

Conditions of the Contract for the Sewerage Network Facilities

The Draft Contract

**NATIONAL GANGA RIVER BASINPROJECT
UNDER WORLD BANK FINANCE
AGREEMENT NO. _____**

General Conditions of Contract (GCC)

GENERAL CONDITIONS
FOR A CONTRACT

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

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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:

Item	Definition
Adjudicator	means the person that is named in the SCC (Schedule 14)
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 the President or government of the Country;
Authorities	means the BUIDCO, NMCG, ULB and the Country as specified in the SCC (Schedule 14)
Background Information Document	means the Bidding Documents provided to the Concessionaire by the BUIDCO during the bidding process that preceded this Contract. It includes the Project Information Memorandum, provided as part of the RFP to this Contract
BUIDCO	has the meaning ascribed to it in the Digha-Kankarbagh Project Agreement
BUIDCO's Representative	is defined in GCC Section 8.1.1(1)
Bank	means the World Bank
Bidding Documents	means the Definition as described in Glossary of the RFP
Change	is defined in GCC Section 10.1.1(1)
Change Order	is defined in GCC Section 10.1.2(4)
Completion	means that the Sewerage Network 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 Concessionaire is entitled to have a Completion Certificate issued in respect of the Sewerage Network, or part thereof, in accordance with DBSS Section 5
Completion Certificate	means a certificate issued by the Design-Build-Operations Engineer in accordance with Schedule 15 DBSS Section 5.2, separately for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities

Concessionaire	has the meaning ascribed to it in the array of Parties and the term “ Concessionaire ” and Concessionaire is used interchangeably throughout this Contract
Concessionaire’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 Sewerage Network
Concessionaire’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 Sewerage Network
Concessionaire’s Personnel	is defined in GCC Section 8.3(1)
Concessionaire’s Representative	is defined in GCC Section 8.1.2(1)
Contract	means the clauses reflected in this Conditions of the Contract for Sewerage Network Facilities, which forms part of the overall “Digha-Kankarbagh Project Agreement” and consists of the Contract Documents. The words “Contract” and “Conditions of the Contract for Sewerage Network Facilities” are used interchangeably throughout this document
Contract Documents	means the General Conditions, and all Schedules to the General Conditions as set out in Article 1.2 of this Supporting Volume 1
Contract Price	is defined, separately for for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, in GCC Section 5.1,
Contract Records	is defined in GCC Section 1.8.1(1)
Contract Term	means the term of the contract, starting on the Effective date and continuing till the End of Concession
Costs	means all expenditures reasonably incurred, or to be incurred, by the Concessionaire including overhead but excluding profit
Country	means India
Country of Origin	means the countries and territories eligible under the rules of the World Bank as defined under the <i>Guidelines: Procurement under IBRD Loans and IDA Credits & Grants 2011, revised July 2014</i>

Customers	mean all persons to which the Concessionaire provides services, including those customers in existence as of the Operations Starting Date and persons who become customers after the Operations Starting Date
Data Room	means the data room which may be established by the BUIDCO in the bidding process as set out in the Bidding Documents
DBSS Section	means Design-Build Services Schedule Section
Design Build Cost	means value of Design, Build, and Commissioning services (Part A of Price Schedule), separately for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
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 Sewerage Network, separately for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, 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	has the meaning ascribed in GCC Section 2.2(a), separately for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Design-Build Services	means the design-build services to be performed by the Concessionaire as contemplated by the General Conditions and the Design-Build Services Schedule (Schedule 15)
Design-Build Starting Date	is defined in GCC Section 2.1.3(1)
Digha Associate Infrastructure	means the pumping stations including the rising main and trunk sewer of the specific pumping station, proposed to be built in Digha as part of the Sewerage Network Facilities
Digha Lateral Network	means the Digha network starting from the property chambers till the trunk sewer including related works
Digha Sewerage Network Facilities	means the Digha Associate Infrastructure and Digha Lateral Network
Digha Network	means the Sewerage Network of 303 km to be laid at <i>Digha</i> including online monitoring system and related works to be built as part of the Project

Effective Date	means the date on which this Contract comes into force and effect pursuant to GCC Section 2.1.1
End Date	is defined in GCC Section 2.1.2
Environmental Management Plan	A set of mitigation measures to be implemented by the Concessionaire as indicated in [Appendix 1 where <i>EMP have been specified</i>] of the DBSS , which shall be implemented by the contractor
Environmental, Social, Health and Safety Management Plan	A set of mitigation and management measures to be implemented by the Concessionaire as indicated in Appendix 1 Schedule 15 (Design Build Services) which shall be implemented by the Concessionaire
Extension Date	is defined in GCC Section 2.4.3
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
Force Majeure	is defined in GCC Section 9.8(1)
GC Section	means General Conditions of Contract Section
IDA	means the International Development Agency
IBRD	means International Bank for Reconstruction and Development
including	means including without limitation and “ includes ” means includes without limitation, unless expressly stated otherwise
Indicative Flow Rate	means the rate of sewage flow which is projected by the BUIDCO to be available for handling in the respective for each of the years till the End date
Kankarbagh Associate Infrastructure	means the pumping stations including the rising main and trunk sewer of the specific pumping station, proposed to be built in Kankarbagh as part of the Sewerage Network Facilities
Kankarbagh Lateral Network	means the Kankarbagh network starting from the property chambers till the trunk sewer including related works
Kankarbagh Sewerage Network Facilities	means the Kankarbagh Associate Infrastructure and Kankarbagh Lateral Network
Kankarbagh Network	means the Sewerage Network of 150 km to be laid at <i>Kankarbagh</i> including online monitoring system and related works to be built as part of the Project
Liquidated Damages – Delay	is defined in GCC Section 2.3.6(2)

Liquidated Damages – Operations	is as defined in GCC Clause 5.4 read with SCC (Schedule 14) Clause 5.4
Manager	is defined in GCC Section 8.2(3)
Network	means the Digha Network or Kankarbagh Network as the context may require.
Operations Payment	is defined in Schedule 19 of the Contract
Operations Period	is defined in GCC Section 2.2(b), and the term ‘Network O&M Period’ may be construed accordingly It shall be separate for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Operations Starting Date (OSD)	is defined in GCC Section 2.1.3(2). It shall be separate for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Operational Acceptance	means the acceptance by the BUIDCO of the Sewerage Network, or part thereof, in accordance with Schedule 15 DBSS Section 6.3
Operational Acceptance Certificate	means the certificate issued by BUIDCO on Operational Acceptance of the Sewerage Network. It shall be separate for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Operations Services	means the Operations Services to be performed by the Concessionaire as contemplated by the General Conditions and the Operations Services Schedule (Schedule 16)
OSA Section	means Operations Services Schedule (Schedule 16) Section
Party	means the BUIDCO, NMCG or the Concessionaire, as the case may be, and “Parties” means both or all of them
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 Sewerage Network
Project Engineer	has the meaning ascribed in Article 6 of the Concession Agreement, and the term “ Design-Build Operations Engineer ” is also used interchangeably in this document
Services	means the Design-Build Services and the Operations Services to be performed by the Concessionaire as set out in the General Conditions and the Schedules 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 (like drains) and includes domestic sewage
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 lifting and pumping stations and all appurtenant structures forming a part of the Sewerage Network
Sewerage Network Facilities	shall mean the new Sewerage Network to be Designed, Built, Refurbished, Operated and Maintained by the Concessionaire pursuant to this Contract, at DIGHA in Patna of approx. 303 Km length including 02 Number Sewage Pumping Station(s) in Digha and approx.150 Km length including 02 Number Sewage Pumping Station(s) in Kankarbagh of specified capacity and all appurtenant structures which shall be designed and built by the Concessionaire as a part of the Contract, and the term “Sewerage Network Facility” shall be construed accordingly
Sewerage Network Performance Security	is defined in GCC Section 5.5.1(1)
Site	means the physical area as set out in the Site Schedule identified for the location of the Sewerage Network, separately for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities
Site Information	is defined in GCC Section 3.5(1)
Subcontract	means any contract, whether written or verbal, entered into by the Concessionaire and a Sub-Contractor for the performance of any part of the Services.
Sub-Contractor	means any person or entity to which the Concessionaire subcontracts or subconsults any part of the Services in accordance with the provisions of GCC Section 8.6, including any person or entity engaged for the supply of any Plant and Equipment, Concessionaire's Equipment (Design-Build) or Concessionaire's Equipment (Operations) or for the provision of any Services.
Submission Deadline	means the last date for the submission of bids, as stated in the Bidding Documents and is same as the Bid Due Date as stated in the RfP

Subsequent Concessionaire	means the Concessionaire that is to assume the provision of the Services upon termination or completion of the Contract and may include one of the Authorities
Taxes	is defined in GC Section 5.6
Technical Standards	is defined in the Technical Standards Schedule (Schedule 23)
Tests on Completion	means those tests set out in Article 5 to Schedule 23 of the Contract (Technical Specifications) as conducted pursuant to Schedule 15 DBSS Section 5.2(1)
Testing, Trial and Commissioning Period	shall have the meaning as defined in Clause 2.3.2 of Special Conditions of Contract (Schedule 14), Schedule 15
Third Party	means any person or entity other than the Parties
Time for Completion	is defined in GCC Section 2.3.2. It shall be separate for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Time Schedule	is defined in GCC Section 2.3.3(1). It shall be separate for the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and shall mean either or both of them, as the context may require
Transition Assistance	is defined in GCC Section 2.4.2
TSS Section	means Technical Specifications specified in Schedule 23 of the Contract
Unforeseeable	means not reasonably foreseeable on the Submission Deadline by an experienced Concessionaire that conducted or should have conducted the inspections and examinations or who knew or should have known the information described in GCC Section 3.5; and
War Risks	is defined in GCC Section 9.9(1)

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 “14” – Special Conditions of Contract (the “SCC”)

Schedule “15” – Design Build Services (“the design Build Services Schedule”)

Schedule “16” – Operations and Maintenance Services (“the Operations and Maintenance Services Schedule”)

Schedule “17” – Description of Site and Site Area

Schedule “18” – Concessionaire’s Price Schedule

Schedule “19” – Terms and procedure of Payment

Schedule “20” – Liquidated Damages – Operations

Schedule “21” – Price Adjustment Formula

Schedule “22” – Schedules of Performance Guarantee & Advance Payment Guarantee

Schedule “23” – Technical Specifications

Schedule “24” – MoU signed between the Central Government, State Government and the ULB.

Schedule “25” – Allowed and Suggested alignments / locations of the Sewerage Network

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 1.3.1(1), 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. Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of the Parties there under shall be prescribed by Incoterms 2010. Incoterms means international rules for

interpreting trade terms published by the International Chamber of Commerce, 38 Cours Albert 1er, 75008 Paris, France.

1.3.6. Entire Agreement

This Contract constitutes the entire agreement between the BUIDCO, NMCG and the Concessionaire 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.

1.3.7. 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.

1.3.8. 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 in the Country, provided, however, that if the final day of any period shall fall on a Saturday, Sunday, or legal holiday in the Country, then the final day shall be deemed to be the next day which is not a Saturday, Sunday or legal holiday in the Country.

1.3.9. Independent Concessionaire

- (1) The Concessionaire shall be an independent operator in its performance of the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the BUIDCO/NMCG and the Concessionaire or its Shareholders.
- (2) Subject to the provisions of the Contract, the Concessionaire shall be solely responsible for the manner in which the Contract is performed. All employees, agents, representatives or SubContractors engaged by the Concessionaire in connection with the performance of the Contract shall be under the complete control of the Concessionaire and shall not be deemed to be employees of the BUIDCO/NMCG, and nothing contained in the Contract, or in any Subcontract awarded by the Concessionaire, shall be construed to create any contractual relationship or legal obligation between the Concessionaire's employees, agents, representatives or SubContractors and the BUIDCO/NMCG.

1.3.10. Joint Venture

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

- (2) If the Concessionaire is a joint venture of two or more Partners, each Partner of the joint venture, shall be jointly and severally bound to the BUIDCO/NMCG for the fulfilment of the provisions of the Contract by the Concessionaire.
- (3) The composition, control or constitution of the Concessionaire shall be in accordance with the Concessionaire's Bid and shall not be altered without the prior consent of the BUIDCO.

1.3.11. Non-waiver

- (1) Subject to GC Section 1.3.11(2), 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 the BUIDCO's or Concessionaire'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.

1.3.12. 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.

1.3.13. Country of Origin

"Origin" means the place where the materials, equipment and other supplies for the Sewerage Network are mined, grown, produced or manufactured, and from which the services are provided.

1.3.14. Survival of Obligations

Upon the termination or expiration of the Contract pursuant to the Contract, all rights and obligations of the Parties 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 GC Section 1.4.
 - (3) The Concessionaire's address for the purpose of giving notice pursuant to this GC Section 1.4 shall be in the Country 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. Settlement of Disputes

1.6.1. Adjudicator

- (1) If any dispute of any kind whatsoever arises between the BUIDCO/NMCG and the Concessionaire in connection with or arising out of the Contract including,
 - (a) any question regarding the existence, validity or termination of the Contract; and
 - (b) any matter related to the performance of the Services,

the Parties shall seek to resolve any such dispute or difference by mutual consultation. If the Parties fail to resolve such a dispute or difference by mutual consultation, the dispute shall be referred in writing, by either the Concessionaire or the BUIDCO, to the Adjudicator with a copy to the other Party or Parties.

- (2) GC Section 1.6.1(1) shall apply,
 - (a) during the execution of the Services and after the completion of the Services; and
 - (b) before and after the termination, abandonment or breach of the Contract.
- (3) The Adjudicator shall give its decision in writing to both Parties no later than 30 days after the referral of a dispute. If the Adjudicator has rendered its decision within the 30 day time limit, and no notice of intention to commence arbitration has been given by either the BUIDCO or the Concessionaire prior to the expiration of 60 days after the reference of the dispute to the Adjudicator, the Adjudicator's decision shall become final and binding upon the BUIDCO and the Concessionaire. Any decision that has become final and binding shall be implemented by the Parties forthwith.

- (4) The Adjudicator shall be paid a fee at the rate specified in the SCC plus reasonable expenditures incurred in the execution of its duties as Adjudicator, and these costs shall be divided equally between the BUIDCO and the Concessionaire.
- (5) If the Adjudicator resigns or dies, or the BUIDCO and the Concessionaire agree that the Adjudicator is not fulfilling its functions in accordance with the provisions of the Contract, a new Adjudicator shall be jointly appointed by the BUIDCO/NMCG and the Concessionaire. If the BUIDCO/NMCG and the Concessionaire cannot agree on a new Adjudicator within 30 days after the resignation, death or removal of the existing Adjudicator, the new Adjudicator shall be appointed at the request of either Party by the Appointing Authority specified in the SCC.

1.6.2. **Arbitration**

- (1) If either the BUIDCO or the Concessionaire is dissatisfied with the Adjudicator's decision, or if the Adjudicator fails to give a decision within 30 days after a dispute being referred to it, then either the BUIDCO or the Concessionaire may, within 60 days after such reference, give notice to the other Party, with a copy for information to the Adjudicator, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.
- (2) Any dispute in respect of which a notice of intention to commence arbitration has been given, in accordance with GC Section 1.6.2(1), shall be finally settled by arbitration.
- (3) Arbitration proceedings shall be conducted in accordance with the rules of procedure designated in the SCC.

1.6.3. **Obligations during Arbitration**

Notwithstanding any reference to the Adjudicator or arbitration herein,

- (a) the Parties shall continue to perform their respective obligations under the Contract unless they otherwise agreed; and
- (b) the BUIDCO shall pay the Concessionaire any monies due to the Concessionaire.

1.7. Assignment

- (1) The Concessionaire 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 the BUIDCO, which consent may not be unreasonably withheld.
- (2) The Concessionaire 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 the BUIDCO pursuant to GC Section 1.7(1), the assignment must,
 - (a) be in writing;
 - (b) be dated and signed by the BUIDCO's Representative; and

(c) state the specific details of the assignment.

1.8. Contract Records, Accounting and Auditing

1.8.1. Contract Records

- (1) Except as provided in GC Section 6.1, all data, information, documentation, account, plans, programs, reports, surveys and guidelines of any kind whatsoever (the “Contract Records”) prepared by the Concessionaire in performing the Services shall become and remain the property of the BUIDCO and the Concessionaire shall deliver all Contract Records and a detailed inventory of those Contract Records to the BUIDCO 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 the BUIDCO’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 Concessionaire 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 Concessionaire shall provide the BUIDCO with unrestricted access to the Contract Records during the term of the Contract, including the right to make and retain copies.
- (4) The Concessionaire may retain a copy of the Contract Records but shall not use them for purposes unrelated to this Contract without the prior approval of the BUIDCO. This GC Section 1.8.1(4) does not in any way relieve the Concessionaire of its obligation of confidentiality pursuant to GC Section 6.2.
- (5) Except as provided in GC Section 6.1, the Concessionaire acknowledges that the BUIDCO, as owner 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 Concessionaire.

1.8.2. Accounting

The Concessionaire shall keep accurate and systematic accounts in respect of the Services and the Contract in accordance with internationally accepted accounting principles.

1.8.3. Auditing the Concessionaire’s Own Accounts and the Contract Records

- (1) The BUIDCO may, in its sole discretion, audit,
 - (a) the Concessionaire's own accounts, financial information, financial statements and technical information at any reasonable time and with 24 hours' notice to the Concessionaire; and
 - (b) the Contract Records and Design-Build Documents at any reasonable time and without notice to the Concessionaire,in respect of any matters related to the Contract.
- (2) The BUIDCO may complete the audit or audits itself or may retain an independent auditor, at the BUIDCO's expense, to complete the audit or audits.

1.8.4. Concessionaire's Audited Accounts

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

1.8.5. Inspections and Audit by the Bank

The Concessionaire shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the BUIDCO's accounts and records relating to the performance of the Contract and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank.

