or pick axe or both and shovel closely applied.

(b) Gravel, soft laterite, kankar and cobble stone having maximum diameter in anyone direction between 75 mm and 300 mm.
(c) Soling of road paths etc., and hard core.
(d) Macadam surfaces such as water-bound and bitumen/tar bound.
(e) Lime concrete, stone masonry in lime/cement mortar below ground level.
(f) Soft Conglomerate, where the stones may be detached from the matrix with pick axe.
(g) Generally any material which requires the close application of pick axe or scarifies to loosen and not offering resistance to digging, greater than that offered by the hardest of any soil mentioned above.
(h) Un-reinforced cement concrete which may be broken up with crow bars or pick axe and stone masonry in cement mortar below ground level.

All soils

The Earth work excavation in all soils, including the ones mixed with boulders of up to 30 cms size, includes excavation both by manual and machine excavation based on location of excavation and space constraints. The quoted rates are applicable for both manual and machine excavation, the location and extent of manual and machine excavation should be as described below,

Manual excavation

The manual excavation for laying the sewers in pipeline trenches shall be carried out as decided and directed by the Engineer In-charge, along the alignment of such narrow roads and main roads where it is not possible for machine excavation and, at excavations in deeper depths of more than 3m, providing all safety measures to workmen at Contractor's risk, also, manual excavation is to be adopted at the possible locations of underground utilities to safeguard against damage after carried out Trial Pit in several location along the alignment.

Machine excavation

The machine excavation for laying the sewers in pipeline trenches shall be carried out along the alignment of wide roads and in depths where there are no underground utilities without causing any damage to public property, and inconvenience to public after carried out Trial Pit in several location along the alignment.

14 Shoring and Bracing

a) As per Specifications and directions of the Engineer, the Contractor shall supply, fix and maintain necessary sheathing, shoring and bracing etc., in steel or wood, as may be required to support the sides of the excavation, to protect workmen in the trench and to prevent any trench movement which might any way injure or delay the work, change the required width of the trench, make unsafe condition for adjacent pavements, utilities, buildings or other structures above or below ground.

b) Sheathing, shoring and bracing shall be withdrawn and removed as the backfilling is being done, except when the Engineer may agree that such sheathing, shoring and bracing be left in place, at

the Contractor's request. In any case, the Contractor shall cut off any such sheathing at least 600 mm below the surface and shall remove the cut off material from the trench.

c) All sheathing, shoring and bracing which is left in place under the foregoing provisions shall be removed in a manner so as to, not endanger the completed work or other structures, utilities or property, whether public or private.

Limits of excavation.

The trench for laying of sewers and construction of manholes shall be excavated in accordance with the relevant applicable Indian standard, as per the approved drawings, or as directed by the Engineer. The width at bottom of trenches for sewers, unless otherwise specified in the approved construction drawings, or directed and approved by Engineer, for different diameters of pipes laid at different depths shall be as given below,

a) For all diameters, up to an average depth of 1.20 m, width of trench in mm is equal to diameter of pipe plus 300 mm.

b) For all diameters for depths above 1.20 m, width of trench in mm is equal to diameter of pipe plus 400 mm.

c) Not withstanding (a) and (b) the total width of trench should not be less than 0.75 meters for depths exceeding 0.90 meters.

The width at top of trenches for sewers shall depend on depth of sewer, location and alignment of sewer, as per the approved construction drawings and directions of Engineer-in-Charge. Unless otherwise specified in the drawings or directed by Engineer-in-Charge, for providing of sheet piling as per specifications in Bill of quantities, the top widths for excavations shall be equal to bottom width (i.e. vertical side cuts.)

The depth of excavations shall limit to the specified gradients/reduced levels as per the approved construction drawings at ends, considering the necessary beddings / encasement / surround.

The Contractor shall not excavate beyond the dimensions specified as above. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Contractor, the Contractor shall fill the excess space with granular material or concrete as directed by the Engineer-in-Charge. Nothing extra shall be paid to the Contractor on account of this. The Contractor shall quote the rates for excavation items, limiting the trench widths as above for whatsoever depths encountered, including necessary arrangements as required. Any extra claim and increase in quantity other than the widths specified above, shall not be entertained or paid.

15 Trial pits

Trial pits shall be excavated by the Contractor, as directed to do so, along the lines of the trenches as shown on the drawings in advance of the excavations for the purpose of satisfying himself as to the location of underground utilities, obstructions or soil strata's and conditions. Trial pits shall be excavated preferably by manual excavation. The Contractor has to take the permission of the concerned Engineer-in-Charge, KMDA, before taking up the work.

It involves, Earth work excavation for trial pits in all kinds of strata and for all depths, recording necessary details of underground utilities and kind of strata, including depositing on bank excavated earth, including barricading, posting safety sign boards, shoring, strutting, bailing out water, wherever necessary as directed with all lead and lifts etc., complete. Any damage to the existing utilities unless otherwise specified shall be repaired at Contractor's own cost. The Precautionary measures shall be taken by the Contractor while making trial pits and shall inform the Engineer before commencing such works. The Contractor will be paid as per the item in BOQ on account of this work.

a. Dewatering

Extra charges will be paid at quoted rates, for excavation in all classifications in watery situation or foul conditions towards dewatering including overnight recuperation for specified depth ranges with all lead and lifts etc., complete, including cost of installation and running of dewatering system such as well point system / any other system wherever required.

Dewatering shall be done in accordance with specifications. The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water from the excavation in case of inundation etc., of trenches. The sewer lines shall be laid above normal ground water table level and as directed by the Engineer. Dewatering shall be either continuous or intermittent using Diesel pump or any other method approved by the Engineer. The method of dewatering shall depend on site condition and should be furnished by the Contractor and approved by the Engineer. The method of dewatering shall be either well point system or sump pumping. The effectiveness of each method will depend upon the nature of the soil, the proportions of the trench and degree of lowering required. Pumping test may be necessary to determine which method is Suitable.

If sump pumping is not practicable other control methods shall be considered and should be approved by the Engineer-in-Charge. The trenches should be kept dry till the completion of work, which includes excavation, pipeline laying, jointing, testing and commissioning and backfilling. Precaution should be taken against the floatation of the pipes.

The Contractor shall conduct ground studies if found necessary and the cost for such studies has to be borne by the Contractor himself. The Contractor shall be responsible for the adequate pumping, drainage and bailing out of water met due to all causes from the excavation for laying sewer lines, construction of manholes, wet wells and all types of constructions. In case of failure to make such provisions or any other provisions, which may result in unsuitable sub-grade conditions, the Contractor shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility. Should the Contractor select to use a gravel sub-grade with or without un-jointed pipes with the gravel layers to facilitate flow of water to pumps or other points of disposal, such gravel sub grade with or without conveying pipes shall not be measured or paid as an extra item.

Sump pumping

This method may be used in highly and moderately permeable soils such as gravels, sand and gravel mixtures. This method is simple and cheap to install and used with watertight trench

sheeting to limit the volume of flow. To prevent the boiling in the bottom of the trench the following precaution should be taken

- Drive sheeting deeper to lengthen drainage path
- Use open pipe surrounded in gravel as a sump.
- Move the sump to one side of the trench

To prevent removal of fines from soil causing loss of strength in the soil and undermining of the trench bottom and side support

- Surround suction inlet with protected graded filter
- Increase flow rate through the soil by using open pipe surrounded with gravel.

The delivery side of the pump should be monitored by taking samples of water and checking the proportion of fines being removed. If fines are being continuously withdrawn or there are signs of trench instability, sump pumping should be stopped and alternative methods to the considered.

b. Slips and slides

The Contractor is responsible for proper protection of excavations made by him from any slips and slides. All slides and caving shall be handled, removed or corrected by the Contractor without any extra compensation at whatever time and under whatever circumstances they may occur. The excavations shall be made good and brought to necessary depth, width and levels without any extra cost. Special care should be taken to protect the safety of the workmen, staff and public or whoever at the site.

c. Stacking of excavated material

Pursuant to specification in Bill of Quantities or directions of Engineer in-charge of execution, the excavated material shall be stacked at suitable locations so as not to cause any inconvenience to the public or traffic, with all safety measures in accordance with IS 3764 with latest revisions and amendments. The excavated material shall be placed away from the sides of the trench. The excavated materials shall be stacked at a suitable distance, keeping in view the safety aspect of working personnel due to sliding and slippage based on nature of soil and condition. The Contractor shall be solely responsible for the untoward incident caused due to his negligence of stacking the excavated material. Under circumstances where in, sewers have to be laid in narrow pathways, the excavated material shall be transported or placed with all lifts & lead as detailed in bill of quantities to the nearby suitable place or as decided by the Engineer and brought back after laying and jointing for refilling of the trenches as per specifications under clause 19.12.

d. Barricading

The Contractor shall Provide, erect and remove casurina pole three tier barricading using poles of 7.50 to 10 cms. Dia. and 1.50m height above ground fixed vertically at intervals of 2.0 to 2.5 mtrs. C/C and horizontally at 0.50 mtrs, above ground level, including fixing poles in the ground for a minimum depth of 0.30 mtr.and tied with coir rope firmly including cost and conveyance of all materials, labour, lead and lift charges complete. The work will not be paid separely as per BOQ.

e. Carting and Re-Carting of Excavated earth

The carting of excavated earth, of all types and at all depths, from trenches is to be carried out, for laying of sewers and construction of manholes in narrow roads and other roads where there is a space constraint, and at locations directed by the Engineer In-charge. where the trenches are to be backfilled with the same excavated earth, the excavated earth shall be Carted to a lead distance detailed in bill of quantities & stacking of earth at identified suitable site and re-carting back the stacked earth to the same site by vehicle, including loading, unloading charges for to & fro, with all lifts, labour, HOM of machinery etc. complete. Lead distance indicated is one side distance only. Contractor shall quote the rate for to & fro lead distance., Also, Disposing off the excess excavated Earth of manhole chambers & pipeline trenches of all types to a lead distance detailed in bill of quantities by vehicle, including neatly stacking, loading, unloading, with all lifts, labour, HOM of machinery etc. complete

The responsibility of locating the site for stacking or disposal of excavated earth shall be the responsibility of the Contractor, in coordination with KMDA. Stacking/Disposal of earth shall not cause inconvenience to public or other agencies and should not cause environmental problems. The location and extent of the above specified work shall be taken up by the Contractor, only after the approval and proper directions by the concerned Engineer, KMDA. The work will be paid as per the item in BOQ.

f. Safety measures

Pursuant to Specifications in bill of quantities, relevant Indian standards or directions of the Engineer, the Contractor shall provide adequate safety measures. They shall include:

(a) Barricading all sides of the open trenches.

(b) Red danger lights as can be easily visible from dusk to dawn at an interval of 20 m and at all the road crossings.

(c) Traffic signals and display boards giving direction for diversion of traffic at the appropriate places as may be directed by the Engineer.

(d) Adequately safe wooden plank / board or steel plate over the trenches at every 15 meters interval or less depending upon access requirement to commercial, institutional and domestic properties to facilitate crossing by the public residing on either side of the trench.

(e) Round the clock watch and ward maintaining all safety regulations at the site of work and protecting the site from unauthorized intrusions.

(f) The work due to the above facilities/arrangements by the Contractor will be paid for the items in bill of quantities and the cost for the remaining shall be deemed to be included in the relative items of work.

Progress of Excavation

(g) The Contractor shall adjust excavation of trenches in such lengths that the pipes can be laid in such exposed portion of the trench within 3 days / less than 3 days as per criticality of site condition and directions of the Engineer.

(h) Unless otherwise directed by the Engineer, the following limitations for lengths of open trenches shall rule for a pipeline in one continuous reach.

(i) Not more than 50 m in built up area and 150 m elsewhere shall be opened in advance of pipe laying.

(j) Not more than 50 m of pipeline left uncovered after pipe laying in built up areas and not more than 150 m elsewhere.

g. Excavation for Manholes, Other Appurtenant and Structures.

(a) Excavation for Manholes and other appurtenant structures shall be done in accordance with the applicable clause of this Section. The Contractor shall excavate as required for all the structures with foundations to firm, undisturbed earth up to the level of the underside of the structure.

(b) The standard details for trenches and to the grade of the bottom of Manholes and other structures are as per applicable clauses in this section and construction drawings issued for the execution of work. Where the bottom of the structure is in rock, it should be ensured that no rock shall project above the lower surface of the concrete in such a manner so as to reduce the required thickness of concrete placed simultaneously as an integral part of the foundation and to the outside of structure foundation where structure is to be built.

(c) The Contractor shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

h. Works Included in Excavation

The following works as per specifications are also included in excavation and the term 'Excavation' shall construe to mean all such items of work. The quoted rates should include the same:

(a) Provision of side space or additional space in the trench / pit for working and /or accommodating sheathing, shoring, bracing, etc.

(b) Supply, installation and removal after the work, all-sheathing, shoring and bracing required, protecting the excavation where required or where such work is recommended by the Engineer.

(c) The Contractor shall verify the site conditions and wherever such dewatering is required it is considered that the rates quoted for dewatering item of work are inclusive of dewatering of surface and sub-surface water.

(d) Protection of excavations.

(e) Providing adequate safety measures.

(f) Additional work in connection with overhead wires and poles.

(g) Excavations for socket and collar hollows.

(h) Supplying and fixing of sight rails and boning rods in the trench to facilitate measurement of work etc. complete

(i) Temporary approaches to roads, properties etc., affected by excavation at no extra cost.

i. Sheet piling

(a) Trenching at locations along the alignments of Trunk sewers or other locations where vertical cutting of trenches is necessary as directed by Engineer - in - Charge, Sheet piling shall be provided as per the item in bill of quantities and the specifications in this section.

(b) The Contractor shall Provide and install steel sheeting or sheet piling for both sides of the trench for various depths detailed in bill of quantities, with mild steel sheets not less than 6.5 mm thick, stronger knife edge, recessed spreader sockets, single or double wall shields to be designed by

the Contractor to withstand all types of soils, maximum depths upto 12 m, as approved by the Engineer including all materials, equipment and labour charges for installing and removing the sheet piling at various reaches of sewer line construction, including loading, unloading, transporting to the suitable location etc. complete as directed by the Engineer - in - Charge.

(c) The location and extent of sheet piling shall be got approved by the Contractor from the concerned Engineer, KMDA prior to starting this work. Measurement for the sheet piling work shall be taken and paid for, on one face of wall shield only. Sheet piling will be measured for payment by the number of square meters of sheet piling completed and accepted, as computed from the horizontal and vertical payment lines shown on the plans or as ordered. The limits used for payment will be the actual horizontal limit of temporary sheet piling installed and accepted, and the vertical limit will be as measured from the bottom of the exposed face of the sheeting to the top of the trench. No measurement will be made for end extensions.

25 Measurements for excavation

(a) The Earthwork excavation shall be measured net. Unit of measurement shall be in cubic meters, and the measurements are limited to deci-meters (Two decimal places). Dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundation of the walls, columns, footings, tanks, rafts or other foundations/structures to be built, multiplied by the mean depth from the surface of the ground in accordance with the specifications and construction drawings. Excavations in side slopes will not be paid for. Contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation. No payment will be made for working space except where clearly indicated in the drawing or is essential in the opinion of the Engineer. Where concreting is proposed against the excavated sides, no such over excavation will be permitted. In such cases over excavation shall be made good by the Contractor with concrete of the class as in the foundations at his own cost.

(b) Trench excavation for sewers shall be measured using the dimensions detailed in the standard section shown on the construction drawings. Excavation beyond the widths or depths required will not be paid for, any additional concrete or bedding material required as a result of over excavation will be at the Contractor's expense.

(c) Backfilling for trenches shall not be measured and paid separately.

(d) Excavation in paved roads, pavements and concrete shall not be billed separately and will be measured in cubic meter if required. The quantities of paved roads and pavements will be calculated from the length of the trench excavated measured between the centers of two adjacent manholes multiplied by the standard width indicated on the drawings or the applicable clause in this section for the particular diameter of pipe and the actual measured depth of the road surfacing material. The quantities of concrete broken out during excavation will be calculated from the actual measured quantities.

REINFORCED CEMENT CONCRETE PIPES

Manufacture of pipe

The RCC pipes to be used for lateral, branch and trunk / outfall sewers shall be of class NP-3, Spigot and Socket (S&S) type, RCC SPUN / VIBRATED CAST PIPES (REINFORCED), with rubber gasket jointing, manufactured in Conformity with IS 458. All the Pipes shall be manufactured using Sulphate Resisting cement only. The ends of the pipes shall conform to Clause 5.3 of IS 458 as applicable for S&S joints. The rubber ring shall conform to IS 5382 and IS 12820 as applicable for sewer lines and shall be of type 'IA'. The diameters of pipes shall be as required for sewers as per designs and drawings.

The method of manufacture shall be such that the form and dimensions of the finished pipes are accurate within the limits specified in relevant IS: 458. Pipes manufactured in compliance with IS: 458 shall be either water cured or steam cured in accordance with the relevant requirements of IS: 458.

The Internal diameter, wall thickness, length of barrel, reinforcement (longitudinal and spiral), type of ends and minimum clear cover to reinforcement, strength test requirements, tolerances on - overall length, internal diameter or dimensions of sockets / spigots of pipes shall be as per the relevant clauses / tables of IS: 458. Minimum clear cover to reinforcement shall be 15 mm. The tolerances regarding overall length, internal diameter of pipes or socket and barrel wall thickness shall be as per relevant clauses of IS: 458. Each pipe unit shall be in lengths of 2 m to 4 m based on availability, ease in handling, transportation and laying.

The workmanship and finish for the pipe will conform to the relevant Indian standard specification; Cleaning of pipes shall conform to relevant Indian Standard specification.

Special coating for Inside Surface of RCC Pipes

The RCC pipes shall be provided with special coatings wherever there is possibility of excess generation of hydrogen sulphide gas during transportation of sewage through sewers. The location, length of coatings shall be as given in construction drawings or as approved by the Engineer.

The work involves, Supply and application of Polymer based protective Elastomeric coating / Lining with zero V.O.C. for complete inside surface of RCC sewers, with minimum dry film thickness of 1mm, Acid resistant, Abrasive resistant, Adhesive to concrete surface, Durable and pinhole / break free, with smooth surface after application, complete as per the Clauses in this Section, including all labour, HOM of machinery, with all lead lifts, taxes etc. complete. spray coating / Lining shall be applied by approved and controlled mechanical spray method, for RCC sewers of diameters 400mm to 800 mm prior to delivery of sewers to site or applied at site, as approved by approving authority, including all surface preparation, testing, as per directions of the Engineer-in-Charge. Rate shall be inclusive of cost of all materials, tools and plants, testing and inspection etc. complete, or

Polymer based protective Elastomeric smooth coating / Lining with zero V.O.C. by spray method for complete inside surface of RCC sewers, with minimum dryfilm thickness of 1mm, Acid resistant, Abrasive resistant, Adhesive to concrete surface, Durable and pinhole / break

free, smooth surface after application, complete as per the Clauses in this Section, including all labour, HOM of machinery, with all lead, lifts, taxes etc. complete, spray coating / Lining applied by approved method, for RCC sewers of diameters equal to and greater than 900mm prior to delivery of sewers to site or applied at site, as approved by approving authority, including all surface preparation, testing, and directions of the Engineer in charge, Rate shall be inclusive of cost of all materials, tools and plants, testing and inspection etc. complete.

Specifications for Protective Coating to inside surface of RCC sewers

POLYMER BASED COATING: The inside of RCC pipes (of dia 400mm & above) & manholes (if required) shall be coated with an approved dual-component, solvent-free polymer protective coating of minimum 1mm dry film thickness. The protective coating shall be spray-applied to the inside of the pipes using suitable plural component spray equipment so as to form a completely impermeable, pin-hole-free & seamless lining. It shall form a good bond with host concrete surface, be resistant to acids & abrasion. It shall meet the following properties.

A – ACID RESISTANCE	
Acid & Chemical Resistance (to ASTM 3908- mod 365d immersion)	Change in weight (not more than).
Sulphuric Acid 22%	0.07%
Hydrochloric Acid 10%	0.07%
H2S-120,000ppm (Sour Brine)	0.66%
Sodium Hydroxide 25%	0.07%
Sodium hypochlorite(sat sol)	0.66%
Salt water – 310g/l (Sat. Sol)	0.22%
Ammonium Hydroxide-20%	nil
Nacl/water-solution -10%	nil
Wastewater anaerobic digesters	0.37%
Wastewater API mo	1.1%
B – BOND	
Bond / Adhesion to concrete (to ASTM D 4541)	> 1.5 n/sq mm
D - ABRASION RESISTANCE	
Abrasion resistance (to ASTM D 4060 with Taber CS17-1000/1000rev)	< 15 mg loss
Shore D Hardness (to ASTM D-2240)	45
C – DURABALITY	
Volume solids %	100
Tear resistance (to Die Cast ASTM D 624)	> 85 Kn/m

Tensile strength (to ASTM D412)	>20 n/sq mm
Elongation (to ASTM D-412)	> 425%
Water absorption (to ASTM D 570 (2hr @95 C)	0.16
Flash Point (Pensky martin)	>93 deg C

a) The coating shall be suitable for long term service at any temperature within the range between -10 Deg C and 100 Deg C and resistant to raw sewer, industrial sewer, treated sewer, effluents, chemicals, sea water, abrasives. The coating shall not be affected by high humidity or moisture during application.

b) All the coating materials including primer & finish coats shall be from a single manufacturer of repute, certified to ISO 9002 standards having a minimum 10 years experience in similar products & in projects of similar size and value as this project.

c) The material provided shall be tested in both liquid (lab-draw down films) and field applied samples and shall meet the properties specified for the project and defined in the approved manufacturer's product data sheet.

d) All pre-coating concrete repairs, coating and lining works shall be carried out only by experienced & reputed Contractors who are authorized, approved, and certified applicators of the approved coating manufacturer & certified by the manufacturer for the type of application detailed in this project.

e) The Contractor should submit, the approved coating manufacturer's detailed Method Statement for Coating Application along with their Quality Assurance / Inspection & Testing Plan to engineer in charge prior to commencement of coating activity.