1.9. Concessionaire's Claims during the Design-Build Period

- (1) If the Concessionaire 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 Concessionaire shall give notice to the Project Engineer, 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 Concessionaire became aware, or should have become aware, of the event or circumstance.
- (2) If the Concessionaire fails to give notice of a claim within such period of 30 days, the Time for Completion shall not be extended, the Concessionaire shall not be entitled to additional payment, and the BUIDCO shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this GC Section 1.9 shall apply.
- (3) The Concessionaire 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 Concessionaire 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 Project Engineer. Without admitting the BUIDCO's liability, the Project Engineer may, after receiving any notice under this GC Section 1.9, monitor the record-keeping or instruct the Concessionaire to keep further contemporary records. The Concessionaire shall permit the Project Engineer to inspect all these records, and shall, if instructed, submit copies to the Project Engineer.
- (5) No later than 42 days after the Concessionaire 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 Concessionaire and approved by the Project Engineer, the Concessionaire shall send to the Project Engineer 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 Concessionaire shall send further interim claims at monthly intervals, giving the accumulated delay or amount claimed, and such further particulars as the Project Engineer may reasonable require; and
 - (c) the Concessionaire 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 Concessionaire and approved by the Project Engineer.
- (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 Project Engineer and approved by the Concessionaire, the Project Engineer shall respond with approval, or with disapproval and detailed comments. The Project Engineer 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 Concessionaire 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 Concessionaire shall only be entitled to payment for such part of the claim as it has been able to substantiate.
- (8) The Concessionaire shall proceed in accordance with GC Section 7.2.6 to request,
 - (a) an extension, if any, of the Time for Completion before or after its expiry in accordance with GC Section 2.3.4; or
 - (b) an additional payment, if any, to which the Concessionaire believes it is entitled under the Contract.

- (9) The requirements of this GC Section 1.9 are in addition to those of any other provision which may apply to a claim. If the Concessionaire 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 1.9(2).
- (10) This GC Section 1.9 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 Concessionaire, prior to its signing by the BUIDCO/NMCG. The Contract shall come into force and effect on the date the Form of Contract is signed by the BUIDCO/NMCG (the “Effective Date”), contingent on final approval by the Bank.

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 2.4.3; or
- (3) the date of Contract termination pursuant to GC Section 11.2,

(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 the BUIDCO shall give the Concessionaire 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 and Operations Period

The Contract Term shall be divided into two periods as follows:

- (a) the period commencing on the Effective Date and ending on the day immediately prior to the Operations Starting Date (the “Design-Build Period”); and
- (b) the period commencing on the Operations Starting Date and ending on the End Date (the “Operations Period”), namely the date of completion of the Operation and Maintenance period of 15 years, commencing from the date of Operational Acceptance of the Sewerage Network.

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

2.3.1. Commencement of the Design-Build Services

The Concessionaire shall commence the Design-Build Services no later than 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 Concessionaire 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 Sewerage Network can be used as a fully operational Sewerage Network in accordance with the Contract.

2.3.3. Design-Build Time Schedule

- (1) The Concessionaire shall submit a detailed time programme (the “Time Schedule”) to the Project Engineer no later than 30 days after the Design-Build Starting Date. The Concessionaire shall also submit a revised Time Schedule whenever the previous Time Schedule is inconsistent with actual progress or with the Concessionaire’s obligations. Each Time Schedule shall include a description of,
 - (a) the order in which the Concessionaire 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 monthly milestones of the Design-Build Services.
- (2) The Project Engineer shall review each Time Schedule and provide comments to the Concessionaire as to whether the Time Schedule complies with the Contract. If the Project Engineer fails to provide such comments prior to the expiration of 21 days after receiving a Time Schedule, the Concessionaire shall proceed in accordance with the Time Schedule, subject to its other obligations under the Contract. The Concessionaire shall be entitled to rely upon the Time Schedule when planning its activities.
- (3) The Concessionaire shall promptly give notice to the Project Engineer 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 Project Engineer may require the Concessionaire to submit an estimate of the anticipated effect of the future event or circumstances, or a proposal under GC Section 10.1.3.

- (4) If, at any time, the Project Engineer gives notice to the Concessionaire that a Time Schedule fails, to the extent stated, to comply with the Contract or to be consistent with actual progress and the Concessionaire's stated intentions, the Concessionaire shall submit a revised Time Schedule to the Project Engineer in accordance with this GC Section 2.3.3.

2.3.4. Extension of the Time for Completion

- (1) The Time for Completion shall be extended if the Concessionaire 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 9.8, Unforeseeable physical conditions as provided for in GC Section 9.7, or loss or damage as a result of the occurrences set out in GC Section 9.4(2);
 - (c) any suspension order given by the BUIDCO pursuant to GC Section 11.1.1;
 - (d) any change in the Applicable Law in accordance with GC Section 9.10;
 - (e) any default or breach of the Contract by the BUIDCO or any activity, act or omission of any other Concessionaires employed by the BUIDCO; 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 Concessionaire.

- (2) The Concessionaire shall submit, to the Project Engineer, any notice of a claim for an extension of the Time for Completion in accordance with GC Section 10.1.3.
- (3) The Concessionaire 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 Concessionaire'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 2.3.4, then the Project Engineer may instruct the Concessionaire to submit a revised Time Schedule and supporting report describing the revised methods which the Concessionaire proposes to adopt in order to expedite progress and complete the Design-Build Services.

- (2) Unless the Project Engineer notifies otherwise, the Concessionaire shall adopt the revised methods referred to in GC Section 2.3.5(2), which may require increases in,
 - (a) the working hours or in the numbers of Concessionaire's Personnel, or both; or
 - (b) Plant and Equipment,

at the risk and cost of the Concessionaire. If these revised methods cause the BUIDCO to incur additional costs, the Concessionaire shall, subject to GC Section 1.9, pay these costs to the BUIDCO, in addition to delay damages, if any, under GC Section 2.3.6.

2.3.6. Delay of Completion – Liquidated Damages - Delay

- (1) The Concessionaire guarantees that it shall attain Completion of the Sewerage Network in accordance with the Time for Completion specified in the SCC and GC Section 2.3.2 or in accordance with an extension of the Time for Completion granted to the Concessionaire in accordance with GC Section 2.3.4.
- (2) If the Concessionaire fails to attain Completion of the Sewerage Network within the Time for Completion, or any extension thereof in accordance with GC Section 2.3.4, the Concessionaire shall pay to the BUIDCO 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. The BUIDCO may terminate the Contract pursuant to GC Section 11.2.3 if the Concessionaire reaches the “Maximum” level for Liquidated Damages – Delay.
- (3) The payment or payments by the Concessionaire of Liquidated Damages – Delay shall completely satisfy the Concessionaire's obligation to attain Completion of the Sewerage Network within the Time for Completion or any extension thereof pursuant to GC Section 2.3.4.
- (4) The payment or payments by the Concessionaire of Liquidated Damages – Delay shall not in any way relieve the Concessionaire of its obligations to complete the Sewerage Network or any other obligations and liabilities of the Concessionaire under the Contract.
- (5) If the Concessionaire attains Completion of the Sewerage Network before the Time for Completion or any extension thereof pursuant to GC Section 2.3.4, and if the BUIDCO/NMCG intends to pay a bonus to the Concessionaire for early completion, the amount of the bonus is as set out in the SCC. The aggregate amount of such bonus shall in no event exceed the amount specified as “Maximum” in the SCC.

2.3.7. Design-Build Period –(Special operation requirements) Deleted

2.4. Operations Period

2.4.1. Commencement of the Operations - Services

The Concessionaire shall commence the Operations Services no later than the Operations Starting Date and shall then proceed with the Operations Services with due exception and without delay.

2.4.2. Services after the End Date

The Concessionaire, upon written request by the BUIDCO no later than 60 days prior to the End Date, shall provide assistance to the BUIDCO, at no cost to the BUIDCO, 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 Concessionaire and a Subsequent Concessionaire of the Sewerage Network. The Transition Assistance shall be related to only transition services and shall not be the full range of Services as set out in the Operations Services Schedule.

2.4.3. Extension of the Contract

If both Parties agree, this Contract may be extended for a period of up to 5 years after the End Date. The BUIDCO shall notify the Concessionaire no later than 6 months prior to the End Date if it wishes to enter into negotiations in order to extend the duration of the Contract. The date on which the Contract is to expire as a result of an extension shall be the Extension Date.

ARTICLE 3. OBLIGATIONS OF THE CONCESSIONAIRE

3.1. General – Services and Standards of Performance

The Concessionaire shall,

- (a) perform the Design-Build Services set out in the Design-Build Services Schedule (Schedule 15);
- (b) perform the Operations Services set out in the Operations and Maintenance Services Schedule (Schedule 16); and
- (c) perform the Design Build and Operations Services in accordance with the Technical Standards set out in the Technical Standards Schedule (Schedule 23 and Schedule 25);,

3.2. Law Governing Services

The Concessionaire shall comply with the Applicable Law and shall ensure that the Concessionaire's Personnel and Subcontractors comply with the Applicable Law. The Concessionaire shall indemnify and hold harmless the BUIDCO 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 Concessionaire, the Concessionaire's Personnel the Subcontractors and the Subcontractors' personnel.

3.3. Conflict of Interest

- (1) The compensation of the Concessionaire pursuant to GC Article 5 shall constitute the Concessionaire's sole compensation in connection with this Contract and, except as provided in GC Article 5, the Concessionaire 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 Concessionaire shall use its best efforts to ensure that the Concessionaire's Personnel, Subcontractors, and the Subcontractors' employees and agents, similarly shall not receive any such additional remuneration.
- (2) The Concessionaire, Subcontractors and any entity affiliated with the Concessionaire or the Subcontractors, 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 Concessionaire, Concessionaire's Personnel, Subcontractors and the employees and affiliates of the Subcontractors shall not engage, either directly or indirectly, in any business or professional activities which would conflict with the activities assigned to them under this Contract.

- (4) The Concessionaire and its Shareholders shall not participate in any discussions or work and shall not provide any services or advice to the BUIDCO related to,
 - (a) except with respect to their responsibilities as set out in the Operations Services Schedule, institutional restructuring or reorganisation of the BUIDCO or a utility or department of the BUIDCO;
 - (b) the development or review of bidding documents to retain any Subsequent Concessionaire; or
 - (c) the preparations for the procurement process to retain any Subsequent Concessionaire.
- (5) Failure of the Concessionaire or the Shareholders to comply with this GC Section 3.3, in addition to constituting a breach of this Contract, may result in the disqualification of the Concessionaire and the Shareholders from bidding in the procurement process to retain any Subsequent Concessionaire.

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

- (1) Any Plant and Equipment, Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations) that will be incorporated in or be required for the Site and Sewerage Network or the Operation Services shall have their origin as specified under GC Section 1.1 ("Country of Origin").
- (2) The Concessionaire shall prepare a list of all Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations) (the "Concessionaire's Equipment Lists"). The Concessionaire shall update the Concessionaire's Equipment Lists on an annual basis and shall provide the updated Concessionaire's Equipment Lists to the BUIDCO no later than 30 days after the end of each of the Concessionaire's fiscal years during the Contract Term.

3.5. Site Information and Investigation

- (1) The Concessionaire acknowledges that the BUIDCO made available to the Concessionaire, 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 the BUIDCO from investigations in anticipation of the Design-Build and Operations Services (the "Site Information"). The Concessionaire shall be responsible for interpreting all data about the Site that is provided to it by the BUIDCO.
- (2) The Concessionaire 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, Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations) necessary for the execution and completion of the Services, and the remedying of any defects; and
 - (d) the Concessionaire's requirements for access to the Site, accommodation, personnel, power, transport, water and other services.
- (3) The Concessionaire 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) "The Concessionaire shall not commence any Works, including mobilization and/or pre-construction activities (e.g. limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits), unless the Project Engineer is satisfied that appropriate measures are in place to address environmental, social, health and safety risks and impacts. At a minimum, the Concessionaire shall apply the Management Strategies and Implementation Plans and Code of Conduct, submitted as part of the Bid and agreed as part of the Contract. The Concessionaire shall submit, on a continuing basis, for the Project Engineer's prior approval, such supplementary Management Strategies and Implementation Plans as are necessary to manage the ESHS risks and impacts of ongoing works. These Management Strategies and Implementation Plans collectively comprise the Concessionaire's Environmental and Social Management Plan (O-ESMP). The O-ESMP shall be approved prior to the commencement of construction activities (e.g. excavation, earth works, bridge and structure works, stream and road diversions, quarrying or extraction of materials, concrete batching and asphalt manufacture). The approved O-ESMP shall be reviewed, periodically (but not less than every six (6) months), and updated in a timely manner, as required, by the Concessionaire to ensure that it contains measures appropriate to the Works activities to be undertaken. The updated O-ESMP shall be subject to prior approval by the Project Engineer.

3.6. Access to the Site and Sewerage Network

- (1) The Concessionaire shall, during both the Design-Build Period and the Operations Period, provide free and open access to the Site and the Sewerage Network at the BUIDCO's request. The BUIDCO shall make reasonable efforts to provide reasonable notice to the Concessionaire prior to the BUIDCO's access but such notice is not mandatory. The BUIDCO's representative on the Site, or at the Sewerage Network shall observe all safety and health regulations and reasonable instructions of the Concessionaire.
- (2) The Concessionaire shall give all reasonable access to any other Concessionaires employed by the BUIDCO on or near the Site to carry out their work.

- (3) If the Concessionaire makes available to other Concessionaires any roads or ways the maintenance for which the Concessionaire is responsible, permits the use by such other Concessionaires of the Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations), or provides any other service of whatsoever nature for such other Concessionaires, the BUIDCO shall fully compensate the Concessionaire for any loss or damage caused or occasioned by such other Concessionaires in respect of any such use or service, and shall pay to the Concessionaire reasonable remuneration for the use of such equipment or the provision of such services.
- (4) The Concessionaire shall also arrange to perform its work so as to minimize, to the extent possible, interference with the work of other Concessionaires. The Project Engineer shall determine the resolution of any difference or conflict that may arise between the Concessionaire and other Concessionaires and the workers of the BUIDCO in regard to their work.
- (5) The Concessionaire shall notify the Project Engineer, as applicable, promptly of any defects in the other Concessionaires' work that come to its notice, and that could affect the performance of the Services by the Concessionaire. The Project Engineer, as applicable, shall determine the corrective measures, if any, required to rectify the situation after inspection of the Site and the Sewerage Network. Decisions made by the Project Engineer, as applicable, shall be binding on the Concessionaire.

3.7. Safety Procedures

The Concessionaire shall:

- (a) comply with all applicable safety regulations,
- (b) take care for the safety of all persons entitled to be on the Site,
- (c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
- (d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Schedule 15 (Article 6) [BUIDCO's Taking Over], and
- (e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

3.8. Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the BUIDCO. The Concessionaire shall take reasonable precautions to prevent Concessionaire's Personnel or other persons from removing or damaging any of these findings.

The Concessionaire shall, upon discovery of any such finding, promptly give notice to the Project Engineer, who shall issue instructions for dealing with it. If the Concessionaire suffers delay and/or incurs Cost from complying with the instructions, the Concessionaire shall give a further notice to the Project Engineer and shall be entitled subject to Sub-Clause 1.9 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under GCC clause 2.3.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this further notice, the Project Engineer shall proceed in accordance with GC Section 7.2.6 to agree or determine these matters.

ARTICLE 4. OBLIGATIONS OF THE BUIDCO

4.1. BUIDCO's Assistance to the Concessionaire

The BUIDCO shall use reasonable efforts to,

- (a) provide the Concessionaire, Subcontractors and Concessionaire's Personnel with work permits and such other documents as shall be necessary to enable the Concessionaire, Subcontractors or Concessionaire's Personnel to perform the Services;
- (b) arrange for Concessionaire's Personnel and, if appropriate, their eligible dependants to obtain promptly all necessary entry and exit visas, residence permits, exchange permits and any other documents required for their stay in the Country;
- (c) Facilitate the prompt clearance through customs of any property required for the Services and of the personal effects of the Concessionaire's Personnel and their eligible dependants; and
- (d) Issue to officials, agents and representatives of the BUIDCO 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 Sewerage Network

the BUIDCO 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. The BUIDCO shall provide the Concessionaire, free of charge, full possession of the Site and the Sewerage Network during the term of the Contract.

4.3. Reviews and Approvals of Submissions

- (1) Except as otherwise provided in the Contract, if the Concessionaire submits a plan, report or other documentation to the BUIDCO in writing, and the BUIDCO, or the Project Engineer, is required to approve that submission, the Project Engineer as applicable, shall review and either approve or provide written comment on the Concessionaire's submission no later than 14 days after the day of submission by the Concessionaire to the Project Engineer.
- (2) If the Project Engineer, as applicable, fails to approve or refuses to approve the Concessionaire's submission in accordance with GC Section 4.3(1), the Concessionaire shall notify the BUIDCO in writing that it has not received a response to its submission.
- (3) If the Project Engineer, as applicable, fails to respond to the Concessionaire's written notification pursuant to GC Section 4.3(2) within 14 days after the receipt by the Project Engineer, as applicable, of the Concessionaire's written notification, the Concessionaire'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 Concessionaire and accepted by the BUIDCO while awarding the Contract. These prices have been incorporated in Schedule 18 of the Contract.
- (2) Subject to GC Section 9.7, the Concessionaire 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, Successful Commissioning, Operation & Maintenance of the Sewerage Network Facilities in accordance with the provisions of this Contract.