Surface Preparation & Primer application

i. Prior to commencement of coating activity, all concrete surfaces to be coated shall be free from oil, grease, loose particles, decayed matter, moss, curing compound residue or algal growth. All such contamination and laitance must be removed by use of abrasive sweep blasting, high pressure water jetting, or other approved manual/ mechanical means.

ii. Concrete element's surface irregularities, honeycombs spews must be removed and repaired by a method approved by theEngineer-in-Charge.

iii. Primer as recommended by the approved coating manufacturer shall be applied prior to coating application & the correct over coating time intervals shall be followed as per manufacturer's approved method statement of application.

iv. The coating system shall be spray applied & shall gel/set rapidly. It shall form a uniform monolithic film without any layering.

v. The pipes shall be coated either at pipe factory or at other department-approved coating yard prior to actual laying.

Testing

I. The finished coating shall be uniform, smooth & have a dry film thickness of minimum 1000 microns, when tested with a standard dft gauge/ Elcometer.

II. The dry film thickness shall be measured at points as instructed & predetermined by the engineer in charge by fixing SS strips. The coating shall be uniform, smooth & pin hole free.

Personal Safety Requirements

a) The personnel at site shall strictly adhere to Standard guidelines during the chemical coating activity, at all times. The approved coating manufacturer shall supply complete standard requirement schedules for the personnel to follow, prior to start of any coating application. The general requirements are:-

b) Observe KMDAs standard policy at all times and obey all written and verbal instructions from site managers and representatives.

c) Wear all PPE at all times including Hard Hat, Safety glasses, Boots, Gloves and masks as required.

d) When preparing and applying coatings and chemical materials all PPE must be worn including Gloves, safety glasses and protective paper masks.

e) When using high pressure plural component spray equipment, all personnel working in the application area must wear double filter breathers with OSHA or of at least equivalent make.

Physical & chemical properties & testing methods

TABLE A – PHYSICAL PROPERTIES

Property	Allowable Standard		Method
Tensile Strength	Longitudinal Transverse	17.25 Mpa 17.25 Mpa	ASTM D 638
Elongation at break	Longitudinal Transverse	225% 225%	ASTM D 638
Hardness	54-62		Din 535.5
Plasticiser Permanence	0.4%		ASTM D 1203
Water Absorption	0.1%		ASTM D 570
Water soluble matter	0.05%		ASTM D570
Porosity	No pin holes		Spark Tester 7 KV

TABLE B – CHEMICAL PROPERTIES

Chemical Agent	Test Method	Change in Weight Not more than
Sodium Hypo–Chloride 1%	ASTM D 543 (7 days at 20 C)	0.20%
Ferric Chloride 1%		0.60%
Sodium Chloride 5%		0.15%
Sulphuric Acid 20%		0.12%
Nitric Acid 1%		0.20%
Sodium Hydroxide 5%		0.10%
Ammonium Hydroxide 5%		0.40%
Soap & Detergent Solution 2%		0.40%

Testing of pipes at manufacturing unit

During manufacture, tests on concrete shall be carried out as per IS: 456, IS 458 / relevant IS with latest revisions and amendments.

The specimen of pipes shall be tested in accordance with with IS: 458 and tested in accordance with the methods described in IS: 3597 including the following,

a) Hydrostatic test.
b) Three edge bearing test
c) Absorption test.

Marking

Marking shall be done as per IS: 458 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a) Internal diameter of pipe.
b) Class of pipe.
c) Date of manufacture and
d) Name of manufacture or his registered trade-mark or both.

Carting & Handling

Carting and handling of RCC pipes and fittings shall be in accordance with relevant clause of this section.

Trenching

Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of Earth work excavations clause. Wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all-round the socket in order to make the joint, and the grip shall be maintained clear, until the joint has been approved by Engineer.

Bedding

Necessary bedding Cast-in-situ or Precast with nominal reinforcement as per design requirement (granular, concrete cradle, concrete arch etc.) shall be provided in accordance with approved construction drawings and specifications before laying of RCC sewer pipes.

Laying of the pipe

Laying of concrete pipes shall conform to the Code of practice of IS: 783. Pipes shall be laid underground with a minimum earth cover of 1m. Pipes shall be generally laid in sections as per standard practices and as directed by the Engineer-in-Charge. The RCC pipes shall be laid with sockets facing up the gradient, on desired bedding. All pipes shall be laid perfectly true, both to line and gradient. At the close of each day's work or at such other times when the pipe is not being laid, the end of the pipe should be protected by a close fitting stopper.

All pipes, fittings and material shall be tested and approved by the Engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material. Before laying the pipe, necessary bedding shall be provided wherever required as mention in this section.

Jointing of pipes

The pipe joints shall be flexible joints, jointed by rubber ring of type 'IA', as per IS 783-1985. The sections of the pipe shall be jointed in such a manner that there shall be as little unevenness as possible along the inside of pipe. Care should be taken while jointing to provide the correct gap between the end of spigot and back of the socket to ensure flexibility at each joint and correct location. The joints shall be finished as directed by the Engineer.

The quality of rubber rings, tolerances, etc., shall be in conformity with IS 5382-1985 and latest revisions. After jointing, extraneous material, if any, shall be removed from the inside of the pipe.

CONSTRUCTION OF BLOCKAGE WITHIN THE CONDUITS

The contractor shall not construct any masonry wall inside the conduit for segregating the works previously done and / or prevention of ingress of water either from the completed portion of the conduit or from adjacent areas. Such temporary blocking of conduits, if necessary, shall be provided by adopting other suitable methods, as may be directed by the Engineer – in – Charge which can be removed / dismantled after completion of the relevant section of work.

Measurement of pipes

The length of the sewer pipes shall be measured between the inner surfaces of consecutive manholes at the invert level of the pipes along the central line of pipeline to the nearest centimeter.

Testing at work site

After laying and jointing of pipes is completed, the pipe line shall be tested at work site as per all the requirements of this specifications CPHEEO Manual on Sewerage and Sewage Treatment (latest edition), Relevant IS code(latest edition)and as approved by the Engineer.

Backfilling

Backfilling shall be in accordance with requirements specified in these specifications.

28 DUCTILE IRON (DI) PIPES

Manufacture of pipe

DI pipes and fittings (Class K7) shall be in accordance with IS: 8329 and IS: 9523. Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the Pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the Manufacturer / Contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer

If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the Contractor and not subject to any arbitration or appeal. The pipes and fittings shall be striped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one. In the case of spigot and socket pipes and fittings, the socket shall be without the centre ring. In the case of flanged pipes, the flanges shall be at the right angles to the axis of the pipe and machined on face. The boltholes shall be drilled and located symmetrically off the centreline. The bolthole shall be concentric with the bore and boltholes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 and IS: 9523.

Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per relevant tables of IS: 8329/IS: 9523 for different class of pipes and fittings. Each pipe shall be of uniform thickness throughout its length.

The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS: 8329/IS: 9523.

Coatings

Unless otherwise specified, DI pipes and fittings shall be coated with Bitumen in accordance with relevant IS Specifications. All buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer-in-Charge.

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be cold applied compound complying with the requirements of relevant Indian standards, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions.

Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

Polythene Sleeving: Where polythene sleeving is specified to be applied in addition to bitumen coating, it shall comply with ISO 8180. Site applied sleeving shall be stored under cover out of direct sunlight and its exposure to sunlight shall be kept to a minimum. Pipes having a factory applied sleeving must be stored in the same conditions. Joints in the sleeving shall be properly overlapped and taped in accordance with manufacturer's instructions to provide continuous sleeving.

Cement mortar lining: All pipes and fittings shall be internally lined with cement mortar in accordance with relevant IS. The cement used shall be Sulphate Resisting Cement confirming to IS: 12330. No admixtures in the mortar shall be used without the approval of the Engineer.

Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 11906.

Testing of pipes at manufacturing unit

During manufacture, tests on pipes shall be carried out in accordance with these technical specification by the Third party inspecting agency.

Marking

Marking shall be done as per IS: 8329 and IS: 9523 or any other relevant IS codes approved by the Engineer. The following information shall be clearly marked on each pipe,

a) Internal diameter of pipe.
b) Class of pipe.
c) Date of manufacture and
d) Name of manufacture or his registered trade-mark or both.

Carting & Handling

Carting and handling of D.I. pipes and fittings shall be in accordance with the specifications in this section.

Trenching

Trenching includes all excavation which shall be carried out either by hand or by machine and shall be carried out in accordance with all requirements of -Earth work excavations clause. Wherever a socket or collar of pipe or fitting / special occurs, a grip is to be cut in the bottom of the trench or concrete bed to a depth of at least 75 mm below the bed of the pipe so that the pipe may have a fair bearing on its shaft and does not rest upon its socket. Such grip shall be of sufficient size in every respect to admit the hand all-round the socket in order to make the joint and the grip shall be maintained clear, until the joint has been approved by Engineer.

Wherever D.I. pipes are laid over pillar supports for nala crossings etc. the pipes shall be placed as per the construction drawings and as directed by the Engineer In-charge.

Bedding

The type of bedding (granular, concrete cradle, concrete arch etc.) shall be as per approved construction drawings and specifications in this section.

Laying of the pipe

Laying of DI pipes shall conform to the Code of practice of IS: 12288. Pipes shall be laid as per the requirement in the drawing and as directed by the engineer. Laying of pipes shall be as per IS specified in Bill of Quantities and approved construction drawings. All pipes, fittings and material shall be tested and approved by the Engineer before being laid. Any pipes, fittings or material placed before they are tested and approved shall be removed and replaced with tested and approved material. Before laying the pipe, necessary bedding shall be provided wherever required. Polyethylene sleeves wounded pipes shall be used for water logged areas as per specification and as directed by the Engineer.

Jointing of pipes

Jointing of DI pipes and fittings shall be done as per IS: 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall conform to IS: 638, IS: 12820 and IS: 5382.

Spigot and Socket joints: These shall have sockets, which are integral with the pipe and incorporate an electrometric rubber ring gasket conforming to IS: 12820.The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS: 12820 and IS: 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the approved supplier and as directed by the Engineer.

Gaskets for Flanges

All gaskets used between flanges of pipes shall be of natural rubber conforming to IS: 638 of thickness 3 mm suitable for waste water conveyance and as specified by manufacturer.

Flanged joints

These shall be of PN 1.0 rating and shall comply with dimensions and drilling details as specified in IS: 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer.

Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer's instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

Measurement of pipes

The length of the sewer pipes shall be measured between the inner surfaces of consecutive manholes or start to end points of laid alignment (at road crossings and Nala Crossings) at the invert level of the pipes along the central line of pipeline to the nearest centimetre.

Testing at work site

After laying and jointing of pipes is completed, the pipe line shall be tested at work site as per all the requirements of technical specifications and as approved by the Engineer.

Backfilling

Backfilling shall be in accordance with requirements specified for backfilling.

29 Corrugated HDPE pipes

Manufacture, factory testing and laying and jointing of Corrugated HDPE pipes used for this contract shall be conforming to BIS 16908- part 2-2013. Earthwork excavation, backfilling, testing etc. shall conform to relevant clauses applicable for SWG pipes.

30 BEDDING, ENCASING, SUPPORTS & BACKFILLING FOR SEWERS.

30.1 BEDDING FOR THE SEWERS.

Bedding shall be provided all along the stretch of the pipeline as shown on the approved construction drawings or as directed by the Engineer, which differs based on the depth and nature of foundation over which the pipeline is laid. Pipe shall be generally laid on murrum / gravel bedding as per approved construction drawings and specifications.

Wherever the pipeline crosses under the road, Concrete arch bedding shall be provided in such situations. The various types of bedding, according to which the Contractor shall execute the work, are specified below.

30.2 Earth Bedding.

The trench excavations where the earth at foundation level of sewers is found to be of good quality, suitable for laying of pipe and does not require any import of murram /gravel etc. for foundation of sewers and as approved by the Engineer. Any extra bedding material need not be provided; the excavation shall be carried out to the exact gradient specified so that no making of the sub-grade by backfilling is required. Filling and removing earth or similar materials beneath the allowable depth as above to adjust with the grade will not be permitted except filling with compacted granular bedding material or murrum as directed by the Engineer.

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

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

30.2.1 The gravel/murrum shall be evenly spread over the full width of the formation and compacted to 95% of maximum dry density to the specified gradient in accordance to IS 2720: Part-7, a level slightly higher than level corresponding to the underside of the pipe barrel to allow for settlement of the pipe to the correct level.

30.2.2 Following, placement and jointing of the pipe, further granular material shall be placed in the trench, special care being taken to fill under the sides of the pipes to ensure full contact with the barrel of the pipe. The granular material shall then be placed and compacted evenly to the specified depth.

30.2.3 Field joints which have not been tested shall be left exposed for a minimum length of 150 mm each side of the joint. Trench supports shall be withdrawn gradually in accordance with the progress of the fill with provision that such withdrawal shall not prejudice the safety of the works. After each section of the pipeline has passed the hydraulic test, the exposed joints shall be backfilled and compacted to the above specification.

30.3 Concrete Arch / Cradle bedding and concrete encasement/surround

Where the pipes are laid on a soft soil or super imposed load over pipe sewer laid exceeds the minimum crushing strength even after providing murrum/gravel bedding or with maximum water table level, lying at the invert level of the pipe, or rising above the invert level of the pipe but below the top of the barrel, or as per the approved construction drawings or as directed by the Engineer, the pipe sewers shall be bedded or surrounded in concrete to the specified gradient in accordance with the specifications in this section and applicable relevant Indian Standard for laying of sewers.

30.3.1 Before laying/placing of the bedding, all types of refuse, organic matter etc. shall be removed to the satisfaction of the engineer and the bottom/sub-grade shall be to the specified gradient, dimension and well compacted to the desired density. The pipes shall be supported near each joint with proper supports to avoid any damage to the joints while concreting. Concrete shall not be placed until the pipes have been jointed, inspected and tested. All water in the trench must be bailed out prior to taking up concreting work & the concrete shall be placed to ensure full contact with the pipe barrel throughout its length. The concrete shall be made discontinuous at all flexible pipe joints by a diaphragm of fibre board or other compressible material of at least 20 mm thickness extending for the full area of the surround. The bottom of the trench may be sloped on

the sides or kerbed. The concrete grade shall be of 1:2:4 proportion for concrete cradle bedding and 1:1.5:3 proportion for concrete arch bedding or concrete surround as on approved construction drawings. For concrete arch bedding, the pipe shall be provided with approved gravel bedding to the desired compaction below in layers, and concrete arch above as per drawing.

30.3.2 The materials used in the concreting works shall comply with the relevant Indian standards and specifications in clause of specifications for general civil works. Dry mix shall not be permitted and the slump for concrete for the arching shall not be more than 25 mm. When concrete is to be placed over the pipe for arch portion or surround, it shall be placed carefully so as not to damage or injure the joints or displace the pipe. Back filling shall be done in a careful manner and at such time after the concrete is set, so as not to damage the concrete. Joints shall be avoided as far as possible under the roads.

Where pipes are laid below storm water drains, at road crossings and where the depth of cover is less than 1.0m, the pipeline shall be encased / bedded. The concrete encasement shall be of RCC/PCC as specified.

30.4 Special bedding in poor sub grades

During the progress of work, if the sub grade is observed to be of poor quality which is unsuitable for laying the pipe line and which is not the result of the Contractor's negligence, the Engineer may direct the Contractor to strengthen the sub grade as per, Specifications in Bill of Quantities and in the approved drawings. The strengthening shall be done either by approved gravel, with depth not exceeding 300 mm and/or by plain concrete of mix 1:2:4(Cast-in-situ or Precast with nominal reinforcement as per design requirement) complying to the specifications in this document or as directed by the engineer.

30.5 Measurements for Bedding

For providing Gravel and Concrete cradle/arch/surround bedding in accordance with above Clauses of this Section, the measurement for bedding actually used based on the neat line dimensions of the trench and deducting the volume occupied by the pipe will be considered.

30.6 PIPE SUPPORT STRUCTURES

30.6.1 Anchor, Thrust Blocks.

Anchor blocks shall be provided wherever required in the sewers and for gradients steeper than 16% as per approved construction drawings or as directed by the Engineer and thrust blocks shall be provided for both horizontal and vertical bends wherever required in the rising main pipeline or gravity sewer works (In case of bends in house service connections) wherever necessary to effectively transfer the hydrostatic thrust developed to the surrounding ground. They shall be constructed at the locations shown in the construction drawings and are of the respective dimensions shown therein depending on the angle of the bends, and the pressures developed in the rising main/gravity main. All the anchor/thrust blocks shall be of 1:1.5:3 proportion plain or reinforced cement concrete. The surrounding virgin land of the

anchor/thrust blocks shall not be disturbed, to effectively transfer the load/thrust developed by/in the main. The Contractor should make his own arrangement for any dewatering or bailing out of water.

30.6.2 Pedestals

Pedestals shall be constructed as per, specifications and construction drawings, wherever needed, and as per the directions of the Engineer. Pedestals shall also be provided for the stretc.hes of the pipe, where the pipe is to be gradually brought above the ground for crossing any obstructions as shown in the drawings. The concrete used for pedestals shall be of 1:1.5:3 proportion RCC with materials and work complying to specifications mentioned in clauses for standard specifications for civil works.

Pipe supports shall be placed at a distance of 2.5/5.0 m centre-to-centre depending upon the pipe material and length of pipe available. The dimensions of pipe supports for pipelines of various diameters shall be as shown in the concerned drawing and shall have sufficient height above ground to be able to support the pipe and surround up to a height of 200mm above the crown of sewer and minimum 150mm both the sides of the sewer.

There shall be no joints at the location of the pipe supports. The joints shall be located on any one side of the support, at a minimum distance from the face of the support as given on drawings.

30.7 Measurements for Anchor, Thrust blocks and pipe supports

For providing Anchor, Thrust blocks and pipe supports in accordance with above Clauses of this Section, the measurement shall be based on the neat line dimensions of the structure and deducting the volume occupied by the pipe will be considered.

30.8 BACKFILLING OF TRENCHES AND AROUND FOUNDATIONS OF STRUCTURES

30.8.1 General

Filling of the trenches for sewers shall not be commenced until the sewers are tested and passed. The Contractor shall use approved selected surplus soils from excavated materials for backfilling in accordance with the requirements in relevant Clauses in IS: 4127 and IS: 783 or with quarry dust as specified hereafter and as shown on drawings. The excavated materials suitable for backfilling shall be stored not closer than 600 mm from the edge of the trench and shall not obstruct any public utilities or interfere with travel by local inhabitants or general public. Handling and storage of excavated materials must meet with the regulations of the Local Government Authorities.

30.8.2 The materials for backfilling are:

a) Excavated earth.

Backfilling for locations of trenches along roads of lesser traffic and interior roads and valley portions, as decided and directed by the Engineer In-charge shall be done by with the available earth obtained from excavation including watering and consolidation to 95% proctor density by mechanical and manual means, complete with all lead and lifts.

b) Quarry dust filling.

Backfilling for locations of trenches along main roads and all road crossings, as decided and directed by the Engineer In-charge shall be done by with the Quarry dust of size not exceeding 5.6mm including watering and consolidation to 95% proctor density by mechanical and manual means., complete with all lead and lifts.

30.9 Method of Backfilling

On completion of the pipe laying operations in any section, for a length of about 100 m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying, testing of sewers and refilling of trenches.

Trenches and excavated pits for structures shall be backfilled to original ground level or to such other levels, as the Engineer may direct. All backfilling shall be carried out in orderly manner expeditiously and consistent with good workmanship. Mechanical vibrators/equipment shall be used for compaction only after the back fill has reached its final level as required by the Engineer as the backfill top shall form the base for restoration road works. Backfill material put into the trenches/pits for backfilling, shall unless otherwise specified be compacted and built up as to minimize future settlement. For this, care shall be exercised in selecting backfill material free from large hard clay lumps, especially in cramped areas directly adjoining the walls of structures. Care shall be taken not to injure or disturb the pipes, joints and coatings, after the pipe is properly bedded, jointed and inspected and all measurements for the location of Junctions are properly recorded by the Engineer and sufficient time is allowed for the joint materials or cement concrete or mortar to set. Backfilling around and over the pipe, conduit, or structure shall be taken up uniformly on all sides and in the sequence and manner specified hereinafter, with care to avoid the displacement or damage to the pipe, conduit or structure. Trenches and pits should be carefully guarded till backfilling.

For the purpose of backfilling, the depth of trench shall be divided into the following three zones measured from bottom to top of trench, as follows:

Zone A: From bottom of trench or top of the concrete, when concrete bedding is provided, to the level of the centre line of the pipe.

Zone B: From the level of the centre line of the pipe to a level 300 mm above the top of the pipe.

Zone C: From a level 300 mm above the top of the pipe to the top of the trench.

Backfilling Zone Ashall be done by hand or approved mechanical methods, special care being taken to avoid injuring or moving the pipe with fine earth from excavated material as approved by the Engineer placed in layers of 80 mm and compacted by tamping. The backfilling material shall be deposited in the trench for its full width of each side of the pipe, fittings and appurtenance simultaneously. Backfilling Zone B shall be done by hand or approved mechanical

methods, special care being taken to avoid injuring or moving the pipeThe type of backfill material to be used and the method of placing and consolidating shall be as approved by Engineer to suit individual locations.

Backfilling ZoneB shall be done by hand or approved mechanical methods. Unless otherwise specified backfilling by hand shall be done in layers of 300mm, each layer well compacted before laying the next layer.

As necessary to attain compaction to 95% of the maximum dry density as per part-7, of IS: 2720, the backfill material shall be moistened by sprinkling with water to optimum moisture content. After placing each layer of backfill material, the layer shall be thoroughly and uniformly compacted by means of mechanical or hand tampers. The compacting equipment and the manner of its use shall be subject to the approval of the Engineer. Small pebbles of size less than 50 mm, if any, shall be so distributed throughout the mass, that all interstices are solidly filled with fine material. Machine backfill shall be so conducted that the material deposited in the trench shall not fall directly on top of the pipe from such a height as might result in damage to the pipe joints or alignment. If the trench is subjected to conditions, which might cause flotation of the pipe before sufficient backfill has been placed; the Contractor shall take the necessary precautions to prevent floatation of the pipe, conduit or structure. Before final acceptance of the work, additional tamped earth shall be added to restore the settled trench surface to the required level of the adjacent earth surface or to the base of crushed rock wearing surface or to the finished earth base.