5.2. Terms of Payment

- (1) The Contract Price shall be paid as specified in SCC Clause 17.
- (2) No payment made by the BUIDCO/NMCG herein shall be deemed to constitute acceptance by the BUIDCO of the Sewerage Network or any part thereof.
- (3) In the event that the BUIDCO/NMCG fails to make any payment by its respective due date or within the period of 60 days, the BUIDCO/NMCG shall pay to the Concessionaire interest on the amount of such delayed payment at the rate shown in the SCC and as specified in the SCC for the period of delay until payment has been made in full.
- (4) The currency or currencies in which payments are made to the Concessionaire under this Contract shall be specified in the SCC, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Concessionaire's Bid.
- (5) All payments shall be made in the currency or currencies specified in the Article 2 of the Contract.
- (6) if the Concessionaire was, or is, failing to perform any ESHS obligations or work under the Contract, the value of this work or obligation, as determined by the Project Engineer, may be withheld until the work or obligation has been performed, and/or the cost of rectification or replacement, as determined by the Project Engineer, may be withheld until rectification or replacement has been completed. Failure to perform includes, but is not limited to the following:
 - (i) failure to comply with any ESHS obligations or work described in the Works' Requirements which may include: working outside site boundaries, excessive dust, failure to keep public roads in a safe usable condition, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archaeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion;

- (ii) failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ESHS issues, or anticipated risks or impacts;
- (iii) failure to implement the C-ESMP;
- (iv) failing to have appropriate consents/permits prior to undertaking Works or related activities;
- (v) failure to submit ESHS report/s (as described in Appendix 1 of Schedule 15 (Design Build Services), or failure to submit such reports in a timely manner;
- (vi) failure to implement remediation as instructed by the Project Engineer within the specified timeframe (e.g. remediation addressing non-compliance/s).

5.3. Performance Incentive Compensation

If the BUIDCO/NMCG intends to pay the Concessionaire performance incentive compensation, the BUIDCO/NMCG will pay such compensation at the end of the Operations Period and in accordance with the Performance Incentive Compensation Schedule 25.

5.4. Liquidated Damages - Operations

The Concessionaire shall pay the BUIDCO/NMCG liquidated damages for failure to meet Technical Standards as set out in the Schedule 16 – Operations and Maintenance Services and Schedule 20 – Liquidated Damages Operations Schedule.

5.5. Securities

5.5.1. Performance Security

- (1) The Concessionaire shall each provide a security for the Concessionaire's proper performance of the Contract to the BUIDCO/NMCG no later than the date specified in the Bidding Documents (the "Sewerage Network Performance Security").
- (2) The Sewerage Network Performance Security shall be,
 - (a) in the amount specified in the SCC;
 - (b) denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the BUIDCO/NMCG ; and
 - (c) shall be in the form specified in the Bidding Documents or in another form approved by the BUIDCO/NMCG .
- (3) The Sewerage Network Performance Security is a bank guarantee and shall be issued by either,
 - (a) a bank or insurance company located in the Country; or

- (b) a foreign bank or insurance company through a correspondent bank or insurance company located in the Country.
- (4) The Sewerage Network Performance Security shall be valid until 180 days after the End Date, or any extension to the End Date.
- (5) The BUIDCO shall return the Sewerage Network Performance Security no later than 14 days after its expiration.
- (6) The cost of complying with this GC Section 5.5.1 shall be borne by the Concessionaire.

5.5.2. Advance Payment Security

- (1) The Concessionaire shall provide a security in an amount equal to the advance payment calculated in accordance with the Terms and Procedures of Payment Schedule and in the same currency or currencies.
- (2) The mobilization advance paid to the Concessionaire by the owner shall be recovered commencing from the date on which the payment to the Concessionaire has reached 25% of the Part A price and shall be fully recovered by completion of 90% of the time for completing the works under Part A.

5.6. Taxes and Duties

- (1) Except as otherwise specifically provided in the Contract, the Concessionaire shall bear and pay all taxes including GST, duties, levies and charges (the "Taxes") assessed on the Concessionaire, its Sub-Contractors or their employees by all municipal, state or national government authorities in connection with the Services in and outside of the Country.
- (2) ~~Service Tax if applicable shall be reimbursed by the owner against evidence of applicability and payment.~~
- (3) ~~If any tax exemptions, reductions, allowances or privileges and benefits may be available to the Concessionaire in the Country, the same shall be passed on by the operator to the Owner.~~

ARTICLE 6. COPYRIGHT : DESIGN-BUILD DOCUMENTS

6.1. Copyright – Design-Build Documents

- (1) As between the Parties, the Concessionaire shall retain the copyright and other intellectual property rights in the Design-Build Documents made by or on behalf of the Concessionaire.
- (2) The Concessionaire shall be deemed, by signing the Contract, to give the BUIDCO a no 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 Sewerage Network;
 - (b) entitle any person in proper possession of the relevant part of the Site or Sewerage Network to copy, use and communicate the Design-Build Documents for the purposes of completing, managing, operating, maintaining, altering, adjusting, and repairing the Sewerage Network;
 - (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 Sewerage Network and other places as envisaged by the Contract, including replacements of any computers supplied by the Concessionaire; and
 - (d) entitle the BUIDCO to make the Design-Build Documents available for inspection by a prospective bidder who may be involved in the process to select a Subsequent Concessionaire.
- (3) The BUIDCO shall not, without the Concessionaire's consent, use, copy or communicate the Design-Build Documents to a Third Party by, or on behalf of, the BUIDCO for purposes other than those permitted under GC Section 6.1(2).

6.2. Confidentiality

- (1) The Concessionaire shall keep confidential and shall not, without the written consent of the BUIDCO, 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 6.2(1), the Concessionaire may furnish to its Sub-Contractors such documents, data and other information to the extent required for the Sub-Contractors to perform their work under the Contract, in which event the Concessionaire shall obtain from such Sub-Contractors an undertaking of confidentiality similar to that imposed on the Concessionaire under this GC Section 6.2(1).

- (2) The Concessionaire shall not use such documents, data and other information received from the BUIDCO for any purpose other than the Services as are required for the performance of the Contract. The Concessionaire shall not publish, permit to be published, or disclose any particulars of the Services, Site or Sewerage Network in any trade or technical paper or advertising materials without the prior written consent of the BUIDCO.
- (3) The obligations of the Concessionaire under GC Sections 6.2(1) and 6.2(2), shall not apply to that information which,
 - (a) now or hereafter enters the public domain through no fault of the Concessionaire;
 - (b) can be proven to have been possessed by the Concessionaire at the time of disclosure and which was not previously obtained, directly or indirectly, from the BUIDCO; or
 - (c) otherwise lawfully becomes available to the Concessionaire from a Third Party that has no obligation of confidentiality.

ARTICLE 7. CONTRACT ADMINISTRATION AND SUPERVISION DURING THE DESIGN-BUILD AND OPERATIONS 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 Operations Starting Date, the Design-Build Supervision approach will be put in place by the BUIDCO; and
- (b) from the Operations Starting Date until the End Date, the Operations Supervision approach will be put in place by the BUIDCO.

7.2. Design-Build Supervision

7.2.1. Supervision during the Design-Build Period

GC Section 7.2 shall apply only during the Design-Build Period.

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

- (1) The BUIDCO shall appoint the Project Engineer who shall be responsible for day to day contract management and supervision during the Design-Build Period. The Project Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.
- (2) The Project Engineer shall have no authority to amend the Contract.
- (3) Except, as specifically provided otherwise in the Contract, the Project Engineer may exercise the authority attributable to the Project Engineer as specified in or necessarily to be implied from the Contract. The BUIDCO undertakes not to impose further constraints on the Design-Build Engineer's authority, except as agreed with the Concessionaire.
- (4) If the Project Engineer is obligated to obtain the approval of the BUIDCO before exercising a specific authority, these restrictions shall be set out in the SCC. If the Project Engineer exercises a specified authority for which the BUIDCO's approval is required then, for the purposes of the Contract, the BUIDCO shall be deemed to have given approval.
- (5) Except as otherwise stated in the Contract,
 - (a) if the Project Engineer carries out duties or exercises authority, specified in or implied by the Contract, the Design-Build Engineer shall be deemed to act for the BUIDCO;
 - (b) the Project Engineer 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 Project Engineer, including absence of disapproval, shall not relieve the Concessionaire from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.

7.2.3. Delegation by the Project Engineer

- (1) The Project Engineer 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 Project Engineer shall not delegate the authority to determine any matter in accordance with GC Section 7.2.6.
- (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 1.3.1.
- (3) Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Concessionaire 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 Project Engineer. 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 Project Engineer to reject the work or the Plant and Equipment; and
 - (b) if the Concessionaire questions any determination or instruction of an assistant, the Concessionaire may refer the matter to the Project Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

7.2.4. Instructions of the Project Engineer

- (1) The Project Engineer may issue to the Concessionaire, 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 Concessionaire shall only take instructions from the Project Engineer, or from an assistant to whom the appropriate authority has been delegated under GC Section 10.1.
- (2) The Concessionaire shall comply with the instructions given by the Project Engineer or delegated assistant, on any matter related to the Contract. These instructions shall be given in writing.

7.2.5. Replacement of the Project Engineer

If the BUIDCO/NMCG intends to replace the Project Engineer, the BUIDCO/NMCG shall, not less than 42 days before the intended date of replacement, give notice to the Concessionaire of the name, address and relevant experience of the intended replacement Project Engineer. The BUIDCO shall not replace the Project Engineer with a person against whom the Concessionaire raises reasonable objection by notice to the BUIDCO, with supporting particulars.

7.2.6. Determinations by the Project Engineer

- (1) Whenever the Contract provides that the Project Engineer shall proceed in accordance with this GC Section 7.2.6 to agree or determine any matter, the Project Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Project Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.
- (2) The Project Engineer 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 1.9.

7.3. Operations Supervision

7.3.1. Supervision during the Operations Period

This GC Section 7.3 shall apply only during the Operations Period and the period of time immediately after the End Date solely for the purpose of resolving transition issues and any outstanding issues arising during the Operations Period.

- 7.3.2. The BUIDCO shall appoint its Representative for supervision of the “Operations’ during the O & M period in accordance with SCC clause 8.1.1 (1) (b).

ARTICLE 8. REPRESENTATIVES, STAFF AND SUBCONTRACTING

8.1. Representatives

8.1.1. BUIDCO's Representative

- (1) The BUIDCO's representative (the "BUIDCO's Representative") shall be as follows:
 - (a) during the Design-Build Period, the BUIDCO's Representative shall be the Project Engineer; and
 - (b) during the Operations Period, the BUIDCO's Representative shall be the as mentioned in SCC
- (2) The BUIDCO shall name its representative,
 - (a) no later than 14 days after the Effective Date for the Project Engineer; and
- (3) The BUIDCO may change its representative from time to time and shall give notice of the change without delay. The BUIDCO shall not change its representative at a time and in such a manner as to impede the progress of either the Design-Build Services or the Operations Services.
- (4) The BUIDCO's Representative shall represent and act for the BUIDCO at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract by the BUIDCO shall be given by the Project Engineer as applicable, except as herein otherwise provided.
- (5) All notices, instructions, information and other communications given by the Concessionaire to the BUIDCO under the Contract shall be given to the Project Engineer as applicable, except as herein otherwise provided.

8.1.2. Concessionaire's Representative

- (1) If the Concessionaire's representative is not named in the SCC, the Concessionaire shall name its representative (the "Concessionaire's Representative") no later than 14 days after the Effective Date and shall request the BUIDCO to approve the proposed Concessionaire's Representative. If the BUIDCO makes no objection to the proposed Concessionaire's Representative, the Concessionaire's Representative shall be deemed to have been approved.
- (2) If the BUIDCO objects to the proposed Concessionaire's Representative before the expiration of 14 days after the proposal, the Concessionaire shall propose a replacement no later than 14 days after receiving the BUIDCO's objection and reasons for the objection and GC Section 8.1.2(1) shall apply to the proposed replacement.
- (3) The Concessionaire's Representative shall represent and act for the Concessionaire at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract by the Concessionaire shall be given by the Concessionaire's Representative, except as herein otherwise provided.

- (4) All notices, instructions, information, and other communications given by the BUIDCO to the Concessionaire under the Contract shall be given to the Concessionaire's Representative as established pursuant to this GC Section 8.1.2.
- (5) The Concessionaire shall not revoke the appointment of the Concessionaire's Representative without the BUIDCO's prior written consent, which shall not be unreasonably withheld. If the BUIDCO consents thereto, the Concessionaire shall appoint some other person as the Concessionaire's Representative, pursuant to the procedure set out in this GC Section 8.1.2.
- (6) The Concessionaire's Representative may, subject to the approval of the BUIDCO, 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 Concessionaire'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 the BUIDCO and the Design-Build Engineer.
- (7) Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with GC Section 8.1.2(6) shall be deemed to be an act or exercise by the Concessionaire's Representative.

8.2. Concessionaire's Superintendence

- (1) Throughout the term of the Contract, the Concessionaire 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 Concessionaire'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 Sewerage Network by the Concessionaire and shall be present at the Site or Sewerage Network 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 Sewerage Network, a suitable person shall be appointed to act as his or her deputy.

8.3. Concessionaire's Personnel

- (1) The Concessionaire 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 "Concessionaire's Personnel"). The Concessionaire is encouraged to use local labour that has the necessary skills. The Concessionaire 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 Concessionaire 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 Concessionaire 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 Concessionaire shall at its own expense provide the means of repatriation to all of its and its Subcontractor's 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 Concessionaire defaults in providing such means of transportation and temporary maintenance, the BUIDCO may provide the same to such personnel and recover the cost of doing so from the Concessionaire.
- (5) The Concessionaire 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 Concessionaire shall, in all dealings with its labour and the labour of its Sub-Contractors 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 Concessionaire's Personnel

The BUIDCO or Design-Build Engineer may require the Concessionaire to remove and replace any member of the Concessionaire'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 the BUIDCO reasonable cause to be dissatisfied with him or her, undertakes behaviour which breaches the Code of Conduct (ESHS) (e.g. spreading communicable diseases, sexual harassment, gender based violence, illicit activity or crime)."

8.5. Existing Staff

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

8.6. Sub-Contractors

- (1) The Concessionaire shall not enter into any contract or contracts that will result in the Concessionaire exceeding the maximum percentage of subcontracting permitted by the BUIDCO in respect of the Design-Build Services and the Operations Services, as set out in the Bidding Documents.
- (2) Except with respect to the Sub-Contractors named in the Concessionaire's Bid, the Concessionaire shall not enter into a contract with any Sub-Contractor without the prior consent of the BUIDCO.
- (3) The Concessionaire shall be responsible for the observance by Sub-Contractors of the terms and conditions of the Contract and shall ensure that all relevant terms of the Contract are included in the Concessionaire's contracts with Sub-Contractors.
- (4) Subcontracting by the Concessionaire shall not relieve the Concessionaire of any of its obligations under the Contract and the Concessionaire shall be responsible for the acts, omissions and defaults of all Sub-Contractors, and the Sub-Contractors, employees, agents and sub-Sub-Contractors, as fully as if they were acts, omissions or defaults of the Concessionaire or the Concessionaire's Personnel.

ARTICLE 9. LIABILITY AND RISK DISTRIBUTION

9.1. Deleted

9.2. Limitation of Liability

Except in cases of criminal negligence or wilful misconduct,

- (a) the Concessionaire shall not be liable to the BUIDCO 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 Concessionaire to pay liquidated damages to the BUIDCO; and
- (b) the aggregate liability of the Concessionaire to the BUIDCO, whether under the Contract, in tort or otherwise, shall not exceed the aggregate of the total Contract Price (including the Monthly payment during the Operations Period) and the total available Performance Incentive Compensation, provided that this limitation shall not apply to any obligation of the Concessionaire to indemnify the BUIDCO 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 the BUIDCO upon delivery at the Site.
- (2) Ownership of the Plant and Equipment procured in the Country shall be transferred to the BUIDCO 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 Sewerage Network shall revert to the Concessionaire upon Completion of the Sewerage Network or such earlier time if the BUIDCO and the Concessionaire agree that the Plant and Equipment in question are no longer required for the Sewerage Network.
- (4) Subject to GC Section 9.3.1(5), ownership of the Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations), including spare parts, shall remain with the Concessionaire or its Sub-Contractors.
- (5) The BUIDCO may, in its sole discretion, purchase as of the End Date any of the Concessionaire's Equipment (Operations), including spare parts, at the fair market value of such Concessionaire's Equipment (Operations) as determined by an independent valuator and the Concessionaire shall transfer ownership and possession of such Concessionaire's Equipment (Operations) to the BUIDCO 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, Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations), together with the risk of loss or damage thereto, shall remain with the Concessionaire pursuant to GC Section 9.4 until the End Date.

9.3.2. (Existing Equipment and Materials) Deleted

9.4. Care of the Site and Sewerage Network

- (1) Except as provided in GC Sections 9.9 and 9.4(2), the Concessionaire shall be responsible for the care and custody of the Site and Sewerage Network 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 Sewerage Network from any cause whatsoever during such period. The Concessionaire shall also be responsible for any loss or damage to the Site or Sewerage Network caused by the Concessionaire or its Sub-Contractors in the course of any work carried out, pursuant to GC Section 9.1.
- (2) If any loss or damage occurs to the Site or Sewerage Network or any part thereof by reason of,
 - (a) insofar 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 Concessionaire 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 9.6;
 - (b) any use or occupation by the BUIDCO or any Third Party, other than a Sub-Contractor, authorized by the BUIDCO of any part of the Site or Sewerage Network; or
 - (c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the BUIDCO, or any such matter for which the Concessionaire has disclaimed responsibility herein,

the BUIDCO shall pay to the Concessionaire all sums payable in respect of the Site executed, notwithstanding that the same be lost, destroyed or damaged. If the BUIDCO requests the Concessionaire in writing to make good any loss or damage to the Plant thereby occasioned, the Concessionaire shall make good the same at the cost of the BUIDCO in accordance with GC Section 10.1. If the BUIDCO does not request the Concessionaire in writing to make good any loss or damage to the Sewerage Network thereby occasioned, the BUIDCO shall either request a change in accordance with GC Section 10.1, excluding the performance of that part of the Sewerage Network thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Sewerage Network, the BUIDCO shall terminate the Contract pursuant to GC Section 11.2.1.