As per the applicable clauses in this Specifications, if from the excavated soil, enough backfill material is not available, imported, selected and approved backfill material from the borrow pits shall be placed for backfill. The Contractor shall include the above under backfilling rates. Also for backfilling of trenches, refilling shall be made with the surplus soft soil with all lead and lifts. Accordingly, the same shall be taken into account by the Contractor while quoting the rates for backfill.

Should any subsidence take place either in the filling of the trenches or near about it during the works, the Contractor shall make good the same at his own cost.

30.10 Disposal of Surplus Excavated Material

The excavated material, which is in surplus to the requirements after backfilling shall be removed/disposed off as directed by the Engineer-in-Charge with all lifts to a lead distance detailed in bill of quantities, from the site.. The landfill site is to be identified by the Contractor and got approved by the Engineer-in-Charge of Execution. No surplus or excess material shall be disposed in a stream / channel nor in any place where the pre-construction surface drainage may have to be provided, without written permission of the Engineer-in-Charge.

30.11 Measurements

Backfilling complied to the specifications in this section and in bill of quantities will be measured net in cubic meters, limiting to the dimensions of excavation and deducting the volume occupied by the sewers, bedding, encasement etc. as applicable. The payment for backfilling will be made

only after the Contractor has cleared the road / pathway, of the soil and construction material debris, etc., due to the trench excavations and sewer line works to the satisfaction of the Engineer-in-Charge.

31 Ancillary STRUCTURES – MANHOLES, DROP MANHOLES AND VENTILATING SHAFTS

The Contractor shall construct Wire cut brick, RCC-Manholes, Drop arrangements with HDPE pipes, Cast iron Ventilating shafts, Valve Chambers, at the locations shown on approved construction drawings, as directed by the Engineer as per the specification in the applicable Indian standards mentioned and as mentioned hereafter. The materials used and construction procedure adopted for the ancillary structures shall comply to the specifications as mentioned below and clause in standard specifications for civil works.

31.1.1 Excavation

Earth work excavations for the Manholes, Drop arrangements and C.I. Ventilating shaft arrangements etc. shall be carried complying to specifications in this sectionand specifications in bill of quantities.

31.1.2 Backfilling

Backfilling for sewer ancillary structures shall be in accordance with requirements specified for Backfilling.

31.2 Manholes

Manholes shall be built at every change of alignment, gradient or diameter, at the head of all sewers and branches, at every junction of two or more sewers as shown on the drawings complying to IS: 4111 Part1-1967 and latest revisions and as per specifications in this section or as directed by Engineer. Sulphate resisting cement confirming to IS: 12330 shall be used for all the items of works for manholes. The shape of the manholes generally is circular with conical shape at top for Brick manholes, unless specifically stated as on drawings.

The Contractor shall be wholly responsible for giving suitable connections at the junctions of sewer lines with the manholes. The minimum depth of manhole shall be one meter or as in construction drawings or as directed by Engineer.

For House service connections directly to manholes, DWC HDPE pipes shall be placed during construction of manholes as per specifications in this section and items in BOQ, if the provisional pipes for House service connections are not placed due to the negligence of the Contractor, the Contractor has to redo the total work of dismantling of manhole shaft and placing of the pipes etc. at his own cost.

The Manholes have been divided into different categories based on depth, diameter and material of construction. Any manholes required to be provided extra, at the locations shown by the Engineer, shall be provided by the Contractor, for which payment shall be made at the quoted rates.

31.2.1 Wire cut Brick Manholes

31.2.2 Construction

The work shall be executed in accordance with the approved construction drawings and specifications involving,

a). Providing and constructing of 1:3:6Cement Concrete foundation using approved quality aggregates of 40mm and downsize with an offset of 150mm all-round the chamber.

b). Providing and constructing wire cut brick masonry in C.M 1:4 proportion using modular wire cut bricks of class designation 75 of approved quality and confirming to IS : 1077 with a tapering top portion as per approved construction drawings and providing cement mortar plaster in CM 1:3 proportion, 12mm thick inside and outside except for the conical surface outside, where the thickness of plaster shall be 20mm thick. Samples of bricks shall be tested as per IS : 3495 by the Contractor. Bricks rejected by the Engineer shall be removed from the site within 24 hours. Construction of Brick works shall be in accordance with IS 2212:1962 and latest revisions.

c). Providing and constructing benching with Cement Concrete 1:2:4 to the dimensions as on drawings with 1:6 slope in the concrete towards the central drain, plastered with CM 1:3 proportion, 20mm thick and finished with smooth coat of neat cement and fixing of inlet and outlet sewers in the walls with the internal periphery protected with an arch of 1:2:4 Cement Concrete with graded metal of 10mm to 20mm size.

d). Supplying and fixing of, 3 mm thick plastic (as per IS: 10910) encapsulated over 12mm dia. Fe-415 steel (as per IS: 1786) bar footsteps staggered at 300mm apart and providing and fixing of heavy duty circular steel fibre reinforced concrete / Plastic fibre reinforced concrete / Polypropylene fibre reinforced concrete (SFRC /PFRC/PPFRC) manhole frame and covers of 560 mm diameter conforming to IS 12592 and the payment for providing of (SFRC /PFRC/PPFRC) heavy duty manhole frame and covers shall be paid separately as per quoted rate for the item in bill of quantities.

e). The channel for the manhole shall be constructed in cement concrete of M15 grade. Both sides of the channel shall be taken up to the level of the crown of the outgoing sewer. They shall be benched up in concrete and rendered in cement mortar (1:1) of 20 mm thickness and formed to a slope of 1 in 12 towards the channel.

f). The manhole construction work includes curing, pouring tar over MH frame and cover, cost of tar, engraving manhole number and flow direction on the inner surfaces etc., with all lead and lifts, finishing etc. complete. The cement used for the construction of masonry works and internal &external plastering works of manholes shall be of sulphate resisting cement only confirming to IS:12330.

31.2.3 Testing

All Brick Manholes shall be tested as per relevant provisions in CPHEEO Manual & relevant IS with latest revisions & amendments and specifications in this section for Testing and commissioning.

31.2.4 Measurement & payment

The depth of manhole shall be measured from the top of cover to the invert level of the deepest outgoing sewer from the manhole. The quoted rate for the Manholes for various depths as per the specifications and drawings shall include the cost of sulphate resisting cement, bedding concrete, benching concrete, wire cut brick masonry, plastering, footsteps, fixing SFRC/PFRC/PPFRC manhole frame with cover, dewatering to keep the manhole dry until final testing etc. complete.

The Rates for any fractional variation (increase or decrease) in the depth of the manhole on decimetre basis, shall be paid as per actual, by adding the difference in rates between the immediately preceding and succeeding depths of such fractional depth of manhole on linear basis.

For Example: To pay 1.22M depth manhole:

Rate for 1M depth Manhole including manhole frame & cover and encapsulated footsteps rate Rs. X.

Rate for 2 M depths Manhole including manhole frame & cover and encapsulated footsteps rate Rs. Y.

Therefore rate for 1.22M depth Manhole

= Rs. X + (Y-X)/1.00 x 0.22.

Note: For the depths of manholes less than the lowest depths of Bill of Quantities item, the preceding manhole depth shall be taken as zero with zero value to arrive at the rate.

31.3 RCC Manholes

31.3.1 Construction

The construction of RCC manholes shall be by Cast In-situ of Circular in shape or approved type Pre-Cast RCC, constructed using form vibrators of standard type, using SRC/PPC/PSC Cement. The type of manhole to be constructed shall be as approved by KMDA, Contractor shall take prior approval for the Design and Process of manufacture of the Pre-cast RCC manholes, the type of vibration for compaction of concrete for pre-cast manholes shall be invariably of form or table vibrator type.

The work of Cast In-situ RCC manholes includes,

a). Providing and constructing of 1:3:6Cement Concrete foundation using approved quality aggregates of 40mm and downsize with an offset as given in the drawings.

b). Providing and laying granite jelly cement concrete 1:1.5:3 for beds of manholes etc., using 20mm and down size jelly including laying, tamping, etc. for a depth, as per drawings, with water proof compound for top plaster in CM 1:3 curing and smooth finishing for exposed faces with necessary centering and form work etc., complete as per specification, drawing and as directed by the Engineer.

c). Providing and laying cement concrete of 1:1.5:3 proportion for vertical walls using 20mm and down size jelly including laying, tamping, mixing of required quantity of water proof compound for every one bag of cement for plastering in CM 1:3 curing and smooth finishing for exposed

faces with necessary centering and form work etc., complete as per specification, drawing and as directed by the Engineer.

d). Providing and constructing benching with Cement Concrete 1:1.5:3 to the dimensions as on drawings with 1:6 slope in the concrete towards the central drain, plastered with CM 1:3 proportion, 20mm thick and finished with smooth coat of neat cement and fixing of inlet and outlet sewers in the walls with the internal periphery protected with an arch of 1:1.5:3 Cement Concrete with graded metal of 10mm to 20mm size.

e). Providing and laying cement concrete of grade 1:1.5:3 proportion with 12mm to 20mm I.S.I gauge of approved gradation hard broken granite/aggregate including cost and conveyance of all materials with wood or steel shuttering form work including machine mixing , centering form work, scaffolding, tamping , vibrating , curing and smooth finish with CM 1:3, 12mm thick for inside surface for RCC Covering Flat Slab with all lead and lifts, etc. complete as per drawing, specification and as directed by the Engineer.

f). Providing, Supplying and fabricating of TMT (Fe-500) reinforcement steel of all sizes, including straightening, cutting, bending, hooking, lapping and/or welding wherever required, placing in position, tieing with binding wire of approved quality and gauge including the cost of binding wire and anchoring to adjoining members wherever necessary including all laps and wastages etc., with all lead and lifts, complete as per design, specification and directed by Engineer.

g). Supplying and fixing of, 3 mm thick plastic (as per IS: 10910) encapsulated over 12mm dia. Fe-415 steel (as per IS: 1786) bar footsteps staggered at 300mm apart and providing and fixing of heavy duty circular steel fibre reinforced concrete (SFRC) /PFRC / PPFRC manhole frame and covers of 560 mm diameter conforming to IS 12592 and the payment for providing of SFRC/PFRC / PPFRC heavy duty manhole frame and covers shall be paid separately as per quoted rate for the item in bill of quantities.

h). The RCC Manhole cost includes all materials, steel, curing, pouring tar over MH frame and cover, cost of tar, engraving manhole number and flow direction on the inner surfaces etc., with all lead and lifts, finishing etc. complete. The cement used for the construction of RCC manhole and internal & external plastering works of manholes shall be of sulphate resisting cement /PPC/PSConly,.

The work of construction of Pre-cast RCC manhole includes,

a). Providing & laying mechanically mixed cement concrete of M-15 grade with stone aggregate (with 20 mm nominal size graded stone aggregate) in benching, Neat cement punning over PCC benching, as given in the drawings.

b). Construction of approved type vibrated Pre-Cast RCC Manhole Chambers constructed using Sulphate resistant Cement /PPC/PSC& form vibrator of standard type for Circular Manhole Chambers of various internal dia (as indicated in BOQ) at bottom and 0.50 dia at top made up of pre-cast monolithic base, modular riser and top cone in M- 30 grade concrete placed & aligned to provide vertical sides, with O ring rubber gasket at each joint, water tight & adjustment rings over top cone, complete and all connections shall have, a water tight seal between the pipe and the manhole complete as per standard design & drawing.

c). Making connection of drain or sewer line with existing manhole including breaking in to and making good the walls, floors etc. with CC 1:1:5:3. Finishing with CM 1:3 with a floating coat of neat cement and making necessary channels for drain etc. as per specification, drawing and as directed by the Engineer.

d). Providing, Supplying and fabricating of TMT (Fe-500) reinforcement steel of all sizes, including straightening, cutting, bending, hooking, lapping and/or welding wherever required, placing in position, tieing with binding wire of approved quality and gauge including the cost of binding wire and anchoring to adjoining members wherever necessary including all laps and wastages etc., with all lead and lifts, complete as per design, specification and directed by Engineer-in-Charge.

e). Providing MS Foot rests (PVC encapsulated) and fixing in manhole with CC Block of 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate of 20 mm nominal size) of size 20x20x10 cm with 20mm square bar foot rest, and providing and fixing of heavy duty circular steel fibre reinforced concrete (SFRC)/Plastic fibre reinforced concrete (PFRC)/Polypropylene fibre reinforced concrete(PPFRC) manhole frame and covers of 560 mm diameter conforming to IS 12592.

f). The RCC Manhole cost includes providing danger lighting & use of sight rails & boning roads shoring & strutting wherever required, including sand bedding, watering, curing, cost of all materials, labour, supply & fabrication of steel, pouring tar over MH frame and cover, cost of tar, engraving manhole number and flow direction on the inner surfaces etc., with all lead and lifts, finishing etc. complete. The cement used for the construction of RCC manhole and internal & external plastering works of manholes shall be of sulphate resisting cement only, confirming to IS:12330PPC/PSC.

31.3.2 Testing

All RCC Manholes shall be tested as in specifications CPHEEO Manual on Sewerage and Sewage Treatment (latest edition), Relevant IS code(latest edition) for Testing and commissioning.

31.3.3 Measurement & payment

The depth of manhole both for Cast In-Situ / Pre-Cast RCC manholes shall be measured as stated above in Brick Manhole construction.

31.4 Drop Manholes

In a manhole, wherever the difference between the invert level of downstream sewer and the invert level of the upstream sewer is greater than 60 cm, a drop manhole shall be provided at that position. The locations and construction of the drop manholes shall be provided as on drawings.

DWC HDPE (SN 8 Catagory)as per IS:4984 with latest revisions and amendments suitably supported with MS fasteners at 300 mm c/c. for diameters pipe line as per Bill of Quantities, construction drawings and as directed by Engineer, specials conforming to IS: 1729 shall be used for providing the drop in the manhole & a suitable expander/reducer T-Joint at the top with incoming sewer and 45 degree bend at the bottom with HDPE specials to the direction of flow in

the receiving sewer, encasing the pipe with cement concrete of 1:2:4 proportion including necessary centering and form work, vibrating, curing, including cost and conveyance of all materials, labour with all lead and lifts, etc., complete as per specification and as in construction drawing. The benching concrete in the manhole should surround the joint of the terminating bend and a neat channel shall be made in the benching concrete to direct the flow to the receiving sewer. A continuation of the incoming sewer should be built through the shaft wall to form a rodding and inspection eye, which should be provided with half blank flange as on drawing.
The drop manhole arrangements shall be tested along with sewer lines.

31.5 Vent shafts

CI Vent shafts shall be erected at places as on construction drawings or as directed by Engineer and as per Bill of Quantities. The work includes providing and fixing 150mm diameter, Cast Iron pipe for ventilating shaft of 5 meters high with specials and cowl and with suitable grips in C.C. 1:2:4 pillar using 10mm to 20mm graded hard granite/trap/basalt or any other approved metal with 15 cms thick C.C. around up to 1.22 mtrs above the GL and with a foundation base of 90x90x90 cms plastered with 12 mm thick CM 1:3 to all exposed faces and linking the shaft to the manhole by means of 15 cm dia GSW pipes and specials, jointing with tar dipped hemp 1:1 1/2 CM caulking, curing with all lead and lifts etc., complete for all materials earth work excavation and refilling in all strata, and disposal of surplus earth as directed with all lead and lifts etc. complete.(Sulphate resistant cement shall be used).

32 HOUSE SERVICE CONNECTIONS (HSC) AND EXISTING SEWERAGE SYSTEM SURVEY

32.1 House Service Connections

House service connections shall be provided to collect sewage from individual houses as per approved drawings, specifications and items in Bill of Quantities.
For connecting sewers directly to Manholes DWC HDPE (SN 8 Category) / uPVC(SN 8 Category) pipes shall be used and for connecting sewers directly to the Sewer (i.e. online connection) uPVC(SN 8 Category)DWC HDPE (SN 8 Category) pipes and specials shall be used as on drawings and as decided upon by the Engineer-in-Charge.
The survey for house service connections from the Nearest Manhole or sewer line as decided by the Engineer, to the property boundary shall be finalized before taking up the work. All the property connections/ House Service Connections (HSC) shall be done simultaneously while sewers are laid in a particular road/ area/ zone.

32.1.1 House Service Connection to Manholes

The Location of House service connections directly to manholes shall be as decided by the Engineer In-charge. The work involves placing of required number of DWC HDPE (SN 8 Category)/uPVC(SN 8 Category) Pipes, of length 200mm more than the shaft wall thickness on both sides, at time of construction of manholes, at a depth of about 1m below ground level or as directed by the Engineer In-charge including providing and laying granite or basalt or trap jelly

cement concrete of proportion 1:2:4 for bed and surround of DWC HDPE (SN 8 Category)/uPVC(SN 8 Category)pipe in wall shaft and making the joint water tight.

After completion of the manhole construction, and for providing House service connection up to the property boundary 150 mm dia DWC HDPE (SN 8 Category)/uPVC (SN 8 Category) pipes are to be laid and jointed with required slope, after excavation from property boundary to outside of manhole, and a 900 Bend with cleaning eye and capis fixed for the pipe, inside the manhole as per specifications and drawings. The items shall include all labour, lead and lifts and handling charges as per Bill of Quantities DWC HDPE (SN 8 Category)/uPVC(SN 8 Catagory)pipe joints are to be made with suitable solvents as per relevant IS Code.

32.1.2 House Service Connection to Sewers (Online connections)

For House service connections directly to lateral sewers, the connections are divided into shallow depth and deeper depths as shown on drawings. The work shall be executed as per details on drawings and items in bill of quantities, and it involves earthwork excavations as per BOQ specifications, providing, laying and jointing of DWC HDPE (SN 8 Category)/uPVC (SN 8 Category) Junctions, DWC HDPE (SN 8 Category)/uPVC(SN 8 Category)pipes, of specified sizes. The pipes, specials and laying shall confirm to relevant IS specification with latest amendments and specifications in BOQ.

The cement used for jointing shall be of Sulphate Resisting Cement/PPC/PSC confirming to IS 12330-1988 /IS 1489-2/IS 455with latest amendments.

32.2 Location and Protection of Existing Public and Private Utilities

Prior to excavation, the Contractor shall contact all concerned authorities such as Power distribution companies, ULB, police, telecommunications, forest department, etc. and householders in roads where work is to take place and inform them of the nature of the work and its likely duration. Information should be obtained from utilities companies about the location of their utilities, preferably in the form of record drawings, and the Contractor should carry out utilities tracing using electronic equipment to verify the positions of utilities. Trial excavations should also be carried by hand to further confirm locations of utilities. The Engineer will only permit trench excavation to proceed when he is satisfied that adequate efforts have been made to establish the alignments and depths of existing utilities

Any damage to water supply utility connections which may occur during execution of House service connections, even after taking all necessary precautions by the Contractor shall be paid as per rates quoted for the specified item indicated in Bill of Quantities.

The damaged water supply house connections shall be restored with MDPE pipes including Encasing the MDPE Pipe with 40mm dia., MDPE Pipe at sewer crossings etc., the cost includes encasing the MDPE Pipe with 40mm dia. MDPE Pipe with all works complete as directed by the Engineer-in-Charge for items in bill of quantities. The decision in this matter made by the Engineer in charge of work / concerned Engineer of KMDA shall be final and binding upon the Contractor. For damaged soak pits and not to cause inconvenience to the public, the soak pits damaged during excavation shall be restored as per items in bill of quantities. However for any

damage to other service utilities, the Contractor shall make good the same at his own cost. No extra payment towards this will be made.

32.3 Existing sewerage system Survey

It is anticipated that in the existing sewerage system, leaving the portion executed by KMDA, the system is not maintained properly and the system may not be functioning properly at certain locations. Hence the level survey of the existing sewerage system executed by the agencies other than KMDA has been included in this tender. It is the intended to retain portion of existing system which is properly functioning and suitable to be included into proposed network.

The contract covers, Conducting Level Survey of Existing UGD system by Collecting ground levels, invert level of sewers, Size and type (MOC) of Sewers and at every manhole, including depth of manhole and measuring length in between manholes and safely closing the manhole cover, preparation and submission of Drawings in AutoCAD with all particulars in complete manner as per specification and as directed by the Engineer-in-Charge

KMDA will cross verify the adaptability of existing sewer network with the proposed network, and decision will be given to retain or reject the part or whole of the existing sewer network and the Contractor shall carry out the same in accordance with the items in the Bill of quantities and as directed by Engineer. For laying of new sewers in place of damaged and unserviceable existing sewers, the earthwork excavation shall be measured including existing damaged sewers under all soils classification, the new sewer lines in place of damaged one's, dismantling of existing damaged manholes and reconstruction of the same shall be done as per items in BOQ. The diversion of sewage for in service sewer lines and manholes, if required during this work will be done by KMDA.

The Contractor shall collect all necessary specified details required for developing sewer network plan for providing the existing system network plan in Auto Cad. And also incorporate the same in the "AS BUILT DRAWINGS" of executed new works.

Payment: - payment to Contractor on completion of this item of work complying to the specifications above will be paid as per quoted rate and unit of measurement is meters.

33 TESTING AND COMMISSIONING

33.1 Testing at site

All sewers and appurtenances shall be tested before commissioning and trial run as per the specifications in this section. After laying and jointing of sewer pipes and before backfilling the trenches, the complete length of the sewer is to be checked for water tightness and the sole responsibility of arranging the necessary equipment and apparatus lies with the Contractor at his own cost. Any damage during testing shall be Contractor's responsibility and shall be rectified by him free of cost. Water for testing shall be arranged by the Contractor at his own cost.