- (3) The Concessionaire shall be liable for any loss of or damage to any Concessionaire's Equipment (Design-Build), Concessionaire's Equipment (Operations) or any other property of the Concessionaire used or intended to be used for purposes of the Site or the Sewerage Network, except where such loss or damage arises by reason of any of the matters specified in GC Sections 9.4(2)(b) and 9.9.
- (4) With respect to any loss or damage caused to the Sewerage Network or any part thereof, the Concessionaire's Equipment (Design-Build) or the Concessionaire's Equipment (Operations) by reason of any of the matters specified in GC Section 9.9(1), the provisions of GC Section 9.9(3) shall apply.

9.5. Indemnification

- (1) Subject to GC Section 9.5(5), the Concessionaire shall indemnify and hold harmless the BUIDCO 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 Concessionaire's performance of the Services and by reason of the negligence of the Concessionaire or its Sub-Contractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the BUIDCO, its Concessionaires, employees, officers or agents.
- (2) If any proceedings are brought or any claim is made against the BUIDCO that might subject the Concessionaire to liability under GC Section 9.5(1), the BUIDCO shall promptly give the Concessionaire a notice thereof and the Concessionaire may at its own expense and in the BUIDCO's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

- (3) If the Concessionaire fails to notify the BUIDCO prior to the expiration of 30 days after receipt of a notice given pursuant to GC Section 9.5(2) that it intends to conduct any such proceedings or claim, then the BUIDCO shall be free to conduct the same on its own behalf. Unless the Concessionaire has so failed to notify the BUIDCO within the 30 day period, the BUIDCO shall make no admission that may be prejudicial to the defence of any such proceedings or claim.
- (4) The BUIDCO shall, at the Concessionaire's request, provide all available assistance to the Concessionaire in conducting such proceedings or claim, and shall be reimbursed by the Concessionaire for all reasonable expenses incurred in so doing.
- (5) The BUIDCO shall indemnify and hold harmless the Concessionaire and its employees, officers and Sub-Contractors from any liability for loss of or damage to property of the BUIDCO that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GC Section 9.6, provided that such fire, explosion or other perils were not caused by any act or omission of the Concessionaire.
- (6) The Party entitled to the benefit of an indemnity under this GC Section 9.5 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

9.6. Insurance

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

9.7. Unforeseeable Physical Conditions

- (1) In this GC Section 9.7, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Concessionaire encounters at the Site when performing of the Design-Build Services, including sub-surface and hydrological conditions but excluding climatic conditions.
- (2) If the Concessionaire encounters adverse physical conditions which it considers to have been Unforeseeable, the Concessionaire shall give notice to the Project Engineer as soon as practicable.
- (3) The Concessionaire's Notice pursuant to GC Section 9.7(2) shall describe the physical conditions, so that they can be inspected by the Project Engineer, and shall set out the reasons why the Concessionaire considers them to be Unforeseeable. The Concessionaire 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 Project Engineer may give. If an instruction constitutes a Change GC Section 10.1.3 shall apply.

- (4) If and to the extent that the Concessionaire encounters physical conditions which are Unforeseeable, gives the notice required by GC Section 9.7(2), and suffers delay or incurs Cost due to these conditions, the Concessionaire shall be entitled subject to GC Section 1.9 to,
 - (a) an extension of time for any such delay, if completion is or will be delayed, under GC Section 2.3.4; 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 Project Engineer shall proceed in accordance with GC Section 7.2.6 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 9.7(4).
- (6) Before additional Cost is finally agreed or determined under GC Section 9.7(5), the Project Engineer, pursuant to GC Section 7.2.6, may also review whether other physical conditions were more favourable than could reasonably have been foreseen when the Concessionaire submitted the Bid. If and to the extent that these more favourable conditions were encountered, the Project Engineer may proceed in accordance with GC Section 7.2.6 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 9.7(4)(b) 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 Project Engineer may take account of any evidence of the physical conditions foreseen by the Concessionaire when submitting the Bid, which may be made available by the Concessionaire, 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 the BUIDCO or of the Concessionaire, 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 9.8(2) if the conditions set out in GC Section 9.8(1)(a) and (b) 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 2.3.4(1) for events of Force Majeure during the Design-Build Period. If the Time for Completion is extended in accordance with GC Section 2.3.4(1), 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 9.8(7) and 9.9(6).
- (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 9.4(2), 9.9(3) and 9.9(5), 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 9.9(6).
- (8) In the event of termination pursuant to GC Section 9.8(7), the rights and obligations of the BUIDCO and the Concessionaire shall be as specified in GC Sections 11.2.1(2) and 11.2.2(1).
- (9) Notwithstanding GC Section 9.8(6), Force Majeure shall not apply to any obligation of the BUIDCO to make payments to the Concessionaire herein.

9.9. War Risks

- (1) "War Risks" shall mean any event specified in GC Section 9.8(2)(a) and (b) 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 Concessionaire 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 the BUIDCO 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 the BUIDCO shall indemnify and hold the Concessionaire 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, Sewerage Network or any Plant and Equipment, Concessionaire's Equipment (Design-Build), Concessionaire's Equipment (Operations) or any other property of the Concessionaire used or intended to be used for the purposes of the Services sustains destruction or damage by reason of any War Risks, the BUIDCO shall pay the Concessionaire for,
 - (a) any part of the Sewerage Network or the Plant and Equipment so destroyed or damaged, to the extent not already paid for by the BUIDCO;
 - (b) replacing or making good any Concessionaire's Equipment (Design-Build), Concessionaire's Equipment (Operations) or other property of the Concessionaire so destroyed or damaged; and

- (c) so far as may be required by the BUIDCO, and as may be necessary for completion of the Services, replacing or making good any such destruction or damage to the Site, Sewerage Network or the Plant and Equipment or any part thereof.
- (4) If the BUIDCO does not require the Concessionaire to replace or make good any such destruction or damage to the Site or Sewerage Network, the BUIDCO shall either request a Change in accordance with GC Section 10.1 excluding the performance of that part of the Sewerage Network thereby destroyed or damaged or, where the loss, destruction or damage affects a substantial part of the Site or Sewerage Network, shall terminate the Contract, pursuant to GC Section 11.2.1.
- (5) Notwithstanding anything contained in the Contract, the BUIDCO shall pay the Concessionaire 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 Concessionaire notifies the BUIDCO 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 Concessionaire, the Concessionaire shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Sub-Contractors' 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 9.9(4) or 9.9(6), the rights and obligations of the BUIDCO and the Concessionaire shall be as specified in GC Section 11.2.1(2) and 11.2.2(1).

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 Country, 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 Concessionaire 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 Concessionaire 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 Concessionaire

The Concessionaire shall indemnify and hold harmless the BUIDCO 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 the BUIDCO may suffer as a result of any infringement or alleged infringement by the Concessionaire, 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 the BUIDCO arising out of the matters referred to in GC Section 9.11.1, the BUIDCO shall promptly give the Concessionaire a notice thereof, and the Concessionaire may at its own expense and in the BUIDCO's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.
- (2) If the Concessionaire fails to notify the BUIDCO no later than 30 days after receipt of such notice that it intends to conduct any such proceedings or claim, then the BUIDCO shall be free to conduct the same on its own behalf. Unless the Concessionaire has so failed to notify the BUIDCO no later than the 30 day period, the BUIDCO shall make no admission that may be prejudicial to the defence of any such proceedings or claim.
- (3) The BUIDCO shall, at the Concessionaire's request, give all available assistance to the Concessionaire in conducting such proceedings or claim, and shall be reimbursed by the Concessionaire for all reasonable expenses incurred in so doing.

9.11.3. Indemnity by BUIDCO

The BUIDCO shall indemnify and hold harmless the Concessionaire and its employees, officers and Sub-Contractors 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 Concessionaire may suffer as a result of any infringement or alleged infringement by the BUIDCO 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 the BUIDCO.

9.12. Functional Guarantees

- (1) The Concessionaire guarantees that during the Tests and Inspection set out in DBSS Article 5, the Sewerage Network and all parts thereof shall attain the Functional Guarantees as required.
- (2) If, for reasons attributable to the Concessionaire, the minimum level of the Functional Guarantees are not met either in whole or in part, the Concessionaire shall at its cost and expense make any such changes, modifications or additions to the Sewerage Network or any part thereof as may be necessary to meet at least the minimum level of the Functional Guarantees. The Concessionaire shall notify the BUIDCO upon completion of the necessary changes, modifications or additions, and shall request the BUIDCO to repeat the applicable Tests and Inspection until the minimum level of the Functional Guarantees has been met. If the Concessionaire eventually fails to meet the minimum level of Functional Guarantees, the BUIDCO may consider termination of the Contract, pursuant to GC Section 11.2.3.
- (3) If, for any reasons attributable to the Concessionaire, the Functional Guarantees are not attained either in whole or in part, but the minimum level of the Functional Guarantees is met, the Concessionaire shall, at the Concessionaire's option, either
 - (a) make such changes, modifications or additions to the Sewerage Network or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the BUIDCO to repeat the Tests and Inspection; or
 - (b) pay liquidated damages to the BUIDCO in respect of the failure to meet the Functional Guarantees in accordance with the provisions of the Liquidated Damages.

The payment of liquidated damages under GC Section 9.12(3) up to the limitation of liability specified in the SCC, shall completely satisfy the Concessionaire's guarantees under GC Section 9.12(3), and the Concessionaire shall have no further liability whatsoever to the BUIDCO in respect thereof.

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 10.1.2(6) and 10.1.2(10), the BUIDCO shall have the right to propose, and subsequently require, that the Project Engineer order the Concessionaire 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 Concessionaire may from time to time during its performance of the Contract propose to the BUIDCO, with a copy to the Project Engineer, any Change that the Concessionaire considers necessary or desirable to improve the quality, efficiency or safety of the Design-Build Services. The BUIDCO may at its discretion approve or reject any Change proposed by the Concessionaire.
- (3) Notwithstanding GC Section 10.1.1(1) and 10.1.1(2), no change made necessary because of any default of the Concessionaire 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 10.1.2 and 10.1.3, and the Project Engineer shall provide Concessionaire with further details and sample forms on the Change procedures prior to the Design-Build Starting Date.

10.1.2. Changes Originating from BUIDCO

- (1) If the BUIDCO proposes a Change pursuant to GC Section 10.1.1(1), it shall send to the Concessionaire a "Request for Change Proposal," requiring the Concessionaire to prepare and furnish to the Project Engineer 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 Concessionaire shall submit to the Project Engineer 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 Concessionaire's Estimate for Change Proposal, the BUIDCO shall,

- (a) accept the Concessionaire's estimate with instructions to the Concessionaire to proceed with the preparation of the Change Proposal;
 - (b) advise the Concessionaire of any part of its Estimate for Change Proposal that is unacceptable and request the Concessionaire to review its estimate; or
 - (c) advise the Concessionaire that the BUIDCO does not intend to proceed with the Change.
- (4) Upon receipt of the BUIDCO's instruction to proceed under GC Section 10.1.2(3)(a) (the "Change Order"), the Concessionaire shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GC Section 10.1.2(1).
- (5) The pricing of any Change shall, as far as practicable, be calculated in accordance with the prices included in the Contract. If such prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change.
- (6) If, before or during the preparation of the Change Proposal, it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Concessionaire under this GC Section 10.1 would be to increase or decrease the Contract Price by more than 15 per cent, the Concessionaire may give a written notice of objection thereto prior to furnishing the Change Proposal. If the BUIDCO accepts the Concessionaire's objection, the BUIDCO shall withdraw the proposed Change and shall notify the Concessionaire in writing thereof.
- (7) The Concessionaire's failure to object pursuant to GC Section 10.1.2(6) 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 Concessionaire represents.
- (8) Upon receipt of the Change Proposal, the BUIDCO and the Concessionaire shall mutually agree upon all matters therein contained. No later than 14 days after such agreement, the BUIDCO shall, if it intends to proceed with the Change, issue the Concessionaire with a Change Order.
- (9) If the BUIDCO decides not to proceed with the Change for whatever reason, it shall notify the Concessionaire prior to the expiration of 14 days after the agreement on the Change. Under such circumstances, the Concessionaire 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 Concessionaire in its Estimate for Change Proposal submitted in accordance with GC Section 10.1.2(2).

- (10) If the BUIDCO and the Concessionaire cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the BUIDCO may nevertheless instruct the Concessionaire to proceed with the Change by issue of a “Pending Agreement Change Order.”
- (11) Upon receipt of a Pending Agreement Change Order, the Concessionaire shall immediately proceed with effecting the Changes covered by such Order. The parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.
- (12) If the Parties cannot reach agreement prior to the expiration of 60 days after the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Adjudicator in accordance with the provisions of GC Section 1.6.1.

10.1.3. **Changes Originating from Concessionaire**

- (1) If the Concessionaire proposes a Change pursuant to GC Section 10.1.1(2), the Concessionaire shall submit to the Project Engineer a written “Application for Change Proposal,” giving reasons for the proposed Change and including the information specified in GC Section 10.1.2(1).
- (2) Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GC Sections 10.1.2(8) and 10.1.2(10). If the BUIDCO chooses not to proceed, the Concessionaire shall not be entitled to recover the costs of preparing the Application for Change Proposal.

10.1.4. **Payment in Applicable Currencies**

If the Contract provides for payment of the Contract Price in more than one currency, then whenever a Change is agreed, approved or determined pursuant to GC Section 10.1.2 or 10.1.3, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the Change, and to the proportions of various currencies specified for payment of the Contract Price.

10.1.5. **Design-Build Period**

GC Sections 10.1.1 to 10.1.4 shall apply during only the Design-Build Period.

10.2. Change to the Operations Services

- (1) Except as specifically provided in GC Section 10.2(2) or elsewhere in the Contract, the Concessionaire shall make no claim whatsoever for any adjustment to the Contract Price during the Operations Period.

- (2) The Concessionaire or the BUIDCO may request an adjustment to the Monthly O & M Payment if the total sewer length to be maintained exceeds 2% of the total sewer length included originally in the Contract. In the event of such a change to the volume of sewage, the Concessionaire or the BUIDCO, as applicable, shall be entitled to receive an increase or decrease equal to the actual increase or decrease in Cost demonstrated by the Concessionaire.

ARTICLE 11. SUSPENSION AND TERMINATION

11.1. Suspension

11.1.1. Suspension by the BUIDCO

- (1) The BUIDCO may request the Project Engineer, as applicable, by notice to the Concessionaire, to order the Concessionaire 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 Concessionaire shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Site or Sewerage Network, until ordered in writing to resume such performance by the Project Engineer as applicable.
- (2) If, by virtue of a suspension order given by the Project Engineer, as applicable, other than by reason of the Concessionaire's default or breach of the Contract, the Concessionaire'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 Concessionaire may give a notice to the Project Engineer as applicable, requiring that the BUIDCO shall, no later than 30 days after the BUIDCO's receipt of the notice, order the resumption of such performance or request and subsequently order a Change in accordance with GC Section 10.1, excluding the performance of the suspended obligations from the Contract.
- (3) If the BUIDCO fails to order the resumption of performance in accordance with GC Section 11.1.1(2), the Concessionaire may, by a further notice to the Project Engineer, elect to treat the suspension, where it affects a part only of the Services, as a deletion of such part in accordance with GC Section 10.1 or, where it affects the whole of the Services, as termination of the Contract pursuant to GC Section 11.2.1.

11.1.2. Suspension by the Concessionaire

- (1) If, the BUIDCO/NMCG has,
 - (a) failed to pay the Concessionaire any sum due under the Contract within the period specified in the Contract;
 - (b) failed to approve any invoice or supporting documents without just cause under the Contract; or
 - (c) has committed a substantial breach of the Contract,

the Concessionaire may give a notice to the BUIDCO/NMCG that requires payment of such sum, with interest thereon as stipulated in GC Section 5.2(3) requires approval of an invoice or supporting documents, or specifies a breach & requires the BUIDCO to remedy the same, as the case may be.

- (2) If the BUIDCO/NMCG fails to pay the sums required by the Concessionaire in accordance with GC Section 11.1.2(1) or fails to remedy the breach or take steps to remedy the breach no later than 14 days after receipt of the Concessionaire's notice, then the Concessionaire may, upon giving 30 days' notice to the BUIDCO, suspend performance of all or any of its obligations under the Contract, or, in the case of the Design-Build Services, reduce the Concessionaire's rate of progress.
- (3) If the Concessionaire is unable to carry out any of its obligations under the Contract for any reason attributable to the BUIDCO, including the BUIDCO's failure to provide possession of or access to the Site or other areas in accordance with GC Section 4.2, then the Concessionaire may, upon giving 30 days' notice to the BUIDCO, suspend performance of all or any of its obligations under the Contract, or, in the case of the Design-Build Services, reduce the Concessionaire's rate of progress.
- (4) If the Concessionaire's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GC Section 11.1.2, then the Time for Completion shall be extended in accordance with GC Section 2.3.4, and additional Costs incurred by the Concessionaire as a result of such suspension or reduction shall be paid by the BUIDCO to the Concessionaire in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Concessionaire's default or breach of the Contract.
- (5) During the period of suspension, the Concessionaire shall not remove from the Site or Sewerage Network any Plant and Equipment, Concessionaire's Equipment (Design-Build), Concessionaire's Equipment (Operations), or any part of the Sewerage Network, without the prior written consent of the BUIDCO.

11.2. Termination

11.2.1. Termination for BUIDCO's Convenience

- (1) The BUIDCO may at any time terminate the Contract for any reason by giving the Concessionaire a notice of termination that refers to this GC Section 11.2.1(1).
- (2) Upon receipt of the notice of termination under GC Section 11.2.1(1),
 - (a) the Concessionaire shall, either immediately or upon the date specified in the notice of termination,
 - (i) cease all further work, except for such work as the BUIDCO 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;
 - (ii) terminate all Subcontracts; and
 - (iii) remove all Concessionaire's Equipment (Design-Build) and, except if the BUIDCO asserts its rights pursuant to GC Section 9.3.1(5), Concessionaire's Equipment (Operations) from the Site, repatriate the Concessionaire's Personnel and

- its Sub-Contractors' 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 Concessionaire, subject to the payment specified in GC Section 11.2.2, shall,
 - (i) deliver to the BUIDCO the parts of the Sewerage Network executed by the Concessionaire and all materials which have been paid for by the BUIDCO up to the date of termination; and
 - (ii) deliver to the BUIDCO all the Contract Records, including the Design-Build Documents, prepared by the Concessionaire or its Sub-Contractors as at the date of termination.