33.2 Water Test for Sewers

After laying and jointing of sewer pipes and before backfilling the trenches, the complete length of the sewer is to be checked for water tightness. KMDA may exempt water test for lateral sewers, where house service connections are to be connected immediately.

The procedure for testing is as detailed below,

a) Each section of sewer shall be tested for water tightness from manhole to manhole To prevent change in alignment and disturbance after the pipes have been laid, it is desirable to backfill the pipes up to the top keeping at least 90cm length of the pipe open at the joints in case of longer length pipes.

b) In case of concrete and stoneware pipes with cement mortar joints, pipes shall be tested three days after cement mortar joints have been made. It is necessary that the pipelines are filled with water for about a week before commencing the application of pressure to allow for the absorption by pipe wall.

c) The sewers are tested by plugging the upper end with a provision for an air outlet pipe with stop cock. The water is filled through a funnel connected at the lower end provided with a plug. After the air has been expelled through the air outlet, the stop cock is closed and the water level in the funnel is raised to 2.50m above the invert at the upper end. Water level in the funnel is noted after 30 minutes and quantity of water required to restore the original water level in the funnel is determined. The pipeline under pressure is then inspected while the funnel is still in position. There shall not be any leaks in the pipe or the joints (small sweating on the pipe surface is permitted). Any sewer or part there of that does not meet the test shall be emptied and repaired or re-laid as required and tested again.

d) The leakage or quantity of water to be supplied to maintain the test pressure during the period of 10 minutes shall not exceed 0.2 lit/mm dia. of pipe per kilometer length per day.

e) Ex filtration test for detection of leakage shall be carried out at a time when the ground water table is low.

f) For concrete, R.C.C. pipes of more than 600mm dia. the quantity of water inflow can be increased by 10% for each additional 100mm of pipe dia.

g) After completion of the test all temporary seals shall be removed, the test water shall be drained out / pumped out and the line cleaned properly.

33.3 Test for Straightness and obstruction

As soon as a stretch of sewer is laid and tested, before commissioning the cleanliness of the pipeline is to be checked by the following tests as applicable and as decided by the Engineer.

33.3.1 Torch & Mirror Test

In this method of testing, a torch will be held one end of the pipeline inside a manhole and its image through the pipeline will be reflected and seen on a mirror held at the opposite end of the pipeline, inside the next manhole. Any obstruction / debris / major mis-alignment will not give a clear image in which case the pipeline will again be cleaned / rectified and the tests re-done.

33.3.2 Ring Test

In this method of testing two steel/ wooden rings of suitable thickness and design shall be fixed facing each other at a distance of 2 feet or more. The block of rings shall be inserted from one end of the pipeline, inside manhole and pulled by a rope fixed to the block from the other end of the pipeline, inside the next manhole. The rings shall be of dia 75 mm less than the inside diameter of pipe under testing. The rope used for pulling the ring block may be inserted in the pipeline by suitable means. Any construction / debris / major misalignment will prevent the ring to pass through the pipeline in which case the pipeline will again be cleaned / rectified and the test redone, and no extra payment will be made. Alternately upon the approval of the Engineer, the sewer may be tested by inserting at the high end of the sewer, a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball should roll down the invert of the pipe and emerge at the lower end. Any construction / debris / major misalignment that prevent the ball to pass through the pipeline in which case, the pipeline shall be again cleaned / rectified and the tests redone, and no extra payment will be made.

33.3.3 Water Test for Manholes

The entire height of Brick and RCC manhole shall be tested for water-tightness by closing both the incoming and outgoing ends of the sewers and filling the manhole with water. A drop in water level not more than 50mm per 24 hours shall be permitted. In case of high subsoil water it should be ensured that there is no leakage of ground water into the manhole by observing the manhole for 24 hours after emptying it.

33.3.4 Test Records

Complete test records shall be maintained for all tests carried out for sewers both during construction and after being in service. The tests carried out as in specifications, approved QAP shall be documented in the formats as approved by the Engineer and shall be carried out in the presence of the Engineer or his representative and shall be certified by the Engineer or his representative and the Contractor. All completed Test records/documents shall be submitted to the Engineer before submission of bills.

33.4 Commissioning

After satisfactory completion of works and Testing of the sewer lines and appurtenances as per specifications in above clauses, the system shall be commissioned for trial run and operation.

34 Final Finishing

The Contractor will ensure that the entire structure along with all its installations is in finished and in new and fully operative condition when handed over. He shall have repaired and removed all signs of damage that might have been done during the course of construction of manholes and laying of sewers. He shall also see that the entire exterior has been finished

properly and the entire site is cleared of all extra construction material, debris, and excavated soil. This shall have to be done to the satisfaction of the Engineer.

35 As Built Drawings

The Contractor shall submit to the Engineer within two months of actual completion of the work, "As Built" Drawings as specified below and operation and maintenance instructions for the whole of the Works. These Drawings shall be accurate and correct in all respects, including the existing sewer network for which the Contractor has done the condition assessment survey, shall be submitted to, and approved by the Engineer. Completion Drawings as below on two prints and one polyester film shall be supplied by the Contractor, along with a soft copy in CD. These drawings shall be developed in Auto CAD. Drawing shall be of standard size as below,

i). Strip Plans and L-sections of Under Ground Drainage system showing pipe work in package area on scale as per standard practices to the satisfaction of the Engineer, showing sewer alignments, levels, appurtenances, sizes and material of pipe etc. complete.

ii). Structural Drawings showing reinforcement details of all the components covered under this contract as per standard practices.

36 Sewer crossings By Trench-less Method across National Highways / State Highways / Railway crossings / at any other Specified Locations

All works for Road and Railway crossings by Trench less method i.e. by Pipe Ramming /Manual pipe jacking shall be carried out as per specifications in this section mentioned below and for details and specifications not included in this section shall be carried out as per "Standard contract clauses for Trench less Contracts" and "Standard Guidelines for Trench less contracts", 2008.

37 Design & Submittals

37.1.1 Design

The Contractor shall be responsible for the design of the pipes used for the trenchless method including all joints, for the design of the thrust and reception pits including support and thrust wall and for the design of the jacking system in general. His design (including vetting from any IIT, JU, BESU) will be reviewed by the Engineer but this will not relieve him of his responsibility for the adequacy of the design.

37.1.2 Submittals

In addition to the applicable requirement of this Specification, the following shall be submitted by the Contractor and approved by the Engineer prior to commencement of any works;

1) Programme or work with resource and equipment allocation.

2) Design Calculations:

a) Pipes including jacking and frictional forces in the axial direction and earth, traffic and surcharge loading in the vertical direction and the pipes resistance to these loads. Also allowable deflections at joints to limit damage to the joint from eccentric loading under thrust and sealing limits,

b) Thrust and reception pits to resist external soil and water pressures and stresses resulting from jacking machine. Drawings showing on plan and sections, the method of supporting excavations and equipment layout shall be included. All calculation shall be certified/ signed by a qualified Engineer.

37.1.3 Method Statement which shall include:

a) List of equipment and resources.

b) Detailed step by step procedure describing how work will be carried out including clear definition of responsibilities and authority.

c) Support of existing services and adjacent structures.

d) Safety arrangement for compliance with safety requirements.

e) Locking pipe in position during insertion of next pipe.

f) Sealing thrust and reception pits during exiting and entering of pipe.

38 Site Investigation

After award of the Contract, the Contractor shall be responsible for all necessary geotechnical site investigations, including ground water level monitoring, which he considers necessary but as a minimum at the proposed access pit locations, and central median. The Contractor's site investigation programme shall be submitted to the Engineer for review. The results of such investigations shall be submitted to the Engineer and shall include recommendation for pipe laying, excavation support and soil stabilization if required.

The Contractor shall be responsible for obtaining existing utility structures information after Conducting Ground Penetrating Radar Survey in a corridor of 4-6 meter width to detect buried utilities like pipes, cables etc. in such corridor, marking of the detected utilities on the map of corridor with information of locations and depths to the top of various utilities detected. Work to be conducted using 500MHz and 300MHz antenna for best possible resolution and penetration.

38.1 Utility Service structures

The Contractor shall replace at his own cost towards damage of any utility service structures during the excavation and rehabilitate if necessary at his own cost.

TRENCHLESS TECHNOLOGY FOR SEWER PIPE LAYING

For trenchless technology suitable guidelines/ codes from Indian society of Trenchless Technology shall be followed. The Contractor has to decide after field investigation and as per the guidelines provided by Indian society of Trenchless Technology for selection of trenchless technology that is best suitable for a particular section. The codes from ISTT are below mentioned:

Code of practice for Horizontal Directional Drilling Suiting Indian Condition
Code of practice for Micro Tunnelling and Pipe Jacking Suiting Indian Condition
Code of practice for Glass Reinforced Pipe Technique Suiting Indian Condition
Code of practice for pipe Bursting Suiting Indian Condition
Code of practice for cured in place pipe Technique Suiting Indian Condition
Trenchless Technology Selection Guidelines
Standard Operating Procedure for Application of Trenchless Technology
Manual OF site Investigation for Trenchless Projects
Trenchless technology Risk Mitigation Manual

39 SPECIAL CONDITIONS FOR PIPE RAMMING (PR)

39.1 Description

This method involves the forming of a bore from a drive pit, by driving a steel casing with an open end using a percussive hammer or pushing device that serves as a casing for carrier (sewer pipes). In this process of horizontal ramming of steel pipe involves an open steel pipe string being jacked dynamically with the aid of modified displacement hammer or a horizontal ram from the starting shaft though the subsoil to the target shaft. The soil core entering the pipe is removed continuously, at suitable intervals or after completion of jacking.

39.2 Materials

a). Pipe

Pipe used in this method includes an external casing pipe (also called jacking pipe) and may include an interior carrier pipe.

b). Allowable Forces

Considerable ramming / jacking forces may be required to install pipe using this method.

i) Casing pipe shall be obtained from one manufacturer. Pipe shall be specifically designedand certified for Horizontal auger boring by the pipe manufacturer.

ii) The allowable jacking strength capacity of casing pipe shall be capable of withstanding the maximum jacking forces imposed by the operation. The specified allowable jacking capacity of the casing pipe shall be 3 times greater than the maximum jacking forces imposed by jacking operations as identified by theoretical calculations.

iii) Steel casing pipe shall have minimum yield strength of 35,000 psi.

39.3 Casing Pipe

a). Casing pipe shall be used within the entire roadbed influence area. The roadbed influence area is defined as the subsurface area located under the road and shoulder surface, between each shoulder point or back of curb; and continues transversely outward and downward from each shoulder point or back of curb on a 1 on 1 slope

b). Casing pipe materials shall be steel.

c). Only new casing pipe shall be used.

d). Casing pipe shall normally be constructed without any longitudinal seams. However, longitudinally welded casing pipe is allowed for 1.2 m or larger diameter pipes when a certified welder performs all the welding.

e). Casing pipe shall have smooth interior and exterior walls to reduce jacking force and prevent casing rotation.

f). The inside diameter (ID) of the casing pipe shall be at least 150 mm larger than the largest outside diameter (OD) of the carrier pipe to allow the carrier pipe to be inserted or removed subsequently without disturbing the casing or the roadbed.

g). Casing pipe shall be round. Steel casing pipe shall have roundness tolerance, so that the difference between the major and minor outside diameters shall not exceed 1% of the specified nominal outside diameter, or 6 mm, whichever is less.

h). Casing pipe shall have square and machine beveled ends. The pipe end maximum out –of – square tolerance shall be 1 mm, (measured across the diameter).

i). Casing pipe shall be straight. The maximum allowable straightness deviation over any 3m length of steel casing pipe is 3 mm.

j). Pipe shall be without any significant dimensional or surface deformities. All pipes shall be free of visible cracks, holes, foreign material, foreign inclusions, blisters, or other deleterious or injurious faults or defects. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and shall be immediately removed from the site.

k). Any of the following defects warrants pipe rejection:

i). Concentrated ridges, discoloration, excessive spot roughness, and pitting

ii) Insufficient or variable wall thickness

iii). Pipe damage from bending Crushing, stretching or other stress

iv). Pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe and internal roughness characteristics

v). Any other defect of manufacturing or handling.

l). Casing pipe shall be provided with inside two coats of food grade epoxy painting over one coat of epoxy primer and outside two coats of anti-corrosive red oxide primer of approved quality.

m) The casing pipe shall be tested for seepage test after completion.

39.4 Carrier Pipe

Carrier Pipe material is of either ductile iron or RCC NP-3. The carrier pipe shall be inserted into the casing pipe in conjunction with the casing spacers.

The work includes, Supplying & Conveying of different diameters k-7 Class, Ductile Iron carrier Pipes detailed in bill of quantities, confirming to IS 8329 with latest amendments and conveying to work site lowering and placing horizontally into casing pipe with all necessary arrangements, true to line and level and perfect linking at joints, testing and commissioning, including cement mortar lining of thickness as per IS using sulphate resisting cement confirming to IS 12330, loading and unloading at both destinations and cuts of pipes wherever necessary including

jointing of DI pipes and specials with rubber gaskets including cleaning the socket and spigot ends with soap solution and applying soft soap to the spigot and socket ends before insertion of rubber gaskets, jacking and fixing in perfect conditions including cost of soap solution, soft soap, waste etc. and giving necessary hydraulic test to the required pressure as per ISS with all lead and lifts including cost of jointing materials etc., complete (Contractor will make his own arrangements for procuring water for testing)

Supplying of different diameters S&S RCC SPUN / VIBRATED CAST PIPES (REINFORCED) of NP-3 class detailed in bill of quantities, conforming to IS 458:1988 with latest amendments using Sulphate resistant cement, and conveying to worksite, rolling and lowering into trenches, laying true to line and level including loading and unloading at both destinations and jointing of pipes & specials including cost of specials including perfect linking of joints with jack to correct position including cost of jointing materials ie., rubber rings confirming to IS : 5382 for S&S RCC pipes with all lead and lifts as directed and giving necessary hydraulic test as per ISS and testing & commissioning etc., complete. (Contractor will make his own arrangements for procuring water for testing)

39.5 Construction

39.5.1 Minimum Allowable Depth

The minimum allowable depth of PR installed pipe under the road and shoulder surface should be usually twice the nominal diameter (OD) or 1 m or the minimum allowable depth as per the project requirement, whichever is higher.

In location where the road surface is super elevated, the minimum depth of the bore shall be measured from the lowest side of the pavement surface.

39.5.2 Equipment

Equipment used for this method shall have the basic operations of boring, removing tailings, and jacking pipe.

39.5.3 Method

The starting shaft shall be excavated to accommodate the steel pipe sections to be jacked and the ram. Steel support profiles shall be placed to direct the movement. If a long jacking is necessary string fabrication shall be done at site.

39.5.4 Access Pits

a) Location

A minimum distance of 6 m, from the edge of the paved shoulder or curb to the face of any access pit, equipment, and supplies, shall be maintained in areas posted at 50 kmph or less; otherwise, a minimum distance of 9 m shall be maintained.

b). Sheeting and Bracing

Sheeting and bracing shall be required whenever any part of the access pit excavation is located within the roadbed influence area. Steel sheet pilling shall be furnished and installed. An additional earth retention structure shall be required above and below the bore hole on the drilling face of all access pits to prevent loss of material during construction.

c) Protection

i). At the discretion of Engineer, and depending on the pit distance from the road embankment, traffic barriers may be required to be installed adjacent to access pit locations according to KMDA's plans. If instructed, temporary beam guardrail shall also be installed according to the current KMDA's specifications.

ii). Fencing barriers shall be installed adjacent to access pits, open excavations, equipment and supplies with suitable fencing and plastic drums to prohibit pedestrian access to the work site. Equipment shall not be used as fencing to protect access pits.

iii). The Contractor shall construct and operate safe access pits according to all applicable regulatory requirements.

39.5.5 Overcut Allowance

Overcut is the annular space between the excavated hole and the outside diameter of the casing pipe. No overcut shall be allowed in case of pipe Ramming.

39.5.6 Water tight Joints

Water tight pipe joints are required to ensure the integrity of the roadbed. Pipe shall be constructed to prevent water leakage or earth infiltration throughout its entire length.

A watertight specification for each type of pipe material can be obtained through each pipe material industry. Necessary reference must be made to the appropriate industry specification for more detailed information.

39.6 SPECIAL CONDITIONS FOR MANUAL PIPE JACKING

Manual pipe jacking involves forming entry and exit pits, lowering of pipe segment aligning, laying, jointing of product pipe line through jacking process from the jacking pit.

39.6.1 Scope of Work

The scope of work includes all labour, materials and equipment and to perform all the work necessary to design and construct pipe lines crossing under paved roads, railway crossing using Manual pipe jacking. Construction shall be by using appropriate equipment and Contractor shall propose the location of all working shafts having due regard to existing services, minimizing disruption to traffic and pedestrian movement. Locations shall be approved by the engineer prior to the commencement of construction. The Contractor shall obtain approval of his method statement from the Engineer before commencement of the work.

39.6.2 Design

The Contractor shall be responsible for the design of the pipes used for the trenchless method including all joints for the design of thrust and reception pits including support and thrust wall for the design of the jacking system in general. His design will be reviewed by the Engineer but this will not relieve him of his responsibility for the adequacy of the design.

39.6.3 Submittals

In addition to the applicable requirements of this specification, the following shall be by the Contractor and approved by the Engineer prior to commencement of any works;

1) Programme of work with resource and equipment allocations.
2) Additional soil investigations
3) Design calculations for the non-disruptive method

a) Pipes including jacking and friction forces in the axial direction and earth, traffic and surcharge loading in the vertical direction and pipes resistance to these loads. Also allowable deflections at joints to limit damage to the joint from eccentric loading under thrust and sealing limits.

b) Thrust and reception pits to resist external soil and water pressures and stresses resulting from jacking machine. Drawing showing on plan and sections the method of supporting excavations and equipment layout shall be included. All calculations shall be certified / signed by a qualified Engineer.

4) Materials specifications and product data.
5) Method statement shall include

a) List of equipment and resources

b) Detailed step by step procedure describing how work will be carried out including clear definition of responsibilities and authority

c) Support of existing services and adjacent structures

d) Safety arrangement for compliance with safety requirements.

e) Arrangements for dealing with ground water taking due regard to controlling the loss of materials and preventing settlement around pits pit pipe interface and tunnel face

f) Dealing with different ground conditions

g) Locking pipe in position during insertion of next pipe

h) Sealing thrust and reception pits during exiting and entering of pipe

i) Control of over break

j) Grout mix design and method of grouting

39.6.4 Casing Pipe

a). Casing pipe shall be used within the entire roadbed influence area. The roadbed influence area is defined as the subsurface area located under the road and shoulder surface, between each shoulder point or back of curb; and continues transversely outward and downward from each shoulder point or back of curb on a 1 on 1 slope

b). Casing pipe materials shall be steel.

c). Only new casing pipe shall be used.

d). Casing pipe shall normally be constructed without any longitudinal seams. However, longitudinally welded casing pipe is allowed for 1.2 m or larger diameter pipes when a certified welder performs all the welding.

e). Casing pipe shall have smooth interior and exterior walls to reduced jacking force and prevent casing rotation.

f). The inside diameter (ID) of the casing pipe shall be at least 150 mm larger than the largest outside diameter (OD) of the carrier pipe to allow the carrier pipe to be inserted or removed subsequently without disturbing the casing or the roadbed.

g). Casing pipe shall be round. Steel casing pipe shall have roundness tolerance, so that the difference between the major and minor outside diameters shall not exceed 1% of the specified nominal outside diameter, or 6 mm, whichever is less.

h). Casing pipe shall have square and machine beveled ends. The pipe end maximum out –of – square tolerance shall be 1 mm, (measured across the diameter).

i). Casing pipe shall be straight. The maximum allowable straightness deviation over any 3m length of steel casing pipe is 3 mm.

j). Pipe shall be without any significant dimensional or surface deformities. All pipes shall be free of visible cracks, holes, foreign material, foreign inclusions, blisters, or other deleterious or injurious faults or defects. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and shall be immediately removed from the site.

k). Any of the following defects warrants pipe rejection:

i). Concentrated ridges, discoloration, excessive spot roughness, and pitting

ii) Insufficient or variable wall thickness

iii). Pipe damage from bending Crushing, stretching or other stress

iv). Pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe and internal roughness characteristics

v). Any other defect of manufacturing or handling.

l). Casing pipe shall be provided with inside two coats of food grade epoxy painting over one coat of epoxy primer and outside two coats of anti-corrosive red oxide primer of approved quality.

m). The casing pipe shall be tested for seepage test after completion.

39.6.5 Carrier Pipe

Carrier Pipe material is of either ductile iron or RCC NP-3. The carrier pipe shall be inserted into the casing pipe in conjunction with the casing spacers.

The work includes, Supplying & Conveying of different diameters k-7 Class, Ductile Iron carrier Pipes detailed in bill of quantities, confirming to IS 8329 with latest amendments and conveying to work site lowering and placing horizontally into casing pipe with all necessary arrangements, true to line and level and perfect linking at joints, testing and commissioning, including cement mortar lining of thickness as per IS using sulphate resisting cement confirming to IS 12330, loading and unloading at both destinations and cuts of pipes wherever necessary including

jointing of DI pipes and specials with rubber gaskets including cleaning the socket and spigot ends with soap solution and applying soft soap to the spigot and socket ends before insertion of rubber gaskets, jacking and fixing in perfect conditions including cost of soap solution, soft soap, waste etc. and giving necessary hydraulic test to the required pressure as per ISS with all lead and lifts including cost of jointing materials etc., complete (Contractor will make his own arrangements for procuring water for testing)

Or Supplying of different diameters S&S RCC SPUN / VIBRATED CAST PIPES (REINFORCED) of NP-3 class detailed in bill of quantities, conforming to IS 458:1988 with latest amendments using Sulphate resistant cement, and conveying to worksite, rolling and lowering into trenches, laying true to line and level including loading and unloading at both destinations and jointing of pipes & specials including cost of specials including perfect linking of joints with jack to correct position including cost of jointing materials ie., rubber rings confirming to IS : 5382 for S&S RCC pipes with all lead and lifts as directed and giving necessary hydraulic test as per ISS and testing & commissioning etc., complete. (Contractor will make his own arrangements for procuring water for testing)

39.6.6 Quality Assurance

The pipe line installation by manual pipe jacking shall be executed by firms having a record of at least three years of successful trouble free execution of similar works

39.6.7 Delivery Storage and Handling

All materials shall be properly protected so that no damage or deterioration shall occur during a prolonged delay

39.6.8 Site Investigation

Soil conditions and ground conditions shall constitute the Contractor's risk. After award of the contract the Contractor shall be responsible for carrying out all geotechnical site investigation including ground water level monitoring which he considers necessary but as a minimum at the proposed access pit locations and central median. The Contractor's site investigation programme shall be submitted to the engineer for review. The results of such investigation shall be submitted to the engineer and shall include recommendations for pipe laying, excavation support and soil stabilization if required.