11.2.2. Payment upon Termination by the BUIDCO for Convenience

- (1) Upon termination of this Contract pursuant to GC Section 11.2.1, the BUIDCO shall make only the following payments to the Concessionaire,
 - (a) any portion of the Contract Price payable to the Concessionaire for Services satisfactorily performed prior to the date of termination and calculated as set out in GC Section 5.2;
 - (b) the Costs reasonably incurred by the Concessionaire in the removal of the Concessionaire's Equipment (Design-Build) and, except if the BUIDCO asserts its rights pursuant to GC Section 9.3.1(5), Concessionaire's Equipment (Operations) from the Site and in the repatriation of the Concessionaire's Personnel and its Sub--Contractors' personnel;
 - (c) any amounts required to be paid by the Concessionaire to its Sub-Contractors in connection with the termination of any Subcontracts, including any reasonable cancellation charges;
 - (d) the reasonable Costs incurred by the Concessionaire in protecting the Site, Existing Facility and Sewerage Network and leaving the Site in a clean and safe condition pursuant to GC Section 11.2.1(2)(a)(i); and
 - (e) the reasonable Cost of satisfying all other obligations, commitments and claims that the Concessionaire may in good faith have undertaken with Third Parties in connection with the Contract and that are not covered by GC Section 11.2.2(1).
- (2) The Concessionaire acknowledges that the only payments to be made to the Concessionaire on termination by the BUIDCO are set out in this GC Section 11.2.2. The Concessionaire 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.

11.2.3. Termination for Concessionaire's Default

- (1) The BUIDCO, 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 Concessionaire, referring to this GC Section 11.2.3(1):
 - (a) If the Concessionaire becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Concessionaire 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 Concessionaire takes or suffers any other analogous action in consequence of debt;
 - (b) If the Concessionaire assigns or transfers the Contract or any right or interest therein in violation of the provision of GC Section 1.7;
or
- (2) If the Concessionaire,
 - (a) has abandoned or repudiated the Contract;
 - (b) has without valid reason failed to commence work on the Site or Sewerage Network promptly or has suspended, other than pursuant to GC Section 11.1.1(2), the progress of Contract performance for more than 30 days after receiving a written instruction from the BUIDCO to proceed;
 - (c) Persistently fails to carry out the Services 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 Services,

then the BUIDCO may, without prejudice to any other rights it may possess under the Contract, give a notice to the Concessionaire stating the nature of the default and requiring the Concessionaire to remedy the same. If the Concessionaire fails to remedy or to take steps to remedy the same within 14 days after its receipt of such notice, then the BUIDCO may terminate the Contract forthwith by giving a notice of termination to the Concessionaire that refers to this GC Section 11.2.3(2).

- (3) Upon receipt of the notice of termination under GC Sections 11.2.3(1) or 11.2.3(2) the Concessionaire 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 the BUIDCO may specify in the notice of termination for the sole purpose of protecting that part of the Site and Sewerage Network already executed, or any work required to leave the Site and Sewerage Network in a clean and safe condition;
 - (b) terminate all Subcontracts;
 - (c) deliver to the BUIDCO the parts of the Sewerage Network executed by the Concessionaire up to the date of termination; and

- (d) deliver to the BUIDCO all Contract Records, including the Design-Build Documents, prepared by the Concessionaire or its Sub-Contractors as of the date of termination.
- (4) The BUIDCO may enter the Sewerage Network and upon the Site, expel the Concessionaire, and, if the Sewerage Network is not completed, the BUIDCO may complete the Facility itself or by employing any Third Party. The BUIDCO may, to the exclusion of any right of the Concessionaire over the same, take over and use with the payment of a fair rental rate to the Concessionaire, with all the maintenance costs to the account of the BUIDCO and with an indemnification by the BUIDCO for all liability including damage or injury to persons arising out of the BUIDCO's use of such equipment, any Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations) owned by the Concessionaire and on the Site in connection with the Sewerage Network for such reasonable period as the BUIDCO considers expedient for the completion of the Sewerage Network. Upon completion of the Sewerage Network or at such earlier date as the BUIDCO thinks appropriate, the BUIDCO shall give notice to the Concessionaire that such Concessionaire's Equipment (Design-Build) and, except if the BUIDCO asserts its rights pursuant to GC Section 9.3.1(5), Concessionaire's Equipment (Operations) will be returned to the Concessionaire at or near the Site and shall return such Concessionaire's Equipment (Design-Build) and Concessionaire's Equipment (Operations) to the Concessionaire in accordance with such notice. The Concessionaire shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

11.2.3.1. Corrupt or Fraudulent Practices

If the BUIDCO determines, based on reasonable evidence, that the Concessionaire has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the BUIDCO may, after giving 14 days' notice to the Concessionaire, terminate the Contract and expel him from the Site, and the provisions of Section 11.2 shall apply as if such termination had been made under Section 11.2.3 [Termination for Concessionaire's Default].

Should any employee of the Concessionaire 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 8.4 [Replacement of Concessionaire'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;¹
- (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;²
- (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;³
- (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;⁴
- (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 Bank’s inspection and audit rights provided for under Section 1.8.5 [Inspections and Audits by the Bank].

11.2.4. Payment upon Termination for Concessionaire’s Default

- (1) If the Contract is terminated pursuant to GC Section 11.2.3 and, subject to GC Section 11.2.4(2), the Concessionaire shall be entitled to be paid,
 - (a) any portion of the Contract Price payable to the Concessionaire for Services satisfactorily performed prior to the date of termination;

¹“Another party” refers to a public official acting in relation to the procurement process or contract execution]. In this context, “public official” includes World Bank staff and employees of other organizations taking or reviewing procurement decisions.

²“Party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

³“Parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

⁴“Party” refers to a participant in the procurement process or contract execution

- (b) the value of any unused or partially used Plant and Equipment on the Site, except to the extent that such Plant and Equipment have already been paid for by the BUIDCO; and
- (c) the Costs, if any, incurred by the Concessionaire in protecting the Site and Sewerage Network and in leaving the Site in a clean and safe condition pursuant to GC Section 11.2.3(3)(a).

Any sums due the BUIDCO from the Concessionaire accruing prior to the date of termination shall be deducted from the amount to be paid to the Concessionaire under this Contract.

- (2) If the BUIDCO completes the Sewerage Network pursuant to GC Section 11.2.3(4), the cost of completing the Sewerage Network by the BUIDCO shall be determined, and, if the sum that the Concessionaire is entitled to be paid, pursuant to GC Section 11.2.4(1), plus the reasonable costs incurred by the BUIDCO in completing the Sewerage Network, exceeds the Contract Price, the Concessionaire shall be liable for such excess as follows:
 - (a) if such excess is greater than the sums due the Concessionaire under GC Section 11.2.4(1), the Concessionaire shall pay the balance to the BUIDCO; or
 - (b) if such excess is less than the sums due the Concessionaire under GC Section 11.2.4(1), the BUIDCO shall pay the balance to the Concessionaire.
- (3) The Parties shall agree in writing on the computation described in GC Section 11.2.4(2) and the manner in which any sums shall be paid.

11.2.5. Termination by Concessionaire

- (1) If,
 - (a) the BUIDCO/NMCG has,
 - (i) failed to pay the Concessionaire any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the corresponding Terms and Procedures of Payment Schedule, or commits a substantial breach of the Contract, the Concessionaire may give a notice to the BUIDCO/NMCG that requires payment of such sum, with interest thereon as stipulated in GC Section 5.2(3), requires approval of such invoice or supporting documents, or specifies the breach and requires the BUIDCO to remedy the same, as the case may be; and
 - (ii) failed to pay such sum together with such interest, failed to approve such invoice or supporting documents or give its reasons for withholding such approval, failed to remedy the breach or take steps to remedy the breach no later than 14 days after receipt of the Concessionaire's notice; or

- (b) the Concessionaire is unable to carry out any of its obligations under the Contract for any reason attributable to the BUIDCO/NMCG, including the BUIDCO's failure or NMCG's failure to provide possession of or access to the Site or other areas,

then the Concessionaire may give a notice to the BUIDCO thereof, and if the BUIDCO has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach no later than 30 days after receipt of such notice, or if the Concessionaire is still unable to carry out any of its obligations under the Contract for any reason attributable to the BUIDCO no later than 30 days after receipt of the notice, the Concessionaire may, by a further notice to the BUIDCO referring to this GC Section 11.2.5(1), forthwith terminate the Contract.

- (2) The Concessionaire may terminate the Contract forthwith by giving a notice to the BUIDCO/NMCG to that effect, referring to this GC Section 11.2.5(2),
 - (a) If the BUIDCO/NMCG becomes bankrupt or insolvent;
 - (b) Has a receiving order issued against it, or compounds with its creditors;
 - (c) being a corporation, if a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction; or
 - (d) a receiver is appointed over any part of its undertaking or assets, or if the BUIDCO takes or suffers any other analogous action in consequence of debt.
- (3) If the Contract is terminated under GC Section 11.2.5(1) or 11.2.5(2), then,
 - (a) The Concessionaire shall immediately,
 - (i) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Site and Sewerage Network already executed, or any work required to leave the Site in a clean and safe condition; and
 - (ii) Terminate all Subcontracts; and
 - (b) The Concessionaire, subject to the payment specified in GC Section 11.2.6, shall
 - (i) deliver to the BUIDCO the parts of the Sewerage Network executed by the Concessionaire up to the date of termination; and
 - (ii) deliver to the BUIDCO all Contract Records, including the Design-Build Documents, in existence as of the date of termination.
- (4) Termination by the Concessionaire pursuant to this GC Section 11.2.5 is without prejudice to any other rights or remedies of the Concessionaire that may be exercised in lieu of or in addition to rights conferred by this GC Section 11.2.5.

11.2.6. Payment upon Termination by Concessionaire

If the Contract is terminated under GC Sections 11.2.5(1) or 11.2.5(2), the BUIDCO shall pay to the Concessionaire all payments specified in GC Section 11.2.2(1), and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Concessionaire arising out of, in connection with or in consequence of such termination.

11.2.7. General Provisions - Termination

- (1) In this GC Section 11.2, the expression “Sewerage Network 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 Concessionaire 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 11.2, in calculating any monies due from the BUIDCO to the Concessionaire, account shall be taken of,
 - (a) any sum previously paid by the BUIDCO to the Concessionaire under the Contract, including any advance payment paid pursuant to the Terms and Procedures of Payment Schedule;
 - (b) any sum owing by the Concessionaire to the BUIDCO under the Contract, including Liquidated Damages – Delay or liquidated damages calculated pursuant to GC Section 5.4.

Schedule 14
Special Conditions of Contract

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

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 1.1) – No change.

2. Clause 1.3.1 – Language

The language shall be “**English**”

3. Clause 1.3.14 – 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 Concessionaire’s obligations with respect to Contract Records, accounting and auditing set out in GC Section 1.8;
- (d) The Concessionaire’s obligations with respect to Transition Assistance set out in GC Section 2.4.2;
- (e) The Parties’ rights and obligations with respect to copyright set out in GC Section 6.1;
- (f) The Concessionaire’s obligations of confidentiality as set out in GC Section 6.2;
- (g) The Parties’ rights and obligations with respect to defect liability set out in GC Section 9.1; and
- (h) The Parties’ rights and obligations with respect to indemnification set out in GC Section 9.5

4. Clause 1.4 – Notice

All notices to the relevant party shall be sent to the following address:

- a. Concessionaire

- b. BUIDCO

SFC Building, 2nd floor, Daroga Rai Path

Road no-2, R- Block, Patna 800001

c. NMCG

Major Dhyanchand Stadium, 1st Floor,

Delhi

5. Clause 1.5– Governing Law

The Applicable Law will be the Laws of India as well as the laws prevailing in the State of Bihar .

6. Clause 1.6.1 (4) - Adjudicator

The Adjudicator is: *[To be added at the time of signing of Contract]*
[Name, address, telephone and facsimile numbers]

The adjudicator shall be paid a fee @ Rs. 10000/- per day of effective hearing plus actual expenditure towards travel, transportation, lodging, and boarding. The fees and expenditure shall be shared equally by the Concessionaire and the owner.

7. Clause 1.6.1 (5) - Adjudicator

The authority to appoint new adjudicator shall be with **Chairman, Bihar State Centre, Institution of Engineers (India), Patna.**

8. Clause 1.6.2 – Arbitration

All disputes arising in connection with this contract shall be finally settled under the arbitration rules of the United Nations Commission on International Trade Law (UNICITRAL) by one or more arbitrators appointed in accordance with the rules. However, if the contract is with the domestic Concessionaire arbitration shall be conducted in accordance with the Arbitration & Conciliation Act 1996.

The place of arbitration shall be (i) the location from where the Contract has been issued if the contract is with a domestic Concessionaire, or (ii) a neutral location if the contract is with a foreign Concessionaire. The arbitration shall be conducted in the language for communications defined in GC Clause 1.3.1 [Language].

9. 1.8.5 - Inspections and Audit by the Bank

The existing clause is deleted and replaced with the following Clause:

The Concessionaire shall permit and shall cause its Subcontractors and subconsultants to permit, the Bank and/or persons appointed by the Bank to inspect the Site and/or the accounts and records relating to the performance of the Contract and the submission of the Bid, and to have such accounts and records audited by auditors appointed by the Bank if requested by the Bank. The Concessionaire's and its Subcontractors' and subconsultants' attention is drawn to Clause 11.2.3.1 which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights

provided for under Clause 1.8.5 constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

Article 2: Contract Term, Timing and Completion

10. Clause 2.1.1 – Effectiveness of Contract

The existing clause is deleted and replaced with the following Clause:

This Conditions of the Contract for Sewerage Network Facilities, shall come into force and effect on the date the Digha-Kankarbagh Project Agreement is signed by the BUIDCO, NMCG, and the Concessionaire (the —Effective Date), contingent on final approval by the Bank.

11. Clause 2.1.2 (1) – Expiration of Contract

The Contract shall terminate by End of Concession, as per Concession Agreement.

12. Clause 2.1.3 (2) – Commencement of Services

The “Operations Starting Date”, with respect to the Digha Sewerage Network Facilities, shall be the date of the Operational Acceptance Certificate for the Digha Sewerage Network Facilities and with respect to the Kankarbagh Sewerage Network Facilities, shall be the date of the Operational Acceptance Certificate for the Kankarbagh Sewerage Network Facilities, subject to the Concessionaire having submitted the relevant Sewerage Network Performance Security for the Operations Period in accordance with GCC Clause 5.5.1

13. Clause 2.2 - Design-Build Period and Operations Period

For clarification purposes, the Design-Build Period and Operations Period of Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities shall be different, in accordance with their respective Operations Starting Date

14. Clause 2.3.2 Time for Completion

The Time for completion of the Design – Build Services for Digha Sewerage Network Facilities shall be 32 months from the Effective Date, and for Kankarbagh Sewerage Network Facilities shall be 32 months from the Effective Date, subject to Clause 2.3.4

15. Clause 2.3.3 Design Build Time Schedule

For clarification purposes, the Design-Build Time Schedule of Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities shall be separate, in accordance with their respective Operations Starting Date and Time of Completion

16. Clause 2.3.4 Extension for Time of Completion

For clarification purposes, the Extension for Time of Completion of Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities shall be separate, and extension of one of these Facilities shall not lead to the extension of the other facility.

17. Clause 2.3.6 (2) Delay of Completion - Liquidated Damages- Delay

Time is the essence of the Contract. The Concessionaire shall be liable to pay Liquidated Damages to the BUIDCO/NMCG in accordance with GCC clause 2.3.6 (2) if the Concessionaire fails to achieve various activities/ milestones as tabulated below,

S.N	Activity/Milestone	Target Completion Time for activity from Effective Date	Liquidated damages per day for delay in completion of activity/Milestone
1	2	3	4
1	Completion of works of 10% of Design Build Cost	05months	INR 1,36,000/ or US\$ 2,100
2	Completion of works of 20% (cumulative) of Design Build Cost	10 months	INR 1,36,000/or US\$ 2,100
3	Completion of works of 40% (cumulative) of Design Build Cost	15 months	INR 2,72,000/or US\$ 4,200
4	Completion of works of 60% (cumulative) of Design Build Cost	21 months	INR 2,72,000/or US\$ 4,318
5	Completion of works of 75% (cumulative) of Design Build Cost	25 months	INR 2,00,000 or US\$ 3,100
6	Completion of works of contracted Design-Build Services in all respects	32 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.

16.1 The value of works stipulated in column 2 of the table above excludes the value of materials intended/procured for the works but not used or incorporated in the works.

16.2 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 2.3.4.

16.3 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 Concessionaire, 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 2.3.4.

18. Clause 2.3.6 (2) – Maximum Liquidated Damages – Delay

The maximum Liquidated Damages – Delay shall be 10 % of the value of Design, Build, and Commissioning services (Part A of Price Schedule).

19. Clause 2.3.6 (5)

The existing Clause is deleted and replaced with the following Clause:

If the testing and commissioning of the Sewerage Network occurs prior to the Time for Completion, the Concessionaire shall be entitled to a bonus equal to 0.05% of the Sewerage Network Performance Security for each day by which the Operations Start Date of the Sewerage Network precedes the Time for Completion. For clarification purposes, the bonus of Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities shall be separate, in accordance with their respective Operations Starting Date and Time of Completion

20. Clause 2.4.3 – Extension of the Contract

This clause stands deleted

Article 4: Obligations of the BUIDCO

21. Clause 4.2 – Access to the Site and Sewerage Network

Delete the existing clause and replace it with the following clause:

- (1) The BUIDCO shall be responsible for acquiring and providing legal and physical possession of land subject to a ceiling of approximately 1100Sq.M for the Sewage Pumping Stations at the site of proposed Sewage Pumping Stations 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.
- (2) The BUIDCO shall provide the Concessionaire 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 Concessionaire shall achieve progress of work consistent with the milestones, if laid down in SCC clause 11.
- (3) The Concessionaire 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 Project Engineer or advised by the BUIDCO, so as to minimize the inconvenience to the households and the public over prolonged durations of time.

Article 5: Contract Price and Payment

22. Clause 5.1(3) – Contract Price

Following sub-clauses may be added below Clause 5.1(3):

- (a) **Price Adjustment for Design Build Price**

The prices for the Design Build works and services (Part A of the said price Schedule) shall be subject to price adjustment during the performance of the contract.

(b) Price Adjustment for O&M Price

Price adjustment for the O&M price (Part B of the Concessionaire's Price Schedule incorporated in Schedule 18 of the Contract) payable during the O&M period shall apply and the same shall be determined in accordance with Schedule 21 of the Contract.

23. Clause 5.2 – Terms of Payment

Provisions in Clause 5.2 (1), (3) and (4) shall be replaced with the following clauses:

- (1) The Contract Price shall be paid in accordance with the provisions in Schedule 18 – Concessionaire's Price Schedule and Schedule 19 – Terms and procedures of Payment of the Contract.
- (3) In the event that the BUIDCO/NMCG fails to make any payment by within 60 days from the date of submission of monthly statement of claim in accordance with Schedule 18, the NMCG shall pay to the Concessionaire interest on the amount of such delayed payment at the rate of 10% annually, for the period of delay until payment has been made in full.
- (4) The currency or currencies in which payments are made to the Concessionaire under this Concessionaire shall be as per Concessionaire's Price Schedule incorporated in Schedule 18 of the Contract. In case of NCB, payment shall be made in Indian Rupees.

17. Clause 5.3 - Performance Incentive Compensation

This Clause stands deleted.

18. Clause 5.4 – Liquidated Damages - Operations

The existing Clause is deleted and replaced with the following Clause: The Concessionaire shall pay the BUIDCO?NMCG liquidated damages for failure to meet Performance Standards as set out in the Liquidated Damages – Operations Schedule, i.e. Schedule 20 of the Contract.

19. Clause 5.5.1 (2) (a) and 5.5.1 (4)– Performance Security

The Concessionaire shall provide a Sewerage Network Performance Security for Design-Build Period of 9 % (Nine Percent) and ESHS Performance Security of 1% (One Percent) of the respective Design Build Cost, for each of the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, prior to the Design Build Start Date . The Sewerage Network Performance Security shall be valid till the respective Operations Starting Date. In addition, prior to the Operations Starting Date, the Concessionaire shall provide a Sewerage Network Performance Security for the Operations Period of 4 % (Four Percent) of the Design Build Cost. The ESHS Performance Security and Sewerage Network Performance Security for the Operations Period shall be valid for three years and will be renewed every three years till the End Date. For this purpose, such Design-Build Cost shall be determined on the basis of Concessionaire's Bid Prices quoted in various Parts of the Price Schedule and incorporated in Schedule 18 of the Contract.

In the event that the Concessionaire is unable to obtain from its bank, Performance Securities valid until 180 days after the End Date or any extension to the End Date, it shall furnish to the BUIDCO an explanation for the same. If the BUIDCO is satisfied with such explanation, Concessionaire will be allowed to submit Performance Securities valid initially until 180 days beyond the Time for Completion of the Design-Build Services stipulated in SCC 10 (in reference to GCC 2.3.2) subject to the condition that the Performance Securities shall be renewed from time to time, in the manner specified in the following paragraph, so as to be valid until 180 days after the End Date (i.e. completion of the O&M period of 10 years) or any extension to the End Date

It shall be the responsibility of the Concessionaire to furnish extension of the Performance Securities from time to time 120 days prior to the expiry of the current Performance Securities.

In case the renewed Performance Securities is not received by the BUIDCO at least 60 days prior to the expiry date of the current Performance Securities, the BUIDCO will be entitled to take measures for enforcement/forfeiture of the Performance Securities without any further notice to the Concessionaire.

20. Clause 5.5.2 (2) – Advance Payment Security

Provisions in Clause 5.5.2 (2) shall be replaced with the following clause.

- (2) The mobilization advance paid to the Concessionaire by the owner shall be recovered commencing from the date on which the payment to the Concessionaire 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 Concessionaire for 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 Concessionaire.

21. Clause 5.6 – Taxes and Duties

For clarification purposes, the Concessionaires Price Schedules shall include all applicable Taxes and Duties

Article 7: Contract administration and supervision during the Design-Build and Operations Periods

22. Clause 7.2 Design-Build Supervision

Provisions in Clause 7.2 and 7.3 shall be replaced with the following clause:

7.2.1 Supervision during the Design-Build Period

GC Section 7.2 shall apply during the Design-Build Period and Operations Period and immediately after the End date solely for the purpose of resolving transition issues, if any and any outstanding issues arising during the Operations Period.

7.2.2 Project Engineer's Duties and Authority (Design-Build and Operations Period)

(1) The NMCG along with BUIDCO shall appoint the Project Engineer who shall be responsible for day to day contract management and supervision during the Design-Build Period and the Operations Period. The Project Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties. For clarification purposes, the Project Engineer appointed for the Sewerage Network Facilities and STP Facilities shall be the same.

(2) The Project Engineer shall have no authority to amend the Contract.

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

(4) The Project Engineer is obligated to obtain the approval of the matters specified in the sub-clause 7.22 (5) (d) of the SCC. If the Project Engineer exercises a specified authority for which the BUIDCO's approval is required then, for the purposes of the Contract, BUIDCO shall be deemed to have given approval.

(5) Except as otherwise stated in the Contract,

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

(b) the Project Engineer 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 Project Engineer, including absence of disapproval, shall not relieve the Concessionaire from any responsibility it has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.

(d) The Project Engineer shall obtain the approval of the BUIDCO 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;

(c) certifying additional costs determined under GC Sections 1.9(8)(b); and

- (d) issuing a Change Order, except:
 - a. in an emergency situation, as reasonably determined by the Project Engineer; or
 - b. if such Change Order would increase the Contract Price by less than 1%.

7.2.3 Delegation by the Project Engineer

- (1) The Project Engineer 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 Project Engineer shall not delegate the authority to determine any matter in accordance with GC Section 7.2.6.
- (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 1.3.1.
- (3) Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Concessionaire 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 Project Engineer. 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 Project Engineer to reject the work or the Plant and Equipment; and
 - (b) if the Concessionaire questions any determination or instruction of an assistant, the Concessionaire may refer the matter to the Project Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

7.2.4 Instructions of the Project Engineer

- (1) The Project Engineer may issue to the Concessionaire, 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 Concessionaire shall only take instructions from the Project Engineer, or from an assistant to whom the appropriate authority has been delegated under GC Section 7.2.3. If an instruction constitutes a Change, GC Section 10.1 shall apply.
- (2) The Concessionaire shall comply with the instructions given by the Project Engineer or delegated assistant, on any matter related to the Contract. These instructions shall be given in writing.

7.2.5 Replacement of the Project Engineer

If the BUIDCO/NMCG intends to replace the Project Engineer, the BUIDCO/NMCG shall, not less than 42 days before the intended date of replacement, give notice to the Concessionaire of the name, address and relevant experience of the intended replacement Project Engineer. The BUIDCO/NMCG shall not replace the Project Engineer with a person against whom the Concessionaire raises reasonable objection by notice to the BUIDCO/NMCG, with supporting particulars.

7.2.6 Determinations by the Project Engineer

- (1) Whenever the Contract provides that the Design-Build-Operations Engineer shall proceed in accordance with this GC Section 7.2.6 to agree or determine any matter, the Project Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Project Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.
- (2) The Project Engineer 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 1.9.

23. Clause 7.3.2

Provisions in Clause 7.3.2 shall be replaced with the following Clause:

The Project Engineer shall supervise the “Operations” till the End of Concession

24. Clause 8.1.1(1)(b)

Provisions in Clause 8.1.1(1)(b) shall be replaced with the following Clause during the Operations Period, the BUIDCO’s Representative shall be the Project Engineer

25. Clause 8.1.2 (1) Concessionaire’s Representative

The Concessionaire’s Representative is: _____

23. Clause 8.3 Concessionaire’s Personnel

The Concessionaire’s Key Staff employed during the design build services shall have the expertise and qualifications specified in the Table below.

S.No	Staff	No	Minimum Qualifications
1	Project Manager	1	A Graduate in Civil Engineering with not less than 10 years’ experience in construction of Sewerage networks / water supply networks
2	Civil Engineer	2	A Civil Engineer (Graduate Engineer) with not less than five years’ experience in construction of similar engineering

			works or Diploma in Civil Engineering with 8 years' experience
3	Electro Mechanical Engineer	1	A Electro /Mechanical Engineer (Graduate Engineer) with not less than 5 years' experience in construction of similar engineering works or Diploma in Civil Engineering with 7 years' experience
4	Civil Supervisors	4	Diploma in Civil Engineering with minimum 2 years' experience in Construction of Civil Engineering works
5	Environmental Engineer	1	Graduate Degree in civil Engineering / environmental Science / environmental planning with total 5 years' experience of which minimum 3 years' experience in environmental management works of urban infrastructure projects.
6	Health and Safety Engineer	1	Graduate in any field with specialised qualification in Occupational Health and safety (OHS) with total 5 years' of experience of which 3 years' in management of OHS works in infrastructure projects.
7	Social Expert	1	Degree in Social Science / Sociology / Social Work / Anthropology / Planning with total 5 years' experience of which 3 years in management of social safeguard activities in infrastructure projects.

24. Clause 8.5- Representatives

The Concessionaire is not obliged to retain staff employed by the BUIDCO.

25. Clause 8.6 (1) - Maximum Percentage of Sub contracting

Sub-contracting is allowed for both Design-Build Services and Operations Services

26. Clause 9.1 (b) Defect Liability Period

This clause is deleted.

25. Clause 9.2(b) Limitation of Liability

The existing Clause is replaced as follows:

the aggregate liability of the Concessionaire to the BUIDCO, whether under the Contract, in tort or otherwise, shall not exceed the aggregate of the INR 650,00,00,000 (Six hundred fifty crores only), provided that this limitation shall not apply to any obligation of the Concessionaire to indemnify the BUIDCO with respect to patent infringement.

26. Clause 9.6 – 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 Concessionaire is the insuring Party, each insurance shall be affected with insurers and in terms approved by the BUIDCO/NMCG.

Wherever the BUIDCO/NMCG 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 Concessionaire shall act under the policy on behalf of these additional joint insured except that the BUIDCO/NMCG shall act for their 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 20 days of 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 9.6.2 (Insurance for works and Concessionaire’s Equipment) and Sub-Clause 9.6.3 [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 Project Engineer.

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 Concessionaire or the BUIDCO/NMCG, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Concessionaire and/or the BUIDCO/NMCG 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 Concessionaire shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 9.6) with insurers from any eligible source country.

9.6(2) Insurance for Works and Concessionaire's Equipment

The insuring Party shall insure the Works, Plant, Materials and Concessionaire'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 (a) of Sub-Clause 9.6.1 [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 Concessionaire is liable arising from a cause occurring prior to the End Date, and for loss or damage caused by the Concessionaire in the course of any other operations.

The insuring Party shall insure the Concessionaire's Equipment for not less than the full replacement value, including delivery to Site. For each item of Concessionaire's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Concessionaire's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

- a) shall be effected and maintained by the Concessionaire 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 Project which is attributable to the use or occupation by the owner of another part of the Works, and loss or damage from the BUIDCO'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 the BUIDCO, except to the extent that the Concessionaire 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 Concessionaire shall (as insuring Party) give notice to the BUIDCO, with supporting particulars. The BUIDCO 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 Concessionaire 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 9.6.1 [General Requirements for Insurances].

9.6(3) 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 Sub-Clause 9.6(2) [Insurance for Works and Concessionaire's Equipment]) or to any person (except persons insured under Sub-Clause 9.6(4) [Insurance for Concessionaire's Personnel]), which may arise out of the Concessionaire'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 Concessionaire:

1. Loss of human life – Rs.2.4million or equivalent amount in convertible currency and to be recouped as and when it is used.
2. Permanent Disability of human beings - Rs.2.4million 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.0.10million 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 Concessionaire 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 the BUIDCO's property (except things insured under Sub-Clause 18.2) arising out of the Concessionaire's performance of the Contract, and
- d) may however exclude liability to the extent that it arises from:
 - i. the BUIDCO'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 Concessionaire's obligations to execute the Works and remedy any defects, and
 - iii. a cause listed as BUIDCO's Risks as contained in GCC / SCC, except to the extent that cover is available at commercially reasonable terms.

9.6 (4) Insurance for Concessionaire's Personnel

The Concessionaire 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 Concessionaire or any other of the Concessionaire's Personnel. The BUIDCO and the Project Engineer 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 the BUIDCO or of the BUIDCO'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. For a Subcontractor's employees, the insurance may be affected by the Subcontractors, but the Concessionaire shall be responsible for compliance with this Clause

27. Clause 10.2 Change to Operations Services

- (a) GCC sub-clause 10.2 (1) is amended to read as under:

“Except as specifically provided in Schedule 19 of the Contract (Terms and Procedure of Payment) Schedule 21 of the Contract – Price Adjustment or elsewhere in the Contract, the Concessionaire shall make no claim whatsoever for any adjustment to the Contract Price during the Operations Period.”

- (b) GCC sub-clause 10.2 (2) shall stand deleted.

28. Clause 11.2.2 Payment upon Termination by BUIDCO for Convenience

The following provision is added:

(3) In such cases of termination, BUIDCO shall return the Performance Securities, ESHS Performance Securities, Additional Performance Securities, and the Mobilization Advance Guarantees (if and whichever are applicable), within 30 days from the date of the Notice of Intent to Terminate

29. Clause 11.2.3.1 - Corrupt or Fraudulent Practices

The existing Clause is deleted and replaced with the following Clause:

It is the Bank’s policy to require that Borrowers (including beneficiaries of Bank loans), bidders, suppliers, contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts⁵. In pursuance of this policy, the Bank:

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

(i) “corrupt practice” is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;⁶

(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;⁷

⁵ In this context, any action to influence the procurement process or contract execution for undue advantage is improper.

⁶ For the purpose of this sub-paragraph, “another party” refers to a public official acting in relation to the procurement process or contract execution. In this context, “public official” includes World Bank staff and employees of other organizations taking or reviewing procurement decisions.

⁷ For the purpose of this sub-paragraph, “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

(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;⁸

(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;⁹

(v) “obstructive practice” is

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

(bb) acts intended to materially impede the exercise of the Bank’s inspection and audit rights provided for under paragraph 11.2.3.1 (e) below.

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

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

⁸ For the purpose of this sub-paragraph, “parties” refers to participants in the procurement process (including public officials) attempting either themselves, or through another person or entity not participating in the procurement or selection process, to simulate competition or to establish bid prices at artificial, non-competitive levels, or are privy to each other’s bid prices or other conditions.

⁹ For the purpose of this sub-paragraph, “party” refers to a participant in the procurement process or contract execution.

(d) will sanction a firm or individual, at any time, in accordance with the prevailing Bank's sanctions procedures¹⁰, including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated¹¹;

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

¹⁰ A firm or individual may be declared ineligible to be awarded a Bank financed contract upon: (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross-debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of these Guidelines.

¹¹ A nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

Schedule 15

Design Build Services Schedule (DBSS)

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

Article 1. General

1.1 Description of Design-Build Services

The Concessionaire shall carry out and be responsible for the review of owner's design and redesign where necessary; and construction of the Sewerage Network including pipe network, Sewage pumping stations and all allied appurtenant structures and be responsible for its performance. The Concessionaire's work and services as part of the "Design-Build Services" shall cover all necessary or desirable services / activities for the 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 Concessionaire shall propose its own structural design and configuration for SPS and the design will be subject to approval of the owner. 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 owner.

- 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 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 the BUIDCO 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 Concessionaire shall perform.

Article 2. DESIGN SERVICES

2.1 General

2.1.1 Design and Engineering

- a) The Concessionaire 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 Concessionaire shall follow the standard engineering practices as approved by Project Engineer.
- b) Where the BUIDCO provides detailed designs. The Concessionaire shall review owner’s designs and come up with its own designs for the Sewerage Network based on the alignment suggested/allowed by the BUIDCO under Schedule 12(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 the BUIDCO or its authorised representative.
- c) The designs and drawings as formulated by the Concessionaire shall be subject to approval by the BUIDCO or its authorized representative.
- d) The Concessionaire 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 the BUIDCO or its representative or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Concessionaire by or on behalf of the BUIDCO. Normally it is expected that Concessionaire will not deviate from the specifications prescribed by the BUIDCO 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 the BUIDCO/BUIDCO's Representative and shall be treated in accordance with GC Section 10.1.

2.1.3 Design Responsibilities

- a) The Concessionaire's design and design-related services shall include, but not limited to the following:
 - i. A confirmatory topographical study covering the proposed sites and the network alignment. Survey drawings are to be submitted in hard and soft copy to the owner;
 - 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. Concessionaire uses the population data/ projections for future supplied; and per capita wastewater production assumptions by the BUIDCO. 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. 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;
 - vi. Preparation of design development documents, based on the approved HFD /schematic design documents accepted by the BUIDCO, 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;
 - vii. the preparation of Design-Build Documents setting forth in detail the requirements for construction based on the design development documents accepted by the BUIDCO;
 - viii. 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 the BUIDCO is explicitly required to obtain itself under the Applicable Law in which case the Concessionaire shall prepare all documentation and provide assistance to the BUIDCO in obtaining such approval, permits or licenses;

- ix. 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 Concessionaire and the BUIDCO in writing; and
- x. the conducting of general reviews of the progress of the design process, to the extent necessary, in order to determine to the Concessionaire'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 Concessionaire 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 Concessionaire 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 the owner before operations commences. It also includes hydraulic design system to help monitor and for future upgrades.
- c) The Concessionaire shall prepare any other document, as may be requested by the Project Engineer, that the BUIDCO considers necessary to monitor the progress of the Design-Build Services and assess the Concessionaire's compliance with the Contract.
- d) The Concessionaire shall provide the BUIDCO 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 the owner 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 the owner prior to performing any of the services set out in DBSS in respect of any Design-Build Document.