39.6.9 Health and Safety

The Contractor shall adopt safe working practices for pipe jacking in accordance with appropriate standards. Only authorized persons shall be allowed access to the site. The Contractor shall provide a safety officer suitably experienced in tunnelling operations and with adequate authority to control and implement safe working practices.

The Contractor shall make suitable arrangements for accommodating his personnel at the site including the following as a minimum:

1) Telephone service.

2) Approved gas detectors.
3) First aid kit.
4) One vehicle.

The excavated pits shall have a separate cage type ladder bay complete with ladder in addition to any other bay or bays required for the construction of the works.

The pits shall be fenced off on all sides with close steel panels at least 1.8m in height and equipped with safety warning lights. The panels (maximum space between 100mm) shall be joined by steel rods supported on concrete blocks.

Adequate lighting and ventilation shall be provided to the pits and electricity shall be supplied at no greater than 110/220 volts.

39.6.10 Skilled Operator and Supervision

All operator in the employment of the Contractor shall be skilled and experienced in their respective trades and in particular shall be fully skilled in shaft sinking and manual pipe jacking.

The pipe manufacturer has to guarantee that this pipe and its material are suitable for its intended use.

Standard pipes shall be a minimum in length subject to the installation method used. Where required, pipes shall incorporate lubricant injection holes spaced equally around the circumference. Concrete pipes with a liner shall only be permitted to have lubricant injection holes in the concrete. Lubrication holes shall be clear of joints and shall be plugged on completion of the work. The liner shall be made good and continuous. Pipes may incorporate lifting holes and fixing holes for securing temporary apparatus. All such holes shall be threaded to enable plugs to be screwed into the sockets to withstand any external water pressures.

Joints which shall be used in conjunction with a resilient packing, shall be capable of accepting repeated annular deflections of up to 10 without.

i) Damage to pipe or loss of structural strength.
ii) The ingress or egress of water or lubricant under the maximum operational or test pressures.
iii) The ingress of soil / groundwater on to the bearing surfaces.

The joint design for concrete pipes shall be such that the areas available for transmitting the maximum permitted thrust force will be sufficient to ensure that with an annular deflection of 10 and with resilient packing material in place the maximum pressure applied to the joint bearing surface will not exceed 23.5 N/mm2 for drives in excess of 100 metres and up to 150 metres in length.

Unless independently authenticated test results acceptable to the Engineer are available, two consecutive axial loading tests incorporating a 10 angular deflection with the application of double the maximum permissible thrust force (or, if greater, of the greatest thrust force that the proposed thrust equipment can apply) shall have been successfully conducted without any visible crushing, cracking or sapling of the pipe being evident, before any pipes will be accepted for use. The test shall be extended to record the loading at which any visible signs of failure become evident, and shall be carried out in an approved manner to simulate actual working

conditions. Pipes which have been submitted to the proof load test will not be permitted in the Works.

Where the Contractor elects to construct certain sections within larger diameter pipes and grout the annular space, the external pipe may be of steel with full circumferential weld. The steel pipe and the grout shall be regarded as sacrificial and the inner pipe shall be designed as a stand-alone pipe, capable of withstanding installation and grouting forces and soil, traffic and groundwater loads subject to the method.

39.7 Grout

39.7.1 As Slurry replacement:

The grout shall consist of Portland cement and water as determined by geotechnical data and directed by the Engineer. It's normal strength shall be at least 20 N/mm2. Admixtures shall be used only if tests have shown to the satisfaction of the Engineer that their use improves the properties of the grout, e.g. by increasing workability or slightly expanding the grout.

39.7.2 As Annular Space Filling

A low strength, non- shrink grout or foam concrete shall be used and placed at low pressures. The density of the mix shall be in the range 900 – 1200 kg/m3 and the free water / cement ratio not greater than 0.6.

The carrier pipe and joints shall be protected from the possible adverse physical or chemical – effect of grout. Compressible material shall be wrapped around pipe.

The internal pipe shall be filled with water to avoid floatation forces, hydration temperatures and to resist forces during grouting. A 5m high free vented standpipe should be used.

A free venting standpipe of not less than 100mm dia. shall be installed on the grout injection feed to restrict grouting pressures to a maximum of 1 bar.

39.8 Thrust and Reception Pits

The dimensions of thrust and reception pits shall be limited to the minimum required to construct the Works.

Thrust and reception pits shall be constructed within a sheet pile cofferdam or caisson if the ground conditions dictate. The pit bottom shall be sealed with concrete. Entry and exit sealing rings shall be provided.

The Contractor shall determine the excavated dimensions of the drive and reception shafts as required to suit the site conditions. Minimum shaft dimensions shall be used at all locations where utilities, roads or trees exist adjacent to the required shaft locations.

Excavations shall be supported according to type of pit as specified below:

Type 'A" Thrust and reception pit in all types of soils except rock, with high groundwater able and with the excavation secured by precast reinforced concrete caisson.

The caisson bottom shall be sealed with a concrete plug which shall be placed underwater and designed to resist water uplift as well as forces from the jacking equipment to be installed in the pit. All the joints between caisson rings shall be sealed with the joint sealant and the caisson grouted from outside in order to make in water tight. A reinforced concrete wall shall be provided in the thrust pit to resist the jacking force. A properly braced concrete wall shall be provided in the thrust and reception pits in order to install the entry and the exit rings.

Type 'B' Same as Type 'A' but the excavation is secured by inter – locked steel sheet piles. The sheet piles shall be braced by suitable steel framing welded to the sheet piles. No struts shall be used for bracing. The first set of bracing shall be at 0.5m from the ground surface.

Type 'C' Same as Type 'A' but in dry conditions.

Type 'D' Same as Type 'B' but in dry conditions.

Type 'E' Same as Type 'A' except that the pit is partially in soil and partially in rock. The portion in soil is secured by caisson as in Type 'A' where as the portion in the rock can be unsupported. Special precautions shall be taken to seal the interface between the caisson and the rock so that it is water and soil tight.

Type 'F' Same as Type 'E' except that excavation in soil is secured by sheet piles instead of a caisson.

Type 'G' Same as Type 'E' but in dry conditions.

Type 'H' Same as Type 'F' but in dry conditions.

Type 'I' The thrust and reception pits are in rock in an area of high groundwater table. The excavation can be unsupported. A reinforced concrete wall shall be provided in the thrust pit to resist the jacking force. Properly braced concrete walls shall be provided in the thrust and reception pits in order to install the entry and exit rings.

Type 'J' Same as Type 'I' except in dry conditions.

The pits shall be completely dry prior to commencing and throughout Jacking works. Dealing with groundwater where required shall be conducted in a slow manner. Standby facilities shall be provided.

The thrust wall shall be perpendicular to the proposed line of thrust. The thrust wall shall be sufficient to accept repeatedly the maximum permitted thrust force without undue movement. It

will not be permissible to thrust directly off any permanent part of any shaft, chamber or pumping station unless this is specifically designed to withstand the thrust reaction.

Thrust wall shall not be joined to the jacking rig base concrete.

The maximum permissible thrust force.

i) 50% of the sum of the maximum forces recorded at the rigs used to construct the tail tunnel, or

ii) If the over break to the tail tunnel has been grouted up, 100% of the sum of the maximum forces recorded at the rigs used to construct the tail tunnel.

Any tail tunnel which has been used as a reaction surface shall pass the specified water tightness test at a time not less than 14 days after the load has been removed.

The design of thrust wall and any other associated Temporary Works shall be such as to prevent damage to any part of the Permanent Works or any immediately adjacent service or structure.

Any void between the soil face used to provide a reaction to the thrust force and the thrust wall shall be filled completely with grout.

The Contractor shall take any measures necessary to prevent damage or deterioration of the soil reaction face during the construction of the Temporary and Permanent Works from whatever possible cause, such ingress of water, softening, corrosive soil or loss of fines from a granular soil.

39.9 Pipe Installation within Sleeves

Pipe sections shall be placed and joined individually within the sleeve or mounted on guide rails or trolleys in such a manner as to transmit the pulling / pushing forces through the carriage and not through pipe.

39.10 Thrust System

The rig shall distribute the thrust to the pipes via a thrust ring and packing. The jacks shall apply the thrust to the thrust ring by means of a symmetrical distribution. Inter – jack stations shall be used where frictional resistance or other causes would otherwise result in unacceptable thrust forces.

If used, spacer blocks shall be true and free form any distortions.

All thrust rings shall be true and free from any distortions and sufficiently stiff so as to transfer the load from the jacks uniformly to the packing.

Other than at the shield, each group of jacks shall be interconnected to ensure that an evenly distributed load is applied to the thrust ring. Each jack shall incorporate a load cell.

At the rig and at intermediate stations automatic thrust recording equipment monitoring load cells incorporated in each jack is to be provided together with a pressure metering device. Other continuous records including cutter torque, rate of progress, slurry progress, pitch, roll, slurry slow, earth face pressure, etc. shall be provided.

Copies of these records clearly stating the units measured shall be submitted daily to the Engineer.

The thrust force shall not exceed the maximum permissible thrust force as determined by the Contractor, based on calculations submitted by the Contractor and approved by Engineer and on consideration of the behaviour of the pipe joint at the maximum permitted angular deflection of

0.5 with the maximum permissible bearing stress in conjunction with the stress / strain relationship obtained from the packing compression tests.

39.11 Lubrication Holes

Where lubrication holes are required, these shall be threaded to enable plugs to be screwed into the socket and withstand the external pressure. Non – return valves shall be fitted where opening a hole would permit ground loss. Lubrication holes shall be plugged watertight on completion, lining or coating shall be made good. The pressure of the lubricant shall be maintained until it is replaced by grout.

39.12 Grouting

Upon completion of a section, if grouting is required or specified, the grout shall be pumped through all lubrication holes. The pressure and quantity of grout injected shall be calculated b the Contractor and approved by the Engineer. Grouting shall commence at the lower holes and shall be carried out systematically working from one end of pipe jack to the other. Where injection holes can be opened without loss of ground, grout shall be pumped through the lower injection holes until it emerges from the upper holes.

Grouting progress shall be continuously monitored to ensure no over pressurization.

Upon completion of the pipeline, the Contractor shall continue to monitor the settlement point elevations regularly during the maintenance period and report to the Engineer on a monthly basis. If the specified limits are exceeded then the Contractor should report immediately and submit a proposal to rectify the road surface and prevent further settlement.

40 INSPECTION

(i). PRE – INSPECTION PLAN REVIEW

a). Review geotechnical and soil reports.

b). Ensure MDOT facilities and nearby utility information are shown on the plans and profile and that the proposed alignment does not interfere with them.

c). Note the minimum cover above the top of the pipe and below the pavement surface, or ground elevation (for longitudinal installation outside the influence of the roadway) is ____ m.

d). Note proposed pipe characteristics:

Pipe material _____
Pipe Diameter_____mm,
Pipe wall thickness _____mm,
Over – cut diameter _____mm,
Back ream dia. Increase _____mm,

e). Ensure that the appropriate penetration angle and curvature rate are identified.

f). Review contingency plan.

g). Review job site layout including: distance from access pits to roadbed, proposed sheeting and bracing, materials storage and fabrication area, safety devices (barrels, guardrail etc.) and dewatering pit locations.

h). Review steel pipe coating requirements.

i). Note unique or special items / circumstances: _____

(ii) CONSTRUCTION INSPECTION

a). Verify traffic control is consistent with the permit requirements, and the permits are available on-site.

b). Verify job site layout is consistent with the approved plans, especially the alignment of the pipe and machine.

c). Verify continuous monitoring records indicate bearing and grade of the leading edge of the pipe is consistent with the approved plans, dewatering effort is satisfactory, soil volume removed is consistent with projection, and that workers understand the contingency plan.

d) Verify pipe characteristics are consistent with permit requirements.

e) Verify steel pipe is new with smooth interior and exterior surfaces, is used within the entire influence area of the roadbed, has clean and square ends, joints are watertight, defective pipe is not used, and damaged pipe is removed.

Verify each end of the pipe is sealed with a cap; restoration is completed, and attaches Inspector's Daily Report (IDR).

Permit No. _____

Inspector: _____

Date: _____

41 Other Related works

41.1 Settlement/Heaving Monitoring

The trench less method of pipe laying shall be performed in a manner that will minimize the movement of the ground in front of, above, and surrounding the ramming/jacking operation: and will minimize subsidence of the surface above and in the vicinity of the ramming. The ground shall be supported in a manner to prevent loss of ground and keep the perimeter and face of the boring stable at all times, including during shutdown periods.

Potential settlement shall be monitored at each edge of right of way, each shoulder point, each edge of pavement, the each edge of each lane (or centerline for two lane roads), and otherwise at 15m intervals along the pipe centerline.

A survey shall be performed one day prior to initiating this operation at each required monitoring location. A similar survey shall then be performed at each location, on a daily basis, until the permitted activity has received a final inspection. This survey establishes the pre-existing and post construction conditions, and the amount of settlement. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a meter. Whenever possible, trench less pipe installations shall not be installed directly under a pavement crack. Digital photograph of a pavement condition shall also be taken prior and after the pipe installation.

All operations shall stop immediately whenever monitored points indicate a vertical change in elevation of 12mm or more, or any surface disruption is observed. The Contractor shall then immediately report the amount of settlement to the Engineer with all records.

41.2 Ground Water Control

Dewatering shall be conducted wherever there is high ground water table level to prevent flooding and facilitate the operation. The water table elevation shall be maintained at least 600mm below the bottom of the casing at all times. When needed, dewatering may be initiated prior to any excavation and will be paid as per the item in bill of quantities.

Minor water seepage or pockets of saturated soil may be effectively controlled through bailing or pumping. This control shall be accomplished without removing any adjacent soil that could weaken or undermine any access pit, its supports, or other nearby structure.

Larger volume of ground water shall be controlled with one or more well points or with staged deep wells. Well points and staged deep well pumping system shall be installed and operated without damaged to property or structures, and without interference with the rights of the public, KMDAs of private property, pedestrians, vehicular traffic, or the work of other Contractor's. Any pumping methods of de-watering and control of ground water and seepage shall have properly designated filters to ensure that the adjacent soil is not pumped along with the water. Well diameter, well spacing and the pump's pumping rate, shall provide adequate draw down of the water level. Wells shall be located to intercept ground water that otherwise would enter the access pit excavation and interfere with the work. Upon removal of a well, the hole shall be filled and grouted.

Existing storm sewer shall only be used to discharge water from the dewatering operation in accordance with a permit obtained from the appropriate storm sewer KMDA. Filters of sediment control devices shall be required to ensure that the existing system is not adversely affected by construction debris or sediment.

If grouting is used to prevent ground water from entering the area of the access from pit, the grouting shall be installed without damage to property or structures and without interference with the rights of the public, KMDAs of private property, pedestrians, vehicular traffic, or the work of other Contractor.

Whenever a significant amount of unexpected groundwater enters an access pit, and a catastrophic pit failure is imminent, the pit shall be backfilled immediately, until the groundwater level is at least 600 mm below the bottom of the casing.

41.3 Boring failure

Should anything prevent complete of this operation, the reminders of the pipe shall be constructed by the methods approved by the Engineer. Abandonment of any component of the installation shall be allowed as approved by the Engineer. If obstruction is encountered which prevents completion of installation of pipes, pipe remain shall be taken out of service and immediately filled with flow able fill.

41.4 Contamination

When an area of contaminated ground is encountered, all operations shall stop immediately, and shall not proceed until approved by the Engineers. Any slurry shall be tested for contamination and disposed off, in a manner, which meets local, State and/ of federal requirements.

41.5 Bulk head

Casing ends shall be enclosed or bulk headed with a 1:.1.5.:3 proportion concrete, or approved alternate to seal the ends to prevent water leakage or earth infiltration. The concrete shall extend longitudinally into the pipe end opening to create a minimum 300 mm thick bulk head barrier, or as required by permit. Engineers may allow rubber bulkheads in special situations.

41.6 Work site Restoration

a). Access pits and excavation shall be backfilled with suitable material, and in a method approved by Engineer.

b). The disturbed grass surface area shall be top soiled, seeded, fertilized, mulched, and anchored according to the current KMDAs specifications. If a final site restoration is not completed within 5 days after completion of the operation, the installation of temporary soil erosion and sedimentation control measures shall be provided.

c). upon completion of the work, the Contractor shall remove and properly dispose off all access materials and equipments from the work site.

d). The permit, including the surety requirements, shall remain in effect for a minimum of one year after completing the work to monitor for settlements of the pavement and /or slope.

41.7 Payments

The payment for the works under Trench less method of pipe laying by Pipe Ramming/Manual pipe Jacking method will be made after executing according to the above specifications as per the relevant items in BOQ. All costs for works executed under the above specifications that are apart from the items in bill of quantities, shall be included in the item for installation of Casing Pipe by ramming / Manual pipe jacking method, No extra claim in this regard is entertained.

41.8 Interface between contracts

The Contractor shall under take the end connections at the interface points only after the pipe line as passed the Hydraulic tests on completion. After completing the end connections the Contractor shall lay the bed and surround and backfill the trench in the normal manner.

42 Reinstatement of roads

The road restoration / reinstatement shall be carried out after completion and necessary testing of all the Works and only after approval of the Engineer.

Contractor shall make good of the road surface to the original grade, level and specifications as per Bill of Quantities. Trenches shall be backfilled in layers as per clause mentioned in this section, well watered and well compacted before road restoration to avoid settlement of restored strip. In case any settlement of the road restoration strip, the Contractor has to rectify the surface by redoing the restoration work at no extra cost to KMDA as per Bill of Quantities. Road restoration shall be done as per the requirements of the concerned local authorities, requirements specified in this section of Technical specifications, applicable IRC guidelines and as directed by the Engineer. The replacement of road structures shall be carried out as soon as practicable and in conformity with IRC guidelines after backfilling has been completed. Suitable excavated road pavement which complies with the requirements of the Engineer may be used at the sub-base levels. Compaction shall be carried out with approved mechanical compacting equipment.

The edges of the trench shall be cut to form a straight line consistent with fixed width of trench. A vertical joint shall be formed between the new work and the existing road surface and shall be painted with hot bitumen or rich cement slurry as the case may be, as approved by the Engineer. The joint between the base course and wearing course shall be stepped 75 mm.

The finished levels of the completed reinstatement shall conform to the adjoining carriageway surface. Reinstatement of the wearing courses shall match as nearly as practicable the colour or other characteristics of the existing surface.

42.1 WATER BOUND MACADAM SUB – BASE / BASE.

42.1.1 Scope

This work shall consist of clean, crushed aggregates mechanically interlocked by rolling and bonding together with screening, binding material where necessary and water laid on properly backfilled pipeline and manhole trenches and finished in accordance with the requirements of these specifications and as directed by the Engineer.

The scope involves Providing, laying , spreading and compacting stone aggregates of specific sizes to Water Bound Macadam specification including spreading in uniform thickness, hand packing, rolling with 3 wheeled steel/vibratory roller 8-10 tones in stages to proper grade and camber, applying and brooming requisite type of screening/binding materials to fill up the interstices of coarse aggregates ,watering and compacting to the required density with all lead & lifts etc. complete with the following two layers of materials each compacted to 75 mm thick,

(i). Materials (Refer table 400 - 7, 8 & 9) Using Screening Crushable type such as Moorum or Gravel Grading-II (Clause: 404 of MORT & H).

(ii). Material (Refer table 400 - 7, 8 & 9) Using Screening Crushable type such as Moorum or Gravel Grading-III (Clause: 404 of MORT & H).

42.1.2 Materials

(a) Coarse aggregates - Coarse aggregates shall be either crushed or broken stone, crushed slag, over burnt (Jhama) brick aggregates or any other naturally occurring aggregates such as kankar and laterite of suitable quality. Materials other than crushed or broken stone and crushed slag shall be used in sub-base courses only. If crushed gravel / shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-6. The type and size range of the aggregate shall be specified in the contract or shall be as specified by the engineer. If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part 5).

(b) Crushed or broken stone - The crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and distinguished particles, dirt and other deleterious material.

Table 400-6, Physical requirements of coarse aggregates for water bound macadam for sub– base courses.

	Test	Test Method	Requirements
1	* Los Angeles Abrasion value Or *Aggregate impact value	IS:2386 IS:2386 (Part-4) or IS;5640**	40 percent (Maxi.) 30 percent (Maxi.)
2	Combined Flakiness and Elongation indices (Total)***	IS:2386 (Part - 1)	30 percent (Maxi.)

* Aggregate may satisfy requirements of either of the two sets.

** Aggregates like brick metal, kankar, laterite etc. which get softened in presence of water shall be tested for Impact value under wet condition in accordance with IS: 5640.

*** The requirement of flakiness index and elongation index shall be enforced only in the case of crushed broken stone and crushed slag.

(c) Crushed slag - Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of crushed slag shall not be less than 11.2 KN per m3 and the percentage of glossy material shall not be more than 20. It should also comply with the following requirements:

(i)	Chemical stability	To comply with requirements of appendix of BS : 1047
(ii)	Sulphur content	Maximum 2 per cent
(iii)	Water absorption	Maximum 10 per cent

(d) Over-burnt brick aggregates -Brick aggregates shall be made from over burnt bricks or brick bats and be free from dust and other objectionable and deleterious materials.