- e) When the Concessionaire notifies the BUIDCO in accordance with DBSS, the Concessionaire shall provide to the owner 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 Concessionaire 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 Concessionaire 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 Concessionaire pursuant to DBSS;

2.2 Implementation Responsibilities – On Site Issues

In preparing the design for the Sewerage Network and the Design-Build Documents, the Concessionaire 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 pump 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 Concessionaire 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 02 Nos Pumping stations and specified allied works and redesign and construction of 303 Km long Sewerage Network in Digha, and Design and Construction of 02 Nos. Pumping stations and specified allied works and redesign and construction of 150 Km long Sewerage Network in Kankarbagh all allied / ancillary works and then carry out Operation & Maintenance of the Sewerage Network, Sewage Pumping Stations and all allied / ancillary works till End of Concession by way of other services. Concessionaire shall verify these details as per site condition.
- 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 the 15 years O & M period, the Concessionaire shall have to handover the facilities to the BUIDCO in full working condition.
- 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.; the BUIDCO shall assist in facilitating such approvals as and when so requested by the Concessionaire.
- 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 (C-ESMP)

that complies to the requirements of Environmental Management Plan provided in Appendix 1 of Schedule 15 (Design Build Services), recommendations of Environmental and Social Impact Assessment Report of the project (shared as part of the information to the bidders) and ESHS implementation plan in line with the ESHS code of Practice submitted, 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.
- j) Preparation of BOQ in accordance with Schedule 19 of this Contract to the satisfaction of the BUIDCO.
- k) O&M manual and as-built drawings for all civil, electrical & mechanical works. Concessionaire should submit as-built drawing and O&M manual before commencement of O&M 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) Mobilising necessary sewer cleaning equipment and maintaining such equipment for timely maintenance of sewer network
- n) The Concessionaire shall train the BUIDCO's selected staff for on job training during the specified 6 months of O & M period. A Maximum of Fifteen (15) staff of BUIDCO will be trained for a total period of 45 days.
- o) 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 BUIDCO.

2.4 Other Design Responsibilities

The Concessionaire shall carry out the following design or design-related responsibilities:

- a) the Concessionaire shall prepare plans and designs for all temporary works as required by the Concessionaire's design and as required by the Contract

- b) the Concessionaires shall prepare plans and designs for landscaping of the site;
- c) the Concessionaire 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 Concessionaire shall prepare detailed plans and methodologies for the testing and inspection of the Plant and Equipment.

Article 3. BUILDING, CONSTRUCTION SERVICES

3.1 General

- a) The Concessionaire shall carry out all building, refurbishment and construction of Sewerage Network pursuant to Articles of DBSS
- b) The Concessionaire shall provide all of the demolition, excavation, building, co-ordination, repair, warranty, review, inspection, testing, quality assurance and control, monitoring, scheduling, clean-up etc.
- c) Station and all allied appurtenant structures as contemplated by Design-Build Documents.
- d) The Concessionaire shall have total control of the laying and construction services and shall effectively direct and supervise these services so as to ensure conformity with the Design-Build Documents.
- e) The Concessionaire 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.
- f) Unless agreed with BUIDCO, the Concessionaire 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. BUIDCO 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 3.4, the Concessionaire shall procure and transport all the equipment in an expeditious and orderly manner to the Site.
- b) The Concessionaires shall at its own risk and expense for transport all equipment, to the site.
- c) The Concessionaire shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of Equipment, to the Site. The Concessionaire shall indemnify and hold harmless the BUIDCO 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 Concessionaire 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 the BUIDCO, the BUIDCO 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 Concessionaire, the Concessionaire 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 Concessionaire 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 Concessionaire 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 Concessionaire shall review the Design-Build Documents and produce its own designs duly addressing any inconsistency or omission that the Concessionaire may discover. If the Concessionaire does discover any error, inconsistency or omission in the Design-Build Documents, the Concessionaire shall not proceed with the work affected until corrected designs (of such errors or inconsistency or supplied any missing information) and these corrections have been approved in writing by the BUIDCO. The owner will give decision on approval within 15 days of submission of corrected designs

3.2.3 Plant and Equipment

- a) The Concessionaire 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 Concessionaire 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 the BUIDCO.

3.2.4 Documents at the Site

The Concessionaire 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 the BUIDCO upon request and at any reasonable time.

3.2.5 Alignment and Setting Out

- a) The Concessionaire 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 Concessionaire shall forthwith notify the BUIDCO of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the BUIDCO.

3.2.6 Quality Assurance

- a) The Concessionaire shall institute a quality assurance system to ensure compliance with the requirements of the Design-Build aspects. Compliance with the quality assurance system shall not relieve the Concessionaire of its duties, obligations or responsibilities.
- b) The Concessionaire shall submit for approval details of all quality assurance procedures and documents relating to Concessionaire's compliance with the quality assurance system to the BUIDCO before each stage of the Design-Build Services is commenced as set out in the Time Schedule. When any document is issued to the BUIDCO, it shall be accompanied by the signed quality statements for such document, if any. The BUIDCO may audit any aspect of the quality assurance system and the Concessionaire shall take any corrective action as the BUIDCO may deem appropriate.

3.2.7 Concessionaire's Access Routes and Rights of Way during the Design-Build Period

- a) The Concessionaire 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. The BUIDCO will not be responsible for any claims which may arise from the use or otherwise of any access route. The BUIDCO 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 Concessionaire shall bear all costs and charges for special or temporary rights-of- way required by it for access to the Site. The Concessionaire 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.

3.2.8 Site Regulations and Safety

- a) The Concessionaire 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 the BUIDCO, proposed Site regulations for the BUIDCO'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 Concessionaire 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 Concessionaire 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, owners 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 Concessionaire shall develop and implement a comprehensive occupational health and safety program for the protection of the Concessionaire's Personnel and all other persons who may attend at the site. The program shall include a description of how the Concessionaire 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.

3.2.9 Concessionaire's Equipment (Design-Build) and Site Clearance

- a) All Concessionaire's Equipment (Design-Build) brought by the Concessionaire onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Concessionaire shall not remove the same from the Site without the BUIDCO's consent that such Concessionaire's Equipment (Design-Build) is no longer required for the execution of the Contract.
- b) The Concessionaire shall maintain the site of construction and installation in a tidy condition and free from the accumulation of waste products and debris. The Concessionaire 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 Concessionaire shall remove products, tools, construction machinery, and equipment, including the Concessionaire's Equipment (Design-Build), not required for the performance of the remaining Design-Build Services.

- c) Prior to notifying the BUIDCO pursuant to DBSS 6.2(1), the Concessionaire shall remove products, tools, construction machinery and equipment, and waste products and debris, including the Concessionaire's Equipment (Design-Build).
- d) Upon the issue of any Completion Certificate, the Concessionaire shall clear away and remove, from the site, all Concessionaires' Equipment (Design-Build), surplus material, wreckage, rubbish and temporary work or structures. The Concessionaire shall ensure that the site is in a clean and safe condition to the satisfaction of the BUIDCO.
- e) If the Concessionaire fails to remove, no later than 30 days after the issue of the Completion Certificate, any remaining Concessionaire's Equipment (Design-Build), surplus material, wreckage, rubbish and temporary work or structures, the BUIDCO may sell or otherwise dispose of such items. The BUIDCO 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 Sewerage network and SPS site. Any balance of the proceeds shall be paid to the Concessionaire. If the proceeds of the sale are insufficient to meet the BUIDCO's costs, the outstanding balance shall be recoverable from the Concessionaire by the BUIDCO.
- f) The BUIDCO will, if requested, use reasonable efforts to assist the Concessionaire in obtaining any local, state or national government permission required by the Concessionaire for the export of the Concessionaire's Equipment (Design-Build) imported by the Concessionaire solely for use in the execution of the Contract that is no longer required for the execution of the Contract.

3.2.10 Protection of the Environment

- a) The Concessionaire 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,
 - i. adopting working practices that prevent or minimize the transfer of any pollutant off-site; maintaining the access roads in good repair;
 - ii. using appropriate dust suppressant methods;
 - iii. restricting trucking and loud machinery and equipment use to daylight hours;
 - iv. using mufflers, silencers and other appropriate methods to minimize the noise of the construction;

v. maintaining a clean SPS site, that is free of garbage.

b. The Concessionaire shall, at all times during building and construction, ensure that the Environmental Management Plan specified in Appendix 1 of Schedule 15 (Design Build Services) is fully complied and measures recommended in Environmental and Social Impact Assessment Study for the project (shared with the bidders as part of the information to the bidders) and ESHS implementation plans are implemented as per the ESHS code of practice

3.2.11 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 Concessionaire shall immediately carry out such work.
- b) If the Concessionaire is unable or unwilling to do such work immediately, the BUIDCO may do or cause such work to be done as the BUIDCO may determine is necessary in order to prevent damage to the Sewerage Infrastructure. In such event the BUIDCO shall, as soon as practicable after the occurrence of any such emergency, notify the Concessionaire in writing of such emergency, the work done and the reasons therefore. If the work done or caused to be done by the BUIDCO is work that the Concessionaire was liable to do at its own expense under the Contract, the reasonable costs incurred by the BUIDCO in connection therewith shall be paid by the Concessionaire to the BUIDCO. Otherwise, the cost of such remedial work shall be borne by the BUIDCO.

Article 4. TEST AND INSPECTION

4.1 Tests and Inspection

- a) The Concessionaire 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 Concessionaire 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 the Sewerage Network in accordance with Schedule 23 of the Contract (Technical Specification) and implement such quality assurance plan.
- b) The Concessionaire 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) The BUIDCO or their designated representatives shall be entitled to attend any test or inspection, provided that the Concessionaire 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 Concessionaire is ready to carry out any test or inspection, the Concessionaire shall give a reasonable advance notice of such test or inspection and of the place and time thereof to the BUIDCO. The Concessionaire shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the BUIDCO or their designated representatives to attend the test or inspection.
- e) The Concessionaire shall provide the BUIDCO with a certified report of the results of any test or inspection. The Concessionaire 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 the BUIDCO, 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 Concessionaire may proceed with the test or inspection in the absence of such persons, and shall provide the BUIDCO with a certified report of the results thereof.
- g) The BUIDCO may require the Concessionaire to carry out any test or inspection not required by the Contract, provided that the Concessionaire'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 Concessionaire'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 Concessionaire 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) If any dispute or difference of opinion arises between the Parties in connection with or arising out of the test or inspection of the Plant and Equipment or part of the Sewerage Network that cannot be settled between the parties within a reasonable period of time, it may be referred to an Adjudicator for determination in accordance with GC Section 1.6.1(1).
- j) The Concessionaire shall give the BUIDCO, at the BUIDCO'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 the BUIDCO shall give the Concessionaire a reasonable prior notice.
- k) The Concessionaire agrees that neither the execution of a test or inspection of Plant and Equipment or any part of the Site and the Sewerage Network, nor the attendance by the BUIDCO, nor the issue of any test certificate pursuant to DBSS, shall release the Concessionaire from any other responsibilities under the Contract.
- l) No part of the Sewerage Network, Pumping Stations and foundations shall be covered up on the Site without the Concessionaire carrying out any test or inspection required under the Contract. The Concessionaire shall give a reasonable notice to the BUIDCO 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 THESEWERAGE NETWORK

5.1 Monthly Progress Notice

- a) The Concessionaire shall submit to the BUIDCO after the end of each month six copies, each signed by the Concessionaire's Representative named in accordance with GC Section 8.1.2, a notice (the "Monthly Progress Notice") in such form as the BUIDCO may from time to time prescribe, showing the percentage of completion that the Concessionaire considers it has effected in the preceding month, in respect of the Design-Build Services.
- b) The BUIDCO shall, no later than 30 days after receipt of the Monthly Progress Notice, deliver to the BUIDCO a statement (the "Project Engineer's Statement") indicating, separately, the percentage of completion of the Design-Build Services with documentary evidence such as photographs etc. that the BUIDCO considers the Concessionaire has effected in the applicable month.
- c) If the BUIDCO notifies the Concessionaire of any defects or deficiencies, or both, in any of the Design-Build Services, the Concessionaire shall then correct the defects or deficiencies, and shall repeat the procedure described in DBSS Section 5.1(a).

5.2 Completion

- a) As soon as the Design-Build Services have, in the opinion of the Concessionaire, been completed in accordance with Schedule 23 of the Contract (Technical Specifications) (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 Concessionaire shall so notify the BUIDCO 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 BUIDCO. However, final completion has to cover all such part commissioned networks. Operation of such commissioned sub-networks shall be the responsibility of the Concessionaire.
- b) The BUIDCO shall, no later than 30 days after receipt of the Concessionaire's notice under DBSS Section 5.2(a), either issue a Completion Certificate stating that the Sewerage Network has reached Completion as of the date of the Concessionaire's notice under DBSS Section 5.2(a), or notify the Concessionaire in writing of any defects or deficiencies or both.
- c) If the BUIDCO is not satisfied that the Design-Build Services are complete, the BUIDCO shall notify the Concessionaire in writing of

any defects or deficiencies no later than 14 days after receipt of the Notice of Completion.

- d) If the BUIDCO notifies the Concessionaire of any defects or deficiencies or both, the Concessionaire shall then correct such defects or deficiencies, and shall repeat the procedure described in DBSS Section 5.2(a).
- e) If the BUIDCO is satisfied that the Design-Build Services have reached Completion, the BUIDCO shall, no later than 14 days after receipt of the Concessionaire's repeated Notice of Completion, issue a Completion Certificate stating that the Design-Build Services have reached Completion as of the date of the Concessionaire's repeated Notice of Completion.
- f) If the BUIDCO fails to issue the Completion Certificate and fails to inform the Concessionaire of any defects or deficiencies 14 days after receipt of the Notice of Completion or 7 days after receipt of the Concessionaire'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 Concessionaire shall complete all outstanding minor items so that the Sewerage Network are fully in accordance with the requirements of the Contract, failing which the BUIDCO will undertake such completion and deduct the costs thereof from any monies owing to the Concessionaire.

Article 6. COMMISSIONING OPERATIONAL ACCEPTANCE

AND

6.1 Commissioning

Commissioning of the Sewerage Network shall be commenced by the Concessionaire immediately after issue of the Completion Certificate by the Project Engineer, pursuant to DBSS Section 5.2(b) or immediately after issue of the deemed Completion, under DBSS Section 5.2(f).

6.2 Tests on Commissioning

- a) The Tests on Commissioning as set out in the Technical Standards Schedule, and repeats thereof, shall be conducted by the Concessionaire 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 Concessionaire's and Project Engineer's advisory personnel shall attend the Tests on Commissioning, and shall advise and assist the BUIDCO. The BUIDCO shall promptly provide the Concessionaire with such information as the Concessionaire 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 Concessionaire, 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 the BUIDCO and the Concessionaire, the Concessionaire 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) At any time after the successful completion of the Tests on Commissioning, the Concessionaire may give a notice to the BUIDCO requesting the issue of an Operational Acceptance Certificate in respect of the Sewerage Network.
- c) The BUIDCO shall, after consultation with the NMCG, and no later than 7 days after receipt of the Concessionaire's notice, issue an Operational Acceptance Certificate.
- d) If within 7 days after receipt of the Concessionaire's notice, the BUIDCO fails to issue the Operational Acceptance Certificate or fails to inform the Concessionaire in writing of the justifiable reasons why the BUIDCO has not issued the Operational Acceptance Certificate, the Sewerage Network shall be deemed to have been accepted as of the

date of the Concessionaire's said notice.

6.4 TAKING OVER

6.4.1. TRANSITION PLAN

1. At least one years prior to the End Date, the Concessionaire shall develop a plan to hand-over the network and SPS to the Subsequent Concessionaire at the end of the term of the Contract (the "Transition Plan").
2. The Transition Plan shall include,
 - (i) plans to transfer the system to the Subsequent Concessionaire;
 - (ii) transition plans with respect to the Concessionaire's Personnel including a plan for transition of the Concessionaire's Personnel to a Subsequent Concessionaire;
 - (iii) a proposed process for the transfer of all Contract Records to the BUIDCO;
 - (iv) plans to transfer operations and maintenance functions to the Subsequent Concessionaire; and
 - (v) a program to train staff of the BUIDCO in all aspects of the operation and maintenance of the New Facility.

6.4.2 The network and SPS will be taken over by BUIDCO on satisfactory completion of the Operation & Maintenance of the the same provided that

- i. The SPS plant /equipment and the network are in good, smooth running condition.
- ii. In case of major repairs /replacement of equipment, the performance guarantee for such unit/equipment is extended by six months from the date of putting back in to satisfactory operation of such unit/equipment.
- iii. All records of operation & maintenance are handed over to BUIDCO in proper condition.
- iv. The Third Party Inspection of the plant viz: Civil units, Mechanical units/equipment, Electrical units/equipment, instruments, & all other Major & minor units/machines has to be carried out & the defects unsatisfactory working performances of the equipment/ machines are to be corrected by

the Concessionaire at his own cost. The necessary Third Party inspection Charges are also to be borne by the BUIDCO.