(e) Grading requirement of coarse aggregates - The coarse aggregates shall conform to one of the Grading given in Table 400 – 7 as specified, provided; however, the use of Grading No. 1 shall be restricted to sub-base courses only

Table 400 – 7, Grading requirements of coarse aggregates

Gradation	Size range	I.S. Sieve designation	Percent by weight passing
1	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2	63 to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3	53 to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grading 1 shall be 100 mm while for layer with other grading i.e., 2 & 3, it shall be 75 mm.

(f) Screenings - Screenings to fill voids in the coarse aggregate shall generally consist of the screen material as the coarse aggregate. However, where permitted, predominantly non-plastic material such as murrum or gravel (other than rounded river borne material) may be used for this purpose provided liquid limit and plasticity index of such material are below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 per cent.

Screenings shall conform to the grading set forth in Table 400-8. The consolidated details of quantity of screenings required for various grades of stone aggregates are given in Table 400 – 9. The table also gives the quantities of materials (loose) required for 10 m2 for sub-base base compacted thickness of 100/75 mm. The use of screenings shall be omitted in the case of soft aggregates such as brick metal, kankar, laterites, etc. as they are likely to get crushed to a certain extent under rollers.

Table 400 – 8, Grading for screenings

Grading classification	Size of Screenings	IS Sieve designation	Per cent by weight passing the IS sieve
A	13.2 mm	13.2 mm	100
		11.2 mm	95-100
		5.6 mm	15-35
		180 mm	0-10
B	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 mm	15-35

Table 400 – 9, Approximate quantities of coarse aggregates and screenings required for 100 / 75 mm compacted thickness of water bound macadam (wbm) sub-base / base course for 10 m2 area

Classification	Size Range	Compact thickness Loose Qty.	Screenings			
			Stone screening		Crushable type such as murram or gravel	
			Grading classification and size	For WBM sub-base/ base course (loose Qty)	Grading classification and size	Loose Qty.
Grading-1	90mm to 45mm	100 mm 1.21 to 1.43 m3	Type A13.2 mm	0.27 to 0.30 m3	Not Uniform	0.30 to 0.2 m3
Grading - 2	63mm to 45 mm	75 mm 0.91 to .7m3	Type A 13.2 mm	0.12 to 0.15 m3	- do -	0.22 to 0.24 m3
- do -	- do -	- do -	Type B 11.2 mm	0.20 to 0.22 m3	- do -	- do -
Grading-3	53mm to 22.4 mm	- do -	- do -	0.18 to 0.21 m3	- do -	- do -

(g) Binding material - Binding material to be used for water bound macadam as a filter material meant for preventing gravelling, shall comprise of a suitable material approved by the engineer

having a Plasticity Index (PI) value of less than 6 as determined in accordance with IS : 2720 (Part 5).

The quantity of binding material where it is to be used will depend on the type of screenings. Generally, the quantity required for 75 mm compacted thickness of water bound macadam will be 0.06 – 0.09 m3 / 10m2 and 0.08 – 0.10 m3/ 10 m2 for 100 mm compacted thickness.

The above mentioned quantities should be taken as a guide only, for estimation of quantities for construction etc.

Application of binding materials may not be necessary when the screenings used are of Crushable type such as murrum or gravel.

42.2 Construction operations

(a) Preparation of base - The surface of the sub-grade /sub-base/base to the specified lines and cross fall (camber) shall be made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained if necessary by sprinkling water. Any sub-base /base / surface irregularities, where predominant, shall be made good by providing appropriate type of profile corrective course (levelling course) to applicable clause of these specifications.

As far as possible, laying water bound macadam course over an existing thick bituminous layer may be avoided since it will cause problems of internal drainage of the pavement at the interface of two courses. It is desirable to completely pick out the existing thin bituminous wearing course where water bound macadam is proposed to be laid over it. However, where the intensity of rain is low and the interface drainage facility is efficient, water bound macadam can be laid over the existing thin bituminous surface by cutting 50 mm x 50 mm furrows at an angle of 45 degrees to the centre line of the pavement at one meter intervals in the existing road. The directions and depth of furrows shall be such that they provide adequate bondage and also serve to drain water to the existing granular base course beneath the existing thin bituminous surface.

(b) Inverted choke - If water bound macadam is to be laid directly over the sub-grade, without any other intervening pavement course, a 25 mm course of screenings (Grading B) or coarse sand shall be spread on the prepared sub-grade before application of the aggregates is taken up. In case of a fine sand or silty or clayey subgrade, it is advisable to lay 100 mm insulating layer of screening or coarse sand on top of fine grained soil, the gradation of which will depend upon whether it is intended to act as a drainage layer as well.

As a preferred alternative to inverted choke, appropriate geo-synthetics/ Jute geotextile performing functions of separation and drainage may be used over the prepared subgrade as directed by the Engineer-in-Charge. Section 700 shall be applicable for use of geo-synthetics/ Jute geotextile.

(c) Spreading coarse aggregates - The coarse aggregates shall be spread uniformly and evenly upon the prepared sub-grade/sub-base/base to proper profile by using templates placed across the road about 6 m apart, in such quantities that the thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 2 and 3, as specified in specifications above. Wherever possible, approved mechanical devices such as aggregates spreader shall be used to

spread the aggregates uniformly so as to minimize the need for manual rectification afterwards. Aggregates placed at spread in one or more layers by any approved means so as to achieve the specified results.

The spreading shall be done from stockpiles along the side of the roadway or directly from vehicles. No segregation of large or fine aggregates shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. The surface shall be checked frequently with a straight edge while spreading and rolling so as to ensure a finished surface as per approved drawings.

The coarse aggregates shall not normally be spread more than 3 days in advance of the subsequent construction operations.

(d) Rolling - Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 80 to 100 KN capacity or tandem or vibratory rollers of 80 to 100 KN static weight. The type of roller to be used shall be approved by the engineer based on trial run. Except on super-elevated portions where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/ edges shall be compacted with roller running forward and backward. The roller shall then move inward parallel to the centre line of the road, in successive passes uniformly lapping preceding tracks by at least one half width.

Rolling shall be discontinued when the aggregates are partially compacted with sufficient void space in them to permit application of screenings. However,where screenings are not to be applied, as in the case of crushed aggregates like brick metal, laterite and kankar, compaction shall be continued until the aggregates are thoroughly keyed. During rolling, slight sprinkling of water may be done, if necessary. Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wave-like motion in the sub-grade or sub-base course.

The rolled surface shall be checked transversely and longitudinally, with templates and any irregularities corrected by loosening the surface, adding or removing necessary amount of aggregates and re-rolling until the entire surface conforms to desired cross fall (camber) and grade. In no case shall the use of screenings be permitted to make up depressions.

Material which gets crushed excessively during compaction or becomes segregated shall be removed and replaced with suitable aggregates.

(e) Application of screenings - After the coarse aggregate has been rolled to as per above specification, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregates.

The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motions of hand shovels or by mechanical spreaders, or directly from tipper with suitable grit spreading arrangement. Tipper operating for spreading the screenings shall be so driven as not to disturb the coarse aggregate.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling with mechanical brooms, hand-brooms or both. In no case screenings shall be applied fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregate. The spreading, rolling, and booming of screenings shall be carried out in only such lengths of the road which could be completed within one day's operation.

(f) Sprinkling of water and grouting - After the screenings have been applied, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into voids and to distribute them evenly. The sprinkling, sweeping and rolling operation shall be continued, with additional screenings applied as necessary until the coarse aggregate has been thoroughly keyed, well-bonded and firmly set in its full depth and a grout has been formed of screenings. Care shall be taken to see that the base or sub-grade does not get damaged due to the addition of excessive quantities of water during construction.

In case of lime treated soil sub-base, construction of water bound macadam on top of it can cause excessive water to flow down to the lime treated sub-base before it has picked up enough strength (is still "green") and thus cause damage to the sub-base layer. The laying of water bound macadam layer in such cases shall be done after the sub-base attains adequate strength, as directed by the engineer.

(g) Application of binding material - After the application of screenings in accordance with the above clause, the binding material where it is required to be used shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms, or mechanical brooms to fill the voids properly, and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

(h) Setting and drying - After the final compaction of water bound macadam course, the pavement shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam has set.

The engineer shall have the discretion to stop hauling traffic from using the completed water bound macadam course, if in his opinion it would cause excessive damage to the surface. The compacted water bound macadam course should be allowed to completely dry and set before the next pavement course is laid over it.

42.2.1 Reconstruction of defective macadam

The finished surface of water bound macadam shall conform to the tolerance of surface regularity as prescribed in the relevant IS standards. However, where the surface irregularity of the course exceeds the tolerances or where the course is otherwise defective due to sub-grade soil mixing

with the aggregates, the course to its full thickness shall be scarified over the affected area, reshaped with added material or removed and replaced with fresh material as applicable and re-compacted. In no case shall depressions be filled up with screenings or binding material.

42.2.2 Arrangement for traffic

During the period of construction, the arrangement of traffic shall be done by the Contractor in accordance with the applicable clause of this section.

42.2.3 Measurements for payment

Water bound macadam shall be measured as finished work in position in cubic metres as per Bill of Quantities item of work.

42.3 PRIMING OF BASE COURSE WITH BITUMINOUS PRIMERS

42.3.1 Scope

This specification relates to the operation of priming an absorbent base course, preparatory to a subsequent bituminous treatment, through application of a low viscosity bituminous material by spraying. The specification is intended to indicate what is considered to be a good practice for priming and shall apply unless modified by special provisions to take into account any unusual conditions.

The scope involves, Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base of low porosity such as WBM including clearing of road surface and spraying primer at the rate of 0.75 kg/sqm using mechanical means. As per MORTH specification clause No. 502 complete in all respects with all lead & lifts etc. complete.

42.3.2 Materials

The bituminous primer to be used should be such that it can penetrate into the base course to perform its intended function.

42.3.3 Types of primer

Table 11.2.1 can be used as guidance for choice of primer on different types of surfaces.

Type of Surface	Emulsion	Cut-back		Road tar
Low porosity	Not suitable	MC-0		RT-1 or RT-2
Medium porosity	SS or MS	MC-1 orSC-1	MC-2 or SC-2	RT-2 or RT-3
High porosity	MS	MC-3 or RC-1		RT-3 or RT-4

The primers shall conform to IS: 8887 – 1978 (for cationic emulsions), IS: 217-1961 (for cut-backs), and IS: 215-1981 (for road tars), as applicable.

42.3.4 Viscosity

For selecting the appropriate type of primer out of the materials indicated in Table 1, the atmospheric temperature during application should be given consideration. Also, within the range of viscosity specified, the primer for use may be selected keeping in view the level of porosity of the surface to be treated.

42.3.5 Quantity of primer

The primer shall be applied at the rate of 0.75 kg/sqm.

42.4 Construction

a. Weather and seasonal limitations

Cut-back and road tar primers shall not be applied on wet surface or during dust storm or when the weather is foggy or rainy. Bitumen emulsion can be applied on wet surface. However, emulsions shall not be applied during dust storm or when it is actually raining.

Atmospheric temperature during priming should be above 10□ C.

b. Equipment

All equipment required for the execution of work should be in good working condition at site.

c. Preparation of base course surface

The base course surface to be primed shall be swept clean and free from dust. All loose materials and other foreign matter on the surface shall be removed completely, if necessary by using power blowers or sweepers.

Large irregularities, potholes, depressions, etc. shall be repaired prior to priming. Minor depressions may be ignored until the surface is primed. After which these might be patched with a suitable premixed material prior to the subsequent bituminous treatment.

The underlying surface shall be dry prior to priming. Except that in the case of bitumen emulsions, it may be desirable to dampen the surface slightly in order to obtain better penetration of the primer.

Pre-wetting should be done by water spraying, using equipment capable of uniform application of water over the entire surface. The spraying may be taken up 2 to 12 hours before priming, in such quantity that the surface during priming is damp but not saturated with water. Traffic shall be kept off the prepared areas prior to priming.

d. Application of primer

After the base to be primed has been prepared as described above, the primer shall be uniformly applied over the surface using mechanical sprayers. Rate of application of primer shall correspond to the quantities given in specifications unless specified otherwise.

The spraying should preferably be carried out using sprayer mounted on distributor truck or with hand sprayer using mechanical pump. The use of hand-held containers such as watering cans, perforated buckets etc., is unacceptable and should not be permitted under any

circumstances. Quantity should be checked periodically using Tray Coating Test or any other suitable means.

Temperature of application of primer should be high enough to permit the primer to be sprayed effectively through the jets of the spray bar and to cover the base course surface effectively.

e. Curing

The primed surface shall be allowed to cure fully. No traffic shall be allowed over the primed surface during this period and in any case not before 24 hours if the primer is a cut-back bitumen and 6 hours in the case of bitumen emulsion. Any pool of excess cut-back primer, which has not been completely absorbed by any part of the base course surface during the curing period, should be carefully swept over the adjacent surface, and then a light sand blotter course applied. The amount applied should be just sufficient to blot up the excess bitumen and prevent it being picked up under traffic. If an excess of bitumen residue is found on the primed surface after bitumen emulsion has broken, a very light sand dusting may be applied to soak up the surplus material.

All loose sand should be swept from the base course surface prior to any subsequent bituminous treatment.

42.5 Tack Coat

Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor at the rate of 0.375 kg/sqm on the prepared granular surface cleaned with mechanical broom such as WBM surface as per MORTH specification clause No. 503 complete in all respects with all lead & lifts etc. complete for old surfaces at vertical and horizontal joints.

42.6 Specifications for single coat bituminous surface dressing (20mm thick pre-mix bituminous surfacing).

42.6.1 Scope

This specification is intended to indicate what is considered to be good practice for construction of single coat bituminous surface dressing and shall apply unless modified by special provisions to take into account unusual conditions. The work specified consists of a wearing surface composed of a single application of bituminous material covered with one application of cover material of size as specified below, applied on a previously prepared base or pavement.

The specific scope involves, Providing, laying and rolling of open-graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates either using penetration grade bitumen 80/100 or cut-back or emulsion to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in suitable plant, laying and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades. Mechanical method using Penetration grade Bitumen and HMP of appropriate capacity, as per MORTH specification No.511 complete in all respects. (Bitumen 1.46kg/sqmt. Metal = 0.027) with 40-60 TPH hot mix with all lead & lift etc. complete.

42.6.2 Materials

a. Bituminous materials - The bituminous materials shall be of grade 80/100 or cut-back conforming to the requirements as specified and provided for in the proposal and satisfy the related specification, issued by the Indian Standards Institution (vide I.S.I Standards 73-1961,215-1961,217-1961 and 454-1961).

b. Cover materials

(i). General requirements - The cover material shall consist of crushed stone, crushed slag crushed gravel (shingle) or other stones, as specified, and shall have clean, strong, durable, and fairly cubical fragments free from disintegrated pieces, salt, alkali, vegetable matter, dust and adherent coatings. The aggregate shall preferably be hydrophobic in nature and of low porosity.

(ii). Physical requirements - The aggregate shall satisfy the requirements given in Table below.

Sl. No.	Property	Value	Method of test
1	Abrasion value, using Los Angeles Machine or	Max. 35%	IS: 2386 (Part IV)
	Aggregate impact value	Max. 30%	- do -
2	Flakiness index	Max. 25%	IS: 2386 (Part I)
3	Stripping value	Max. 25%	IS: 6241
4	Water absorption (except in case of slag)	Max. 1%	IS: 2386 (Part III)
5	Soundness: Loss with sodium sulphate – 5 cycles (in case of slag only)	Max. 12%	IS: 2386 (Part V)
6	Unit weight or bulk density (In case of slag only)	Min. 1120 kg per m^3	IS: 2386 (Part III)

Where all these conditions cannot be satisfied, it is left to the Engineer-in-charge to allow reasonable tolerances.

Size - The size of chippings to be used shall depend on whether the treatment is for the first coat or for the subsequent or renewal coat and shall be as per the size specified below. For single application of the aggregate, it is desirable to keep the grading of the various sizes as specified in Table below:

	Sieve designation nominal size of aggregate	Specification
I	For surfacing water-bound macadam - first coat	100 percent passing through 20 mm square mesh sieve and retained on 10 mm square mesh sieve
II	For subsequent or renewal coats 10 mm	100 percent passing through 12.5 mm square mesh sieve and retained on 6.3 mm square mesh sieve.
Note – It is essential to sieve the aggregates through proper size sieves to ensure the size stipulated in the specifications. The sieve sizes indicated above are as per IS: 460 – 1962.		

42.6.3 Construction methods

a. Weather and seasonal limitations - Preferably, the surface dressing work shall be carried on only when the atmospheric temperature in shade is 16°C or above. No bituminous material shall normally be applied when the surface or the cover material is damp, when the weather is foggy or rainy or during dust storm, except, in case of emulsions, the surface should be slightly damp.

b. Equipment - All equipment necessary for the proper construction of work shall be on the site of the work in good condition.

c. Preparation of road surface - The underlying course on which surface dressing is to be laid shall be prepared, shaped and conditioned to a uniform grade and section as specified. Any depressions or pot-holes shall be properly made up and thoroughly compacted sufficiently in advance. The defective parts should be clearly cut out and the patches of new material put in, and not put on the existing surface.

Where the existing surface shows signs of "fatting-up", such position should be rectified. It is important that the surface be dry and thoroughly cleaned immediately before applying the binder. The surface should be swept clean free of caked earth and other foreign matter cleaned first with hard brushes, then with softer brushes and finally blowing off with sacks or gunny bags to remove the fine dust. The base shall be applied with Tack coat uniformly preferably by a mechanical sprayer.

d. Application of bituminous material - After the surface to be treated has been prepared, as specified above; bituminous material shall be sprayed uniformly over the dry surface preferably using mechanical sprayers. The binder shall be applied at a temperature appropriate to the type of binder and equipment used. The premix open graded surfacing consisting of aggregates 13.2mm to 5.60mm shall be applied to an uniform thickness as per applicable IS standards to get the final compacted thickness of 20mm.

e. Rolling cover materials - Immediately after the application of the cover materials as described, the entire surface shall be rolled with a 8 to 10 tonne smooth wheeled road roller. The rolling shall begin at the edge and proceed lengthwise, over the-area to be rolled lapping not less than one third of the roller tread and proceed towards the centre. When the centre is reached, the rolling shall then start at the opposite side and again proceed towards the centre. In the super-elevated portions, the rolling should proceed from the inner to the outer edge. While the rolling is in progress, additional aggregate shall be spread by hand in whatever quantities may be required to fill irregularities and to prevent picking up of the aggregate by the roller. Rolling shall be continued until the particles are firmly embedded in the bituminous materials and present a uniform closed surface. Excessive rolling which results in the crushing of the aggregate particles shall be avoided.

f. Finishing - The finished surface shall be uniform and conform to the lines, grades and typical cross sections shown in the specifications.

g. Opening to traffic - When straight run bitumen or road tar is employed as the binder, the finished surface shall be thrown open to traffic on the following day but if in special circumstances, the

road is required to be opened to traffic immediately after rolling, speed of the traffic shall be limited to 16 km per hour till the following day.

Where cutback bitumen and emulsion is employed, the finished surface shall be kept closed to the traffic until it has sufficiently cured to hold the cover aggregates in place.

Controlling of traffic shall be done by some suitable device, such as barricading and posting of watchmen, etc.

42.6.4 SEAL COAT.

The scope of work involves Providing and laying seal coat sealing the voids in bituminous surface laid to the specified levels, grade and cross fall using Type A seal coat as per MORTH specification clause No. 513 complete in all respects with all lead & lift etc. complete.(Bitumen = 0.98 kg/sqmt. Metal =0.009).

42.7 SPECIFICATIONS FOR CONSTRUCTION OF CONCRETE ROADS

42.7.1 Scope

This is intended to indicate what is considered to be good practice for the construction of cement concrete road pavements, including preparation of the subgrade and sub -base underneath these pavements. This does not however cover the requirements of fully mechanized constructions.

The scope involves providing specified thickness of 1:3:6 proportion cement concrete as base course and specified thickness of 1:1.5:3 proportion cement concrete as wearing course as per approved construction drawings and specifications.

42.7.2 Materials

a. Ordinary Portland Cement/ PPC/PSC- This should comply with the requirements of IS – 8112/IS-1489-part-1/IS-455 with latest revisions

b. Aggregates

General - Aggregates should comply with IS - 383 -1970 "Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (Second Revision)" with special reference to the additional requirements stipulated for use in road works excepting in the case of Los Angeles Abrasion Test limit.

The Los Angeles Abrasion Test limits shall be not more than 35 per cent and 50 percent for concrete wearing course and sub -base course respectively. ln addition, the limits of deleterious material shall not exceed the requirements set out in IS - 515 -1959 “Specification for Natural and Manufactured Aggregates for Use in Mass Concrete." Weathered rock should not be used. In order to make good concrete, it is important to avoid crushed aggregate of poor shape. Very angular, flaky, elongated or splintery aggregates give a harsh mix of low workability. Maximum size of aggregate should not exceed l/4th of the pavement slab thickness. In case of pavements having reinforcement, maximum size of aggregate should also not exceed l/4th of minimum clear spacing between reinforcing bars.

c. Coarse aggregates

Continuous grading- Continuously graded coarse aggregate should be furnished in at least two separate sizes with separation at 20 mm I.S. sieve when combined material graded from 40 to 4.75 mm is specified, and at 25 mm I.S. sieve when combined material graded from 50 to 4.75 mm is specified.

d. Fine aggregate - Fine aggregate shall preferably be natural sand. Crushed stone sand may also be used satisfactorily in concrete. The fine aggregate shall conform to IS: 383 -1970, the permissible percentage passing limits on 300 and 150 -micron sieves shall be 15 -55 per cent and 0 -20 per cent respectively instead of 15 -50 percent and 0 -15 per cent as stipulated in IS Specification. Crushed sand is usually more angular in shape than naturally occurring sand, and for this reason may tend to make the mix a little harsher. In some cases, it may prove advantageous to use a mixture of naturally occurring sand and crushed stone sand if the former is not obtained in adequate supply or where its grading is poor. Bulking due to presence of moisture in the fine aggregate should be accounted for when volumetric batching is employed.

e. Water - Water used in mixing or curing of concrete shall be clean and free from injurious amounts of oil, salt, acid, vegetable matter or other substances harmful to the finished concrete. It shall meet the requirements stipulated in clauses of IS: 456 -2000 "Code of Practice for Plain and Reinforced Concrete". Potable waters are generally considered satisfactory for mixing or curing.

f. Dowel and tie bars - Dowel and tie bars shall be plain round steel bars conforming to the requirements of IS: 432 -1966.

g. Pre-moulded joint filler – Pre-moulded joint filler shall be of the thickness shown on the drawings within a tolerance of □1.5 mm. It shall be 25 mm less in depth than the thickness of the slab, within a tolerance of □3 mm and of the full width between road forms. Holes to accommodate dowel bars shall be accurately bored or punched out. The joint filler shall comply with the requirements of IS: 1838 -1961 "Specification for Preformed Fillers for Expansion Joint in Concrete, Non -extruding and Resilient Type (Bitumen -impregnated Fiber).

42.7.3 Water content and work ability

The water content per batch of concrete should be maintained constantly except for suitable allowances to be made for free moisture and absorption by aggregates determined from time to time during construction. Adjustments for workability shall be made by variations in the ratio of the coarse to fine aggregate or improving upon their grading without change in cement content or water -cement ratio. The slump of the concrete mix for pavements compacted by vibration should not be more than 25 mm, preferably between 0 and 12 mm, and that by manual compaction not more than 50 mm. No price adjustment would be permissible for variations in the gradations of the aggregates or in the ratio of coarse to fine aggregates necessitated from adjustment at site.

42.7.4 Tools, equipment and appliances

42.7.5 General

All tools, equipment and appliances necessary for proper preparation of sub-grade, laying of sub -base and batching, mixing, placing, finishing and curing of concrete shall be at the project site in good working condition and shall have been inspected by the engineer before the paving operations are permitted to start. Throughout the construction of the project, the construction agency shall maintain all necessary tools, equipment and appliances in first class working condition to ensure proper execution of the work. Arrangements shall also be made for requisite number of stand -by units in the event of break -downs during construction.

42.7.6 List of tools, equipment and appliances

A list of tools, equipment and appliances required for the different phases of concrete road construction is given below.

This list pertains to semi -mechanised type of construction only, as practised most in this country.

(a) Subgrade and sub -base compaction -

(i) Compaction equipment (three wheeled or tandem roller, pneumatic roller, vibratory roller or sheep -foot roller)

(ii) Watering devices (water lorries, bhisties/water carriers or watering cans),

(b) Preparation of sub -bass for concreting and formwork

(i) Scratch templates or strike boards

(ii) Bulk -heads

(iii) Pick axes, shovels and spades

(iv) Formwork and iron stakes

(c) Concrete manufacture

(i) Shovels and spades

(ii) Sieving screens

(iii) Weigh batcher

(iv) Aggregate measuring boxes (only where volume batching of aggregates is permitted as a special case)

(v) Water pump

(vi) Water measures

(vii) Concrete mixer

(d) Transportation, laying and compaction of concrete

(i) Wheel barrows/iron pans

(ii) Wooden bridges

(iii) Spades

(iv) Concrete vibrators (both internal and screed board types)

(v) Wooden hand tampers

(e) Finishing operations - surface and joints

(i) Wooden bridges
(ii) Floats (longitudinal and long -handled wooden floats)
(iii) Templates
(iv) Three -meter long straight edges including one master straight edge
(v) Graduated wedge gauges
(vi) Mild steel sections and blocks for making joint grooves
(vii) Edging tools including double -edging tools
(viii) Canvas belts
(ix) Long handled brooms
(x) Diamond cutter (when making saw -cut joints)
(xi) Grinder (for grinding local high spots)
(f) Curing
(i) Hessian cloth burlap or polyethylene sheeting
(ii) Watering devices as in a (ii) (for ponding operation)
(g) Cleaning and sealing of joints
(i) Iron raker
(ii) Coir brush
(iii) Cycle pump/pneumatic air blower
(iv) Kerosene stove
(v) Thermometer
(vi) Transferring pot
(vii) Painter's brush
(viii) Pouring kettle
(ix) Scraper

42.8 Sub –base

Plain cement concrete of 1:3:6 proportion for specified thickness as in construction drawing shall be laid in accordance with the respective specification in Bill of Quantities and the surface finished to the required lines, levels and cross -section.

42.9 Forms

Steel forms -All side forms shall be of mild steel unless use of wooden sections is specially permitted. The steel forms shall be mild steel channel sections of depth equal to the thickness of the pavement. The sections shall have a length of at least 3 m except on curves of less than 45 m radius, where shorter sections may be used. When set to grade and staked in place, the maximum deviation of the top surface of any section from a straight line shall not exceed 3 mm in the vertical plane and 5 mm in the horizontal plane. The method of connection between sections shall be such that the joint formed shall be free from difference in level, play or movement in any direction. The use of bent, twisted or worn -out forms will not be permitted. At least three stake pockets for bracing pins or stakes shall be provided for each 3 m of form and the bracing and

support must be ample to prevent springing of the forms under the pressure of concrete or the weight or thrust of machinery operating on the forms.

The supply of forms shall be sufficient to permit their remaining in place for 12 hours after the concrete has been placed, or longer if necessary in the opinion of the engineer.

Wooden forms – Wooden forms may be used only when specifically permitted in the drawing with the exception that their use is herein approved for all curves having radii of less than 45 m. Wooden forms shall be dressed on one side. They shall have minimum base width of 100 mm for slab thickness up to 200 mm and a minimum base width of 150 mm for slabs over 200 mm thick. Their depth shall be equal to the thickness of the pavement. These forms when used on straight shall have a minimum length of 3 m. Forms shall be held by stakes set at intervals not exceeding 2 m. Two stakes, one on each side, shall be placed at each joint. The forms shall be firmly nailed or secured to the side stakes, and securely braced at joints, where necessary, so that no movement will result from the pressure of the concrete or the impact of the tamper and during finishing work. Wooden forms shall be capped along the inside upper edge with 50 -mm angle iron well recessed and kept flush with the face of the wooden forms.

Setting of forms - The forms shall be jointed neatly and shall be set with exactness to the required grade and alignment. Both before and after the forms are placed and set the sub grade or sub - base under the forms shall be thoroughly tamped in an approved manner. Sufficient rigidity shall be obtained to support the forms in such a position that during the entire operation of compacting and finishing of concrete they shall not at any time deviate more than 3 mm from a straight edge 3 m in length. Forms, which show a variation from the required rigidity or alignment and levels shown in the drawing, shall be reset or removed, as directed. The length and number of stakes shall be such as to maintain the forms at the correct line and grad -e. All forms shall be cleaned and oiled each time before they are used. Forms shall be set for about 200m ahead of the actual placing of concrete.

42.10 Joints

General - The location and type of joints shall be as shown in the drawing. The edge of the slab at all joints shall be rounded off with an edging tool having a radius of 6 □ 1mm. The concrete along the face of all joints and around all tie bars and dowels shall be compacted with an internal vibrator inserted in the concrete and worked along the joint and around all tie bars and dowels to ensure a concrete free from honeycombing.

Types of joints - There are three general types of joints. These are –

Expansion joint - Such joint provides the space into which pavement can expand thus relieving compressive stresses due to expansion and inhibiting any tendency towards buckling of concrete slabs.

Contraction joint - Such joint relieves tensile stresses in the concrete and prevents formation of irregular cracks due to restraint in free contraction of concrete. Contraction joints also relieve stresses due to warping.

Warping joint - Such joint relieves stresses due to warping. These are commonly used for longitudinal joints dividing the pavement into lanes.

In addition, construction joints are provided whenever construction operations require them. These are full depth joints and may belong to any of the above types.

All joints shall be carefully installed in accordance with the location and details given on the plans.

Transverse joints

General - Transverse joints can be expansion, contraction or construction joints and shall be placed as indicated on the drawing. They shall make a right angle with the centre line of the pavement and surface of the sub -base/subgrade. Contraction and expansion joints shall be continuous from edge to edge of the pavement through all lanes constructed at the same or different times.

a. Transverse expansion joints - These shall extend over the entire width of the pavement. They shall be of the dimensions and spacing as shown on the construction drawing.

Dowel bars (see Supplementary Note N. 4) as per dimensions, location and spacing shown on the drawing are required at expansion joints to transfer wheel loads to the adjacent slab. For slabs of thickness less than 150 mm no dowel bars may be provided (IS: 6509 -1972). The pre-moulded expansion joint filler, a compressible material used to fill the gap between adjacent slabs at expansion joint shall conform to IS: 1838 -1961.

The height of the filler board shall be such that its top is 25 mm below the surface of the pavement. The dowel bars shall be held accurately in position during the placement, compaction and finishing of concrete at and near the expansion joint. This and the protection of the joint groove during construction may be achieved by means of sufficiently strong bulkheads (as per IRC: 43 -1972) with holes drilled along the centre line to accommodate the dowel bars and a mild steel section (as per IRC - 43 -1972) respectively. The latter shall be oiled or greased before placing in position to avoid bonding with concrete. The top and bottom edges of the bulkheads and mild steel section shall be shaped to correspond to the camber of the pavement at the joint. If considered convenient, two -piece split bulkheads may also be used. When dowel bars are provided, bulkheads shall be used in pairs, one at the joint location, and the other some distance away to hold the projecting ends of the dowel bars to maintain their alignment. For cases where dowel bars are not provided, one single bulkhead without holes will be adequate.

The bulkheads shall be securely staked in place at right angles to the centre line and surface of the pavement with sufficient stakes to hold them in the specified position.

After the concrete has sufficiently hardened the mild steel metal section shall be removed carefully without disturbing the edges. The edges shall then be rounded with an edging tool. For facilitating removal of the mild steel section as well as edging operation, the top of the section may be flared on both sides with the required curvature of a rounded edge.

Under no circumstances shall any concrete be left above the expansion 'joint filler or across the joint at any point. Any concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed.

b. Transverse contraction joints - These shall be placed as shown on the drawing and shall be of the weakened plane or "dummy" groove type. They shall be constructed by forming in the surface of the slab a slot not less than 6 mm wide and having a depth equal to one -third to one -fourth the

depth of the pavement at the thinnest part of its section. This slot may be formed in a manner approved by the engineer such as by pushing into the concrete a flat bar or the web of a "T" bar using a suitable vibratory device, removing the bar, and keeping the slot open. It shall be ensured that no spalling of concrete occurs while removing the bar. The edges of the joint shall be rounded with an edging tool before the concrete hardens.

c. Transverse construction joints - These shall be placed whenever placing of concrete is suspended for more than 30 minutes. Excepting in the case of emergency, construction shall always be suspended at the regular site of expansion or contraction joints. If the construction joint is located at the site of an expansion joint, regular expansion joint shall be provided; if at the site of a contraction joint or otherwise, the construction joint shall be of butt type with dowels.

At all construction joints, bulkhead shall be used to retain the concrete and care shall be taken in striking off and finishing the surface to the top face of the bulkhead. When work is resumed, the surface of concrete laid subsequently, shall conform to the grade and cross -section of previously laid pavement, and a straight edge 3m in length shall be used parallel to the centre line, to check any deviation in the surface of the two sections. Any deviation from the general surface in excess of 3 mm shall be corrected.

Longitudinal joints

These shall be of the plain butt type and shall be formed by placing the concrete against the face of the slab concreted earlier. The face of the slab concreted earlier, shall be painted with bitumen before placing of fresh concrete.

Tie bars shall be used at longitudinal joints and they shall be of the dimensions and at spacing shown in the construction drawing. Tie bars shall be supported so as not to be displaced during construction operations. Tie bars shall be bonded in the slabs across longitudinal joints, and whilst casting the first slabs, they may be bent so that one end of them lies along the forms. After removal of the forms, bars shall be straightened so that they extend into the concrete placed on the other side of the joint.

42.11 Construction

a. Storage and handling of cement

Cement shall not be stored for a long time and should be used normally within six months of its date of receipt. Even during this period of storage it is essential that cement shall be protected from moisture by storing it in suitable sheds. Storage shed with a concrete floor laid on a well -drained foundation may be satisfactory. Cement in bags shall be stored on boards raised above the floor level for the purpose of ventilation, and the bags shall not touch the walls of the shed. Different consignments should be separately stacked and used in order in which they have been received. When bulk supply cement is used, special storage facilities such as covered hopper bins will be required. Supply of cement should be co-coordinated with its consumption so that it is not stored right through the rainy season, when normally concreting is discontinued. Cement having lumps which have been caused due to improper storage or by pressure due to over -loading of bags shall not be considered for use unless these lumps can be easily powdered

with pressure between fingers. Before such cement is used, representative sample containing also the lumps in fair proportion shall be taken and tested as per IS - 269 -1976, 8112 -1976, 1489 -1976, 455 -1967 or 8041E -1976 as the case may be, to fulfill the minimum requirements.

b. Storage and handling of aggregates

The location and preparation of sites, minimum size of stack and the methods adopted for dumping and stacking to prevent segregation of coarse and fine material shall be subject to the approval of the engineer. Aggregates from different sources and/or of different grading shall not be stacked together. Each separate size of coarse aggregate shall be stacked separately. The storing of aggregates upon the carriageway or shoulders shall not be permitted.

If aggregates are stored in conical stacks, segregation will be increased by the rolling of the coarser particles down the sides of the stacks. To avoid this, stacks should be built up in approximately horizontal layers. Dry fine aggregate segregates and gets blown away easily it may be helpful to moisten it.To assist in controlling the water/cement ratio, large fluctuations in the moisture content of aggregates may be reduced by storing the bulk of the material well in advance of use. For this purpose, all washed aggregates shall be stacked for draining at least 12 hours before being batched. It is also a good practice to reserve the bottom 150 -300 mm or so of the stacks as a drainage layer. Where this cannot be done, the aggregates should not be placed on the ground. In such case, somewhat raised planks, metal sheets or concrete base should be provided and laid to slopes.

The aggregates shall be handled from the stacks and fed into the mixer in such a manner as to secure the stipulated grading of the material. Aggregates that have become mixed with earth or other foreign material shall not be used. They shall be washed clean before use.

c. Batching of materials

All batching of materials shall be by weight or volume as approved by the Engineer. The proportion of ingredients shall be as specified in the item of work in Bill of Quantities, The Engineer may permit the use of fractional bags of cement provided they are accurately weighed and are handled in a manner meeting with his approval. Water may be measured by volume. It should, however, be borne in mind that weigh batching is definitely much more desirable than volume batching. If batching by volume is permitted, as a special case, separate measuring boxes shall be provided for the different aggregates. The boxes shall be of strong construction provided with handles for convenient lifting and loading into the mixer. They shall be of such size that it should be possible to measure out the requisite quantity of aggregate per batch in whole box or by multiples thereof and capable of being lifted by two men. Each box shall be provided with a straight edge of required length for striking off after filling. If so directed by the engineer, improved facilities such as tipping boxes of accurate capacity working on run -out rails arranged for direct delivery into the hopper of the mixer shall be provided by the construction agency. In volume batching, suitable allowance shall be made for the hulking of fine aggregate due to the presence of water. For this purpose the bulking shall be determined as per relevant Indian Standard Specification.

d. Mixing

General - The mixing of concrete shall be done in a batch mixer of approved type, which will ensure a uniform distribution of materials throughout the mass, so that the mix is uniform in colour and homogeneous. All concrete shall be mixed in quantities for immediate use.

The mixer shall be equipped with approved water -measuring device capable of accurate measurement of water required per batch. The mixer shall preferably be equipped with a mechanically operated pump for filling the mixer tank.

The mixer, if so specified, shall be equipped with an approved timing device which will automatically lock the discharge lever during the full time of mixing and release it at the end of the mixing period; the device shall also be equipped with a ball, adjusted to ring each time the lock is released. If the timing device gets broken, the mixer will be permitted to be used while the same is being repaired, provided an approved time -piece equipped with minute and second bands is provided. Each batch shall be mixed for at least one and a half minutes. Spilling of the materials at either end of the mixer shall be corrected by reducing the size of the batch and in no case shall the volume of the mixed material per batch exceed the manufacturers guaranteed capacity of the mixer. The type, size and number of mixers shall be so chosen as to provide the required output without overloading. The mixing speed of the drum shall not be less than 15 revolutions per minute nor the peripheral speed of the drum greater than 60 m per minute. The batch of cement, fine aggregate and coarse aggregate shall be fed into the mixer simultaneously with the water being introduced either at the same time or before the dry materials. The entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch.

The skip shall be so maintained and operated that each batch will be completely discharged into the mixing drum at the loading of the mixer. The mixer shall be cleaned at suitable intervals while in use.

Pick -up and throw -over blades in the drum of the miner which are worn down 20 mm or more in depth shall be replaced with new blades.

Time of mixing - The mixing of each batch will continue not less than one and half minute after all the materials are discharged into the mixer.

Re-tempering - The re-tempering of concrete i.e. remixing with or without additional cement, aggregate or water shall not be permitted.

Control of workability and strength

a. Work ability of concrete - The work ability of concrete shall be checked by performing "slump test" or "compacting factor test" in accordance with IS ; 1199 -1959 “Method of Sampling and Analysis of Concrete." The frequency of testing shall be one test per 10 m3 of concrete and the permissible tolerances from the specified value for workability shall be -

Slump ± 12 mm

Compacting factor ± 0.03

Where variations beyond the permitted tolerances are observed, necessary adjustment shall be made keeping the water cement ratio same.

b. Strength of concrete - The strength of concrete shall be determined either by compressive or flexural strength tests (preferably the latter, since concrete pavements are designed on the basis of flexural strength of concrete) depending on the facilities available. For this purpose, during the progress of the work, cube/beam samples shall be cast for testing at 7 and 28 days. Sampling and testing shall be done in accordance with IS - 1199 -1959 "Method of Sampling and Analysis of Concrete" and IS - 516 -1959 "Method of Test for Strength of Concrete" respectively. The minimum frequency of samples shall be 3 cube/beam samples for each age of 7 and 28 days for every 30 m3 of concrete.

On a paying job, the strength of concrete should be continuously monitored to ensure that the desired strength is achieved. In certain -cases, because of change in the source of cement or control or climatic factors, the strength may show some variations, which would require re -designing of the mix.

Transporting and placing of concrete -

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the sub -base to the required depth and width of the pavement section, in successive batches and in continuous operation without the use of intermediate forms or bulk -heads between joints. Care shall be taken to see that no segregation of materials results whilst the concrete is being transported from the mixer to the place where it is deposited. The usual method of transport of concrete in India is in pans as head loads or in small wheel barrows. The spreading shall be as uniform as possible to avoid re-handling of the concrete. Where, however, a certain amount of re -distribution is necessary, it shall be done with shovels and not with rakes. While being placed, the concrete shall be tamped with suitable tools for slab thicknesses of 12.5 cm and less so that formation of voids or honeycomb pockets is prevented. The concrete shall be particularly well placed and tapped against the forms and along all joints, For higher thicknesses an internal vibrator shall be employed in lieu of rodding of the concrete. To effect adequate compaction, the concrete shall be placed with appropriate surcharge over the final slab thickness. The amount of surcharge will depend on the mode of placement of concrete and shall be determined by trial. In general, the required surcharge is about 20 per cent of the required slab thickness. Any portion of the batch of concrete that becomes segregated while depositing it on sub-grade shall be thoroughly mixed with the main body of the batch during the process of spreading. In case of unavoidable interruption, a full depth transverse joint shall be made at the point of stoppage of work provided the section on which the work has been suspended is about 2 to 3 hours long. In placing of concrete for two course construction, necessitated by either positioning of the reinforcement, a richer mix for the wearing surface, or when thickness of the concrete is beyond 20 cm, the bottom layer of concrete shall be struck off to the required levels by a vibrating screed working on the side forms with notches corresponding to the depth of the top course of concrete.

The vibrating screed should have a vibrating unit mounted on it similar to that of the screed used for compaction of the final surface of concrete. The time lag between laying of the two courses shall not exceed the initial setting time of cement.

Placement of steel

a. Reinforcement - Reinforcing steel shall be free from dirt, scale or other foreign matter and rust of such degree or development as to impair bond of the steel with the concrete. The width of fabric sheets or bar mats shall be such that when properly placed into the work the extreme longitudinal bars or wires of the sheets or mats will be located not less than 50 mm and not more than 100 mm from the edges of the slab. Except for dummy joints, the length of fabric sheets or bar mats shall be such that when properly placed into the work, the reinforcement will be clear of transverse joints by not less than 50 mm and not more than 100 mm as measured from the centre of the Joint to the ends of longitudinal bars or wires of the sheet or mat.

While overlapping the sheets or mats in either direction, the overlap shall be at least equal to the spacing between the bars or wires in the respective direction or 40 times the diameter of the bar or wire, whichever is more.

Whilst using reinforcement in one layer, the concrete shall be placed in two stages. The initial layer shall be uniformly struck off to a depth corresponding to the reinforcement shown in the drawings and lightly compacted by a screed to obtain uniform levels. The reinforcing fabric sheet or bar mat shall then be placed on the compacted layer of concrete and remaining depth shall be filled in with concrete thereafter.

In doing this operation, the initial layer of concrete shall be struck off to the entire width of the slabs and of sufficient length to permit sheet or mat of reinforcement to be laid full length without further manipulations of the reinforcement. Displacement of the reinforcement during concreting operations shall be prevented.

b. Load transfer devices - dowels - Transverse expansion joints shall be equipped with dowels of the dimension and at the spacing and location indicated on the drawing. They shall be firmly supported in place, accurately aligned parallel to the sub-grade/sub -base, parallel to each other and parallel to the centre line of the pavement, by means of appropriate dowel supports. The dowel supports shall ensure that the dowels are not displaced during construction. The permissible tolerances in dowel bar alignment in both vertical and horizontal directions shall be □1 mm in 100 mm for dowels of 20 mm and smaller diameters and □0.5 mm in 100 mm for. dowels of diameter greater than 20 mm. One -half of each dowel shall be painted with a thin film of bitumen and equipped with a tight fitting metal sleeve of the dimensions shown on the drawing to provide space for the dowel when pavement expands and the join closes. This sleeve shall be partly filled with cotton waste to prevent it being pushed too far on the dowel during construction.

These sleeves are not required on dowels, if used, in dummy contraction or construction joints.

c. Tie bars - Tie bars provided in longitudinal joints of plain butt type to prevent opening of such joints shall be bonded to the adjacent slabs on both sides of the longitudinal joint. They are installed by providing appropriate (drilled) holes in the side forms depending on the size and spacing of bars. They are bent aside temporarily to avoid obstruction to construction traffic and straightened later at the time of laying of slab in the adjacent lane.

Compaction and finishing

Compaction - The pavement shall be compacted either by means of a power-driven pavers-cum -finisher or by a vibrating screed along with internal vibrators where the slab thickness is more than 12.5 cm. For lesser thicknesses vibrating screed may be supplemented with manual rodding. For areas where the width of the slab is very small as at the corner of street junctions, etc. compaction with wooden hand tampers may be adopted subject to the approval of the engineer. In no case, however, hand compaction shall be permitted for slab thicknesses beyond 10 cm. All compaction shall be done in accordance with the following requirements –

Where hand tamping is permitted as a special case –

(i) Concrete with surcharge, as soon as placed, shall be struck off uniformly and screeded, to such level above the base that when compacted and finished, the pavement shall conform to the grade and cross -section indicated by the plans. The entire surface shall then be tamped and the tamping operation continued until a close knit dense surface is obtained.

(ii) The tamper shall rest on the side forms and shall be drawn ahead with a sawing motion, in combination with a series of lifts and drops alternating with lateral shifts, the aim of this operation being compaction and screeding to the approximate level required. Subsequent tamping should advance about 75 mm at a time in the direction in which the work is proceeding, and in the final stages tamping should be closer, about 12 mm at a time until a level and dense surface is obtained.

(iii) Segregated particles of coarse aggregate which collect in front of the tamper or screed shall be thrown outside the forms or thoroughly mixed by hand with the un compacted mass of concrete already placed. Under no circumstances shall such segregate particles be carried forward and pushed on to the base in front of the mass.

(iv) Compaction by tamping or screeding shall be carried on till the mortar in the mix just works up to the surface. Care shall be exercised and the operation of tamping so controlled as to prevent an excess of mortar and water from being worked on to the top. Repeated operation other than to secure the necessary compaction and to eliminate voids shall be avoided.

(v) Immediately after the tamping or screeding has been completed and before the concrete has hardened, While the concrete is still in a plastic stage, the surface shall be inspected for irregularities with a profile checking template and any needed correction made by adding or removing concrete followed by further compaction and finishing.

Floating - As soon as practicable after the concrete has been compacted, its surface shall be smoothened by means of a longitudinal float, operated from a foot -bridge. The longitudinal float shall be worked with a sawing motion, while held in a floating position parallel to the carriageway centre line and passed gradually from one side of the pavement to the other. Movements ahead along the centre line of the carriageway shall be in successive advances of not more than one half the length of the float.

Straight-edging –After the longitudinal floating has been completed and excess water has disappeared, but while the concrete is still plastic, the slab surface shall be tested for trueness with a 3 m straight edge. The straight edge shall be held in successive positions parallel to the road centre line in contact with the surface and the whole area gone over from one side of the slab to the other. Advance along the road shall be in successive stages of not more than one -half

length of the straight edge. Any area of depression found shall be scooped to a depth of 4 -5 cm, filled immediately with freshly mixed concrete, struck, compacted, and re-finished. High areas shall be cut down and refinished. The straight edging and re-floating shall continue until the entire surface is found to be free from observable departures from the straight edge and the slab has the required grade and camber.

The slab surface shall be retested for trueness, before the concrete begins to set, with the 3 m long master straight edge and the graduated wedge gauge.

The straight edge shall be placed on the surface in successive positions, parallel to the carriageway centre line. Irregularities shall be measured with the help of the wedge gauge moved transversely at various points until it touches both the straight edge and the concrete surface.

At any point tested the concrete shall not show a departure greater than 3 mm from the true surface. If at any place the departure exceeds this value not more than 3 passes of the vibrating screed shall be allowed and the surface tested again in the specified manner. If the irregularity still exceeds the limit aforesaid, the concrete shall be removed to a depth of 50 mm or up to the top surface of the reinforcement, if any. The area of concrete to be removed shall be demarcated by the length of the straight edge in the position of measurement across the full width of the slab. Where the point of measurement in default is less than 4.5m from the nearest transverse expansion joint, the whole area upto the joint shall be removed to the required depth. The concrete so removed shall not be re -used in the carriageway. Fresh concrete shall be placed, compacted and finished in the manner already described in these specifications and shall again be subject to test for accuracy of finish.

The foregoing procedure shall be adopted at each shifting of the straight edge and the whole area shall be gone over from one side of the slab to the other. The straight edge shall advance longitudinally in successive stages of not more than one -half the length of the straight edge.

No extra payment shall be made for the removal of the rejected concrete and or laying fresh concrete.

Although the concrete may be removed immediately following measurement of the irregularity and while it is still wet, this shall not mean any waiver from complying with the requirements of this clause, if for any reason the concrete to be removed has already hardened.

After straight edging of the surface, it shall be finished by brooming in the manner described as mentioned in the following paragraphs.

Brooming - After belting and as soon as surplus water if any has risen to the surface, the pavement shall be given a broom finish with an approved long handled steel or fiber broom conforming to the stipulations laid down in JRC - 43 -1972. The broom shall be pulled gently over the surface of the pavement from edge to edge. Adjacent strokes shall be slightly overlapped. Brooming shall be' perpendicular to the centre line of the pavement and so executed that the corrugations thus produced will be uniform in character and width, and about 5mm deep. Brooming shall be completed before the concrete reaches such a stage that the surface is likely to be torn or unduly roughened by the operation. The broomed surface shall be free from porous or rough spots, irregularities, depressions and small pockets, such as may be caused by accidentally disturbing the particles of coarse aggregate embedded near the surface.

Curing of concrete - Immediately after the finishing operations have been completed the entire surface of the newly laid concrete shall be covered against rapid drying, and cured. Failure to provide sufficient cover material of the stipulated type or inadequate supplies of water for curing shall be adequate cause for immediate suspension of concreting operations.

Initial curing - After completion of the finishing operations, the surface of the pavement shall be entirely covered with wet hessian cloth, burlap or jute mats. The coverings used shall be of such length (or width) that when laid will extend at least 500 mm beyond the edges of the slab, shall be so placed that the entire surface and both the edges of the slab are completely covered. They shall be placed as soon as the concrete has set sufficiently to prevent marring of the surface. Prior to their being placed, the coverings shall be thoroughly wetted with water and placed with the wettest side down. They shall be so weighed down as to cause them to remain in intimate contact with the surface covered. They shall be maintained fully wetted and in position for 24 hours after the concrete has been placed, or until the concrete is sufficiently hard to be walked upon without suffering any damage. To maintain the coverings wet, water shall be gently sprayed so as to avoid damage to the fresh concrete. If it becomes necessary to remove the coverings for any reason, the concrete slab shall not be kept exposed for a period of more than half an hour.

Worn coverings or coverings with holes shall not be permitted. Coverings reclaimed from previous use other than curing concrete shall be thoroughly washed prior to use 'for curing purposes, if the covering is furnished in strips, the strips shall be laid to overlap at least 150 mm.

Covering shall be placed from suitable wooden bridges (IRC -43 -1972). Walking on freshly laid concrete to facilitate placing coverings shall not be permitted.

Final curing- Upon the removal of the covering the slab shall be thoroughly wetted and then cured by one of the following methods of final curing -

(a) Curing with wet earth - Exposed edges of the slab shall be banked with a substantial berm of earth. Upon the slab shall then be laid a system of transverse and longitudinal dykes of clay about 50 mm high, covered with a blanket of sandy soil free from stones to prevent the drying up and cracking of clay. The rest of the slab shall then be covered with sufficient sandy soil so as to produce a blanket of earth not less than 40 mm depth after wetting. The earth covering shall be thoroughly wetted while it is being placed on the surface and against the sides of the slab and kept thoroughly saturated with water for 14 days and thoroughly wetted down during the morning of the 15th day and shall thereafter remain in place until the concrete has attained the required strength and permission is given to open the pavement to traffic. When such permission is granted, the covering shall be removed and the pavement swept clean. If the earth covering becomes displaced during the curing period, it shall be replaced to the original depth and re -saturated,

Removing forms - Forms shall not be removed from freshly placed concrete until it has set, or at least 12 hours, whichever is later. They shall be carefully removed in such a manner that no damage is done to the edges of the pavement. After the forms have been removed, the slab edges shall be cleaned and any limited honey -combed areas pointed up with 1 -2 cement sand mortar, after which the sides of the slab shall be covered with earth to the level of the top of the slab for

final curing Slabs with excessive honey -combing as a result of inadequate compaction shall be removed between nearest transverse joints.

Concreting during monsoon months - When concrete is being placed during monsoon months and when it may be expected to rain, sufficient supply of tarpaulins or other waterproof cloth shall be provided along the line of work. Any time when it rains, all freshly laid concrete, which has not been covered for curing purposes, shall be adequately protected by means of tarpaulins or other waterproof cloth. Any concrete damaged by rain shall be removed and replaced.

Concreting in hot weather - As placing of concrete in air temperatures above 40°C, or above 35°C combined with relative humidity below 25 percent and/or wind velocity higher than 10 km/hour, is attended with defects like loss of workability through accelerated setting, formation of plastic shrinkage cracks, etc., it is recommended that unless adequate precautions are taken, no concreting shall be done in conditions more severe than the above. The procedures recommended for adoption in case of hot weather concreting is given in IRC - 61 -1976 "Tentative Guidelines for the Construction of Cement Concrete Pavements in Hot Weather." Brief details of the procedure are given below -Aggregates, cement and water shall be protected from the direct sun and mixing operations shall also be carried out in shade. In addition portable shelters shall be provided to protect the concrete during placing and finishing operations. This may be in the form of gable frames to cover the full length of the concrete pavement laid in a day. The surfaces of the formwork and subgrade coming in contact with concrete shall be moistened prior to placing of the concrete to prevent absorption of mixing water.

Since the setting time of concrete is considerably reduced under such temperatures, labour force shall be reinforced to minimize the time between mixing and placing of concrete. The protective cover shall be adequate to exclude exposure of the concrete directly to the sun and also eliminate contact with drying winds. Prior to removal of the portable shelters, the hardened concrete shall be covered with wet hessian or burlap or the like followed by one of the usual methods of curing like ponding, etc. In addition, the moist curing period shall be extended to 4 weeks.

Work on gradients - The progress on gradient of all operations of placing, compacting and finishing of concrete should proceed from the lower to the higher reaches. The concrete mix shall be stiffer than that used on level reaches.

Protection of concrete - Suitable barricades shall be erected and maintained and watchmen employed to exclude traffic from the newly constructed pavement for the period herein prescribed, and these barriers shall be so arranged as not in any way to interfere with or impede traffic on any lane intended to be kept open and necessary signs and lights shall be maintained clearly indicating any lanes open to the traffic. Where, as shown on the plans or indicated in the special provisions, it is necessary to provide for traffic across the pavement, suitable and substantial crossings to bridge over the concrete shall have to be provided. Such crossings, as constructed, shall be adequate for the traffic and approved by the Engineer.

Any part of the pavement damaged by traffic or other causes occurring prior to its final acceptance shall be repaired or replaced in a manner satisfactory to the Engineer. The pavement shall be protected against all traffic usage including that of construction -traffic.

Sealing of joints - After the curing period is over and before the pavement is opened to traffic, the temporary seal and all other intruded materials in the transverse expansion and contraction joints as well as longitudinal joints shall be removed completely and the groove; filled with the approved joint sealing compound as per IRC - 57 -1974 "Recommended Practice for Sealing of Joints in Concrete Pavements". The joint opening shall be thoroughly cleared of all foreign matter before the primer followed by sealing material is placed. If necessary, the foreign matter shall be blown out by compressed air pressure. All contact faces of the joint shall be cleaned with a wire brush to remove loose material and shall be surface dried before the primer is applied.

Opening to traffic - In general, traffic shall be excluded from the newly constructed pavement for a period of 28 days where Ordinary Portland Cement, Portland Blast Furnace Slag Cement and Portland Pozzolona Cement are used, or for a period of 7 days where Rapid Hardening Cement is used. In all cases, before the pavement is opened to traffic it shall be cleaned and the joints shall be sealed.

43 General Civil Specifications

The following civil specifications shall be applicable for providing and executing all such items which are not mentioned in foregoing paras but are necessary to be provided and for the items in bill of quantities which are mentioned above but require some elaboration. No extra cost shall be paid for such items. It should clearly be understood by the Contractor that all civil specifications mentioned here below shall be treated as part of the technical specifications already mentioned. The specific requirement of different items of work involved in the construction, completion and commissioning of the system as a whole, shall be provided in accordance with the requirement given in these civil specifications.

43.1 Site Clearance

Before taking up construction, site shall be cleared of all jungles, bushes and unwanted vegetation growth. After completion of plant, the entire site area shall be cleared of all left over material and debris. The work shall be carried out in accordance with the specifications in bill of quantities and payment shall be as per quoted rates for the respective items.

43.2 Sections for excavation for all underground structures and pipe lines

Contractor shall prepare sectional drawings showing the details of excavation for all underground structures and pipe lines, in all kinds of soils, boulders, soft and hard rock etc., based on test results of soil testing and investigation reports complying to specifications in this document for earthwork excavations and shall submit to the Engineer for review and approval, prior to starting of the work. If during excavation any change in section is considered necessary for reasons of safety of workers, the Engineer will issue directions for compliance by the Contractor. The Contractor shall comply with the Engineer's directions without any extra charge or payment.

43.3 Form Work

Formwork, shuttering, centering, scaffolding etc., shall be of steel plates or plywood, lined with MS-sheets and for scaffolding steel tubular shall be used. Joints should be sufficiently tied to prevent loss of cement slurry from the concrete. All forms, shuttering shall be levelled, aligned, and thoroughly cleaned, before they are used for concreting. Formwork shall be removed after specified days of curing with the prior written permission of the Engineer. The surface of RCC after removal of formwork / shuttering shall be smooth and even and without honeycombing or undulations.

43.4 Procedure and Materials used in concrete works.

The procedure for concrete works shall be in accordance with the specifications in the bill of quantities, specifications in this section and complying to standard practices in IS:456-2000 with latest amendments, all concrete works shall be executed in accordance with standard practices, including volumetric batching using boxes of standard size, concrete mixers with hopper, compaction using vibrators and according to the directions of the Engineer In-charge of works.

Aggregates

All aggregates, fine and course used in concreting works shall comply to the standards laid down in IS: 456-2000 with latest amendments and specifications in applicable clauses in this section.

Water

The water used in all concreting works shall be of potable quality and tested before usage in the construction works and shall be confirming to IS: 456-2000.

Cement

The cement used shall be of sulphate resisting cement PPC/PSC confirming to IS: 12330//IS-1489-part-1/IS-455 with latest as specified and where ever the concrete is coming in contact with sewage. For other concreting works like encasing pipe, pedestals and other structures where there is no contact with sewage, it shall be OPC/ PPC/PSC confirming to IS:8112 with latest amendments and revisions.

Minimum clear cover over Reinforcement

Minimum clear cover over the steel reinforcement shall be 50mm for the members contact with soil/ground water. For other faces the clear cover over the reinforcement shall be as per latest IS Codes.

Tested Steel

Only tested and approved steel shall be used for reinforcement in RCC works, and the Contractor shall produce the test certificates to the Engineer. The type of steel used shall be of TMT of grade of steel Fe: 500 confirming to relevant IS.

43.5 Restoration of Storm water drains & other miscellaneous works.

The storm water drains and cover slabs damaged during execution of works which is not due to the negligence of the Contractor as decided by the Engineer shall be restored as per the items in bill of quantities. The specifications in this section are deemed to govern the applicable items in

the bill of quantities. All masonry works, concrete works shall be in accordance with relevant IS as mentioned in section 6 and or as directed by the Engineer. Other repairs works under heading "Miscellaneous works" in bill of quantities shall be executed in accordance with the specifications and as directed by the Engineer, the finished item of work shall give neat appearance and should serve the intended purpose of the component to the satisfaction of the Engineer.

43.6 Technical Specifications for Electrical Works: All works shall be carried out in accordance with the requirements of:

i. IE Rules
ii. State Electricity Board
iii. Rules and regulations of Local authorities, and
iv. The standards in this specification

The Contractor is responsible for applying and obtaining necessary statutory approvals and shall ensure workmanship of good quality and shall assign qualified supervisor / engineers and competent labour who are skilled, careful and experienced in carrying out similar works.

43.7 IS codes for electrical Works:

Code No.	Title
IS : 10418	Specification for drums of electric cables
IS : 2633	Methods of testing weight, thickness and uniformity of coating on hot dipped galvanized articles
IS : 209	Specifications for Zinc
IS : 2062	Steel for general structural purposes
IS : 808	Dimensions for hot rolled steel beam, column channel and angle sections
IS : 816	Code of practice for use of metal arc welding for general construction in mild steel
IS : 2629	Hot deep galvanizing of iron & steel
IS : 2633	Methods of testing uniformity of coating
IS : 4759	Hot dip zinc coatings on Structural steel and other allied Products
IS2026/BS171/IEC76	Power Transformer
IS3639	Fittings and Accessories
IS1180	Auxiliary Transformer
IS6600/BSCP.1010/IEC354	Loading of oil immersed transformer
IS335/BS 148/IEC296	Transformer Oil

IS2099/BS223/IEC137	Bushings for > 1000V, AC
IS7421	Bushings for ≤ 1000V, AC
IS13947 (Part 1) / IEC947-1	Degree of Protection
IS3637	Buchholz Relay
IS 1271/BS2757/IEC85	Insulation Materials for Electrical Machinery
IS 3202/ BSCP1014/ IEC354	Climate Proofing
IS 1886	Installation & Maintenance of Transformers
IS 2705	Current Transformers
I.S. 3043 – 1987.	Earth Pits
	General Specification for Electrical works Part VII (DG Sets) published by CPWD.

43.8 IS codes for mechanical equipment:

IS 6280 – 1971 – Sewage Screens
IS 5600 – 1970 - Sewage and Drainage Pumps
IS 6279 – 1971 – Grit Removal devices

The list is not exclusive and the contractor shall be responsible to follow the appropriate standards:

LIST OF MAKES(Recommended) FOR MAJOR EQUIPMENT

1)	Submersible Pump	Aqua / Kishor / KSB / Darling / ABS
2)	Mechanical Bar Screen	Jash / Equivalent/ Quality Engg. Service / Huber (ATE India)
3)	MS / SS / GI Pipes	Tata Steel / Surya Roshni / Jindal / Zenith / Mahalksmi Seamles / Vinayak / Indus
4)	CI Pipes	Truform / Kesoram / Equivalent
5)	DI Pipes	Jindal / Electro – Steel Casings / TATA METALIKS/Equivalent

6)	HDPE Pipes (PE 80, PN 6, IS 14333 or as per design requirement)	Trustline / NOCIL / Dutron / RIL / Time Technoplast Ltd. / ALon Poly Extrusions Ltd.
7)	Valves	Kirloskar / Levcon / IVC Nasik / GM Dalui / Vag / Mceuira
8)	Isolation Gates	Jash / IVC Nasik / Glob tech /Mecha – Tech
9)	MCC	Selurine / PCE Construction / System Construction / Equivalent
10)	LPBS	Elcon / Hansu / Pustron
11)	Cables Thermocable	Gemscab / Polycab / Gloster / KEI / Crystal
12)	Motors	Siemens / Crompton / Marathon / BBL / NGEF / Bhel / G E C N G E F
13)	Cable Trays	Elcon / Sales Link
14)	Cable Glands	Comet
15)	Luminaries	Philips / Crompton / Bajaj
16)	Ultrasonic Flow Meter & Totaliser	Kronhe Marshall / Endress & Hauser / Emerson / SBEM / Honeywel
17)	Pressure Gauges	H. Guru / Waree / General Instruments / Gluck
18)	Level Switches	Pune Techtrol / SBEM / Levcon
19)	Switch Gear Components	L & T / Siemens / C& S
20)	Indicating Meters	Automatic Electric / Imp / CEC / Reyrlle
21)	Annunciator System	IIC / Minilec
22)	Relays	OEN / English Electric / Universal Electric / ABB / Schiendur
23)	Chain Pulley Block	J K Steel / Indef

24)	Air Circuit Breaker	L & T / English Electric / Siemens / Crompton
25)	Moulded Case Circuit Breaker	L & T / Crompton / Siemens
26)	Power Transformer	Kirloskar / Crompton / GCC / Volt Amy / Stanlee
27)	Current Transformer	Kappa / Automatic Electric
28)	Potential Transformer	Kappa /Crompton / Bicco Lawrie
29)	DOL & Star Delta Starter	L & T / Siemens / Andrew Yule
30)	Auto Transformer Starter	Jyoti / MEE

The list is not exclusive and the contractor shall be responsible to follow the appropriate standards:

Instrumentation, Control and SCADA System

A Supervisory Control and Data Acquisition (SCADA) system will be installed in the Sewage Pumping station networked to the PLC and shall acquire, display, monitor and issue remote control actions for maintaining the pumps. The SCADA system shall also originate customer performance reports for management reporting.

Typographical mistake if any in the Tender Documents / Price Schedule will be corrected by the Tender Inviting / Accepting Authority

Signature of Tenderer	Signature of Tender Inviting Authority	Signature of Tender Accepting Authority