- v. The Concessionaire should repaint the plant including all civil structures, mechanical, electrical equipment/ units /structures as per the tender specifications
 - vi. Concessionaire shall repair and replace the equipment and ensure that the equipment has adequate residual life.
- a. In case taking over is delayed on account of Concessionaire's failure, the operation & maintenance period will be extended further till it meets the requirement without any extra cost to BUIDCO. The Concessionaire will also be penalized for such delays

Article 7. REPORTING DURING THE DESIGN-BUILD PERIOD

7.1 Design-Build Progress Reports

- a) The Concessionaire shall prepare monthly progress reports of the Design-Build Services during the Design-Build Period and submit six copies of the reports to the Project Engineer. 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:
 - i. 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;
 - ii. charts showing the status of Design-Build Documents, purchase orders, manufacture and construction;
 - iii. 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, Concessionaire's inspections, tests and delivery relating thereto;
 - iv. detailed records of the Concessionaire's Personnel and Concessionaire's Equipment (Design-Build) on the Sewerage Network site and the actual usage of the Concessionaire's Equipment (Design-Build) during the reporting period and the tasks performed by the Concessionaire's Personnel;
 - v. copies of quality assurance documents, test results and certificates of the Plant and Equipment;
 - vi. all monitoring results;
 - vii. the Environmental, Social, Health and Safety (ESHS) metrics set out in **Appendix 1 of Schedule 15 (Design Build Services) Part 3**";
 - viii. percentage completion achieved compared with the planned percentage completion for each activity; and
 - ix. 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 deployed by the Concessionaire during the Design build period

If replacement of any Key Staff during design & build services period becomes necessary, the Concessionaire shall submit a proposal for BUIDCO'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.

APPENDIX 1

1.0 MITIGATION AND MANAGEMENT PLAN

1.1 Environmental Management Plan

Summarizes the generic environmental management plan for low category investment that identifies the potential issues of various activities that are anticipated in the design and development, construction, and operation phases of the proposed sewer work in DIGHA area Patna. The Project Components Includes:

The environmental management plan ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social assessment study.

In general, the BUIDCO (with assistance from DBO Concessionaire and Independent Engineer/Supervision Consultant) is the responsible entity for ensuring that the mitigation measures as suggested in the ESMP. The roles and responsibilities of the involved institutes are described below.

1.1.1 Implementation of EMP Specific activities by BUIDCO

The role of BUIDCO in the implementation of EMP involves the following activities:

1.1.2 Specific activities by Design Built Operate (DBO) Concessionaire

The Concessionaire shall implement the mitigation measures as recommended in EMP attached to the bid document.

1.1.3 Implementation of EMP

The DBO Concessionaire shall have prime responsibility to implement the EMP. “The DBO engineer” shall monitor the compliance of the EMP. DBO engineer and BUIDCo will have secondary responsibility for implementation of EMP.

The Concessionaire shall ensure that:

Feedback from the local residents can also be taken from time to time to cross check the contractor’s report. Project management consultants should make inspection visits at construction site to check the implementation of Environment Management Plan as per the contract. Broad Institutional arrangement for implementation of EMP is shown in figure 8.1 below:

Table: Environmental Management Plan for DIGHASewerage Project

Activity	Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible Agency	
<i>Sewerage and Sanitation Investments</i>					
<i>A. Design and Development Phase</i>					
Sewerage Network (Trunk Sewer Line)	Accidental leakages/ bursts	<ul style="list-style-type: none"> • Due to accidental burst or leakage of sewers, flooding of the nearby areas • Backlogging due to unexpected heavy flow rates 	Temporary	<ul style="list-style-type: none"> • Designing sewers with adequate capacity and flow velocity • Provision for Regular inspection and maintenance of the sewers Preparation of safety and Emergency Preparedness plan	DBO Concessionaire
Sewage Pumping Station	Location of Sewage Pumping Station and Pumping of sewage to STP	<ul style="list-style-type: none"> • Noise and odour nuisance hazards to neighboring areas. • Cutting of Trees 	Permanent	<ul style="list-style-type: none"> • Ensure minimum noise generation at pump station in SPS by use of less noise generating equipment meeting prescribed noise standards as applicable and enclosed generators. • Minimize Tree cutting if involved. • Tree plantation of at least two row around the periphery of SPS site and landscaping to prevent spread of bad odour with large canopy/ broad 	DBO Concessionaire

				<p>leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc.</p> <ul style="list-style-type: none"> Accumulated sludge and solid waste to be cleared at short intervals and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour. <p>Provision for regular maintenance and switching off equipment when not in use;</p>	
B. Construction phase					
Sewerage (laying of sewers) and Sewage Pumping station	Excavation, cutting, back filling, compaction and construction operations	Damage to underground utilities like water, gas line, electricity and telephone conduits, etc. due to construction activities.	Temporary	<ul style="list-style-type: none"> Identify existing underground other utility structures, lines through available records and in consultation with concerned authorities and plan construction activities accordingly to minimize damage to such utilities. These underground utilities encountered in excavating trenches carefully shall be supported, maintained and protected from damage or interruption of service until backfill is complete and settlement has taken place. 	DBO Concessionaire
		Accidents/ damages due to erosion/ sliding of vertical sides of	Temporary	<ul style="list-style-type: none"> Maintaining the excavation by Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials <p>Exposed surface shall be resurfaced and stabilized. Exposed surface will be resurfaced and stabilized by</p>	DBO Concessionaire

		excavated trenches while places the pipes		making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest.	
		Generation of substantial debris, top soil and muck during construction	Temporary	<ul style="list-style-type: none"> • Top soil shall be preserved and may be used for agricultural purpose or development of city parks. • Soil and debris may be managed for planned land filling and landscaping; <p>Debris may be suitably stored to filling back the excavated areas after placing the trunk sewer lines.</p>	DBO Concessionaire
		Dust Generation (Air Pollution) due to excavation, cutting, back filling and compaction operations	Temporary	<ul style="list-style-type: none"> • Water sprinkling over excavated areas, unpaved movement areas and stockpiles. • Transportation of loose construction material through covered trucks. • Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread at SPS building construction site. • Construction equipment must comply with pollution norms and carry Pollution Under Control certificate. 	DBO Concessionaire
		Noise and vibration disturbances to residents and businesses	Temporary	<ul style="list-style-type: none"> • Construction activities to be carried out in day time with prior intimation to local residents and shop keepers. • Construction work near schools and colleges to be carried out during vacations and work near 	DBO Concessionaire

				<p>hospitals to be completed on priority basis (in shorter time period with alternate provision of traffic, accessibility of exit/entry gates etc.).</p> <ul style="list-style-type: none"> • Use of low noise and vibrating equipment meeting prescribed noise standards. • Provision of protective equipment (PPE) like ear muffs and plugs for construction workers. • Provision of noise barriers in inhabited areas, particularly near sensitive zones like hospitals, schools etc. <p>DG set to be fitted acoustic enclosure.</p>	
		Temporary flooding due to excavation during monsoons or blockage of surface drains	Temporary	<ul style="list-style-type: none"> • Stockpiled areas to be bordered by berms; <p>Stockpiles to be done in high areas to avoid flow in storm water run-off channels and erosion;</p>	DBO Concessionaire
		Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access)	Temporary	<ul style="list-style-type: none"> • Alternate traffic routing must be adopted in consultation with concerned traffic police authorities. Proper traffic planning be made for narrow lane areas. • Work should to be completed on priority near business and market place to minimize business loss. • Care should be taken to minimize congestion and negative impacts at schools and hospitals. Safe 	DBO Concessionaire

				<p>access shall be maintained to these places during construction.</p> <p>Provide temporary crossing/ bridges as may be required to facilitate normal life and business</p>	
		Settlement of backfilled area after construction	Temporary	<ul style="list-style-type: none"> The backfilling material shall be free from petroleum products, slag, cinders, ash or other material. Backfilling activity shall be completed within five days of laying of sewer. <p>Proper compaction as per the soil condition and retain the original level of alignment and grade.</p>	DBO Concessionaire
		Spillage of fuel and oil	Temporary	<p>Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit.</p>	DBO Concessionaire
		Nuisance due to solid waste disposal	Temporary	<ul style="list-style-type: none"> Provide two bins for recyclable and non-recyclable wastes. Ensure that recyclable and non-recyclable waste are collected in segregated manner in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed for designated land fill area of the city. 	DBO Concessionaire

				Provide adequate sanitation facility for workers at construction sites.	
General: safety during construction	Accidents	Safety hazards to labours and public	Temporary	<ul style="list-style-type: none"> • Comply with the Occupational health and Safety act of India • Ensure that the contact details of the police or security company and ambulance services nearby to the site. • Ensure that the handling of equipment and materials is supervised and adequately instructed. • Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers. • Provide adequate safety precautions such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers Monthly reporting of all accidents and immediate reporting to DBO engineer and owner. 	DBO Concessionaire
C. Operation phase					
Sewer line	Leakage/ overflows	Water pollution and possibility of mixing with water supply line	Temporary	<ul style="list-style-type: none"> • Regular monitoring of sewer line and manholes for visible leakages/ overflows. Immediate repair shall be carried out to plug the leakages. Restore the sewer and other utility services if damaged due to leakages. 	DBO Concessionaire

Sewage Pumping Station	Waste Handling	Bad odour, Health hazard and public nuisance	Temporary	<ul style="list-style-type: none"> • Provision for regular clearance of sludge and solid waste to minimize odour nuisance • Ensure maintenance of Green belt as planned Periodic disposal of accumulated sludge/solid waste to disposal site as approved by DBO engineer.	DBO Concessionaire
General Safety	Workers exposure to toxic gases in sewers and hazardous materials during sewer maintenance work	<ul style="list-style-type: none"> • Serious/health/safety hazards • The toxic gases are likely to contract communicable diseases from exposure to pathogens present in the sewage. 	Temporary	<ul style="list-style-type: none"> • During cleaning/ maintenance operation, the sewer line will be adequately vented to ensure that no toxic or hazardous gases are present in the line. • Ensure availability of PPE for maintenance workers. • Follow safety and Emergency Preparedness plan prepared at design stage Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.	DBO Concessionaire

Part 2: Environmental, Social, Health and Safety Management Implementation Plan (ESHS-MSIP)

The Concessionaire shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key Environmental, Social, Health and Safety (ESHS) risks, specific to the detailed design of the contract.

The plan should integrate environmental protection, occupational and community health and safety, gender, equality, child protection, vulnerable people (including those with disabilities), gender-based violence (GBV), HIV/AIDS awareness and prevention and specific to the activities involved in the execution of the Works. The plan should also include mechanisms for monitoring, continuously improving processes and activities and for reporting on the compliance with the policy.

As a minimum, the plan should, include:

- 1. traffic management plan to ensure safety of local communities from construction traffic];*
- 2. water resource protection plan to prevent contamination of drinking water];*
- 3. boundary marking and protection strategy for mobilization and construction to prevent offsite adverse impacts];*
- 4. strategy for obtaining Consents/Permits prior to the start of relevant works such as opening a quarry or borrow pit].*
- 5. apply good international industry practice to protect and conserve the natural environment and to minimize unavoidable impacts;*
- 6. provide and maintain a healthy and safe work environment and safe systems of work;*
- 7. protect the health and safety of local communities and users, with particular concern for those who are disabled, elderly, or otherwise vulnerable;*
- 8. ensure that terms of employment and working conditions of all workers engaged in the Works meet the requirements of the ILO labour conventions to which the host country is a signatory;*
- 9. be intolerant of, and enforce disciplinary measures for illegal activities. To be intolerant of, and enforce disciplinary measures for GBV, child sacrifice, child defilement, and sexual harassment;*
- 10. incorporate a gender perspective and provide an enabling environment where women and men have equal opportunity to participate in, and benefit from, planning and development of the Works;*
- 11. work co-operatively, including with end users of the Works, relevant authorities, contractors and local communities;*
- 12. engage with and listen to affected persons and organizations and be*

responsive to their concerns, with special regard for vulnerable, disabled, and elderly people;

13. provide an environment that fosters the exchange of information, views, and ideas that is free of any fear of retaliation;

14. minimize the risk of HIV transmission and to mitigate the effects of HIV/AIDS associated with the execution of the Works;

Part 3: Environmental, Social, Health and Safety (ESHS) - Content of Progress Report

other unresolved issues from previous months related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

Schedule 16

Operation and Maintenance services

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

Article 1. Introduction

The Concessionaire shall ensure the Operation and Maintenance of the Sewerage Network; pumping stations and other allied works in compliance to the guidelines contained in the Manual on “Sewerage & Sewage Treatment”, latest edition as published by the Central Public Health Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India, New Delhi and the prescription laid down hereunder.

Article 2. Scope of Work

2.1 Operate the Sewerage System, for a period of 15 years from the date of commissioning as specified below:

1. The Concessionaire shall operate and maintain the Sewage Pumping Station (SPS), Lift Stations and Sewer networks under the Contract complete including the road works (liability of restored portions of roads is limited to 3 years only, however the Concessionaire will not be held responsible for road restoration required on account of damage done by other agencies/ utilities), landscaping, civil/structural, mechanical components, instrumentation system, Electrical System, all utility and ancillary buildings, SPS premises area, lift station, for the period upto End of Concession from the date of successful completion of "Tests after Completion of the Works".
2. The Concessionaire shall make his own arrangements at his own cost for staff required for operation and maintenance of networks and other assets, lubricants, diesel, spares, tools and tackles, sewer cleaning vehicles and other equipment maintenance of all types such as routine, breakdown, periodic and repair maintenance, replacement of damaged/ unserviceable sewers, maintenance of house service connections after building lanes, screenings collection; desilted material collection, transportation and disposal; co-ordination with Bihar State Pollution Control Board (BPCB), Bihar Power Corporation Ltd. (BPCL) authorities and any other activity required for the operation and maintenance of the constructed Works in full compliance with all applicable rules, regulations, laws, codes, effluent quality requirements and any other limitations. The Concessionaire will conduct fortnightly checks of the Sewerage Network Facility including lateral network, manholes, etc. The Concessionaire will also maintain a Customer grievance redressal centre and ensure that O&M services meet the standards of services/ service levels maintained as follows:

Charter of Services

SN	Nature of complaints	Time for rectification (in days)	
		Minimum	Maximum

1	Sewerage overflow on the road	1	7
2	Choking at household premises	1	7
3	Replacement of missing manhole cover	1	2

The Concessionaire shall also be liable to pay Liquidated Damages in accordance with Schedule 20, if the time taken for such rectification is beyond the minimum Time for rectification specified in table above.

3. The Concessionaire ensures that there is a steady and uninterrupted flow of waste water/sewage to STPs.
4. Identify and inform the BUIDCO about the illegal connections on the Sewerage Network within seven days of its being detected.
5. The Concessionaire shall submit a weekly report to the Employer detailing the Operation and Maintenance indicating the labour hours expended, Electrical Power Consumed and other Consumables consumed and also problems faced and rectified.
6. The Concessionaire shall submit detailed schedule/manual of all O&M activities with references of equipment manufacturers' maintenance schedules/manuals to the Employer for review and approval.
7. The Concessionaire shall submit Guidelines and Instructions manual for the maintenance staff of all levels for all the tools, plants and equipment and Operating Sewerage Network to maintain the service levels within the standards prescribed within the contract;
8. The Concessionaire shall carry out all O&M activities as per the approved Operation and Maintenance Manuals.
9. If any consumer connection needs extension of sewer line during Network O&M period, from an existing line, the same will be designed and estimated by the Concessionaire using prevailing schedule of rates and market rates. Such costs will also include 15% towards supervision charges. The owner will collect the same and pays to the Concessionaire for executing the same after the connection is formally approved. However, BUIDCO will retain connection fee/ charges.
10. During the Operation and Maintenance period, the Concessionaire shall ensure that the sewage detention time in wet well not exceeds 30 min. and there is no backflow of sewage. The Concessionaire is responsible for maintaining back up power arrangements at his cost to ensure that the O&M services are not affected due to failure of power supply from the Public Utility Company.
11. The Concessionaire's responsibility shall also include the safety and security of the Works during the course of Operation and Maintenance.
12. During Operation and Maintenance period, the Concessionaire shall appoint an Concessionaire and Electrical/Mechanical Technician. In

addition, the Concessionaire shall appoint suitable number of Concessionaires, drivers, cleaners, fitters, electricians, helpers, gardeners, office peons, security guards, laborers as required for the operation and maintenance of complete proposed sewerage system for three shifts and adequate other staff / supporting personnel during general Shift. Security of man-power, built structures, equipment and other system components.

2.2 Undertaking capacity building measures:

Conduct a training and handholding assistance programme for six months in aspects of Operation and Maintenance of the Project Facilities for maximum fifteen employees of the ULB.

2.3 Staff:

1. The minimum personnel required for O & M is as given below. However, the Concessionaire shall mention the personnel required for O&M in his bid. The work shall be carried out on a 24 hour basis without intermission and the staff deployed by the Concessionaire shall be in accordance with this contract.
2. The Concessionaire shall give or provide all necessary superintendence during the O&M and as long thereafter as the BUIDCO may consider necessary. Such superintendence shall be given by a competent person having adequate knowledge of the operation and Maintenance to be carried out (including the methods and techniques required), the hazards likely to be encountered and methods of preventing accident) as may be required for the satisfactory working of the entire plant.
3. No labor below the age to 18 years shall be employed on the work. List of staff is to be given by the agency to the BUIDCO and advance intimation to be given before deputing/removing any staff from site during the period of contract. Not more than one of the Concessionaire's key staff shall be absent from the project site at any given time. In case it is necessary for more than one of the key personnel to be absent at a given time, the Concessionaire shall provide replacement of equivalent or better qualifications. The CVs of such key staff replacements shall be got approved from BUIDCO in advance.
4. BUIDCO shall be authorized to direct the contracting agency to remove any or all staff employed on O&M of the sewerage network if in his opinion continued presence of such staff is detrimental to safety or proper O&M of the sewerage network. The Concessionaire shall comply with such directions & post suitable substitute(s) thereof. Whenever the Engineer has to inform the Concessionaire in writing that any person on the work is in his opinion unsatisfactory or/incompetent or unfaithful or dishonest, untruthful or disorderly or to be otherwise unsuitable/such person shall be discharged by the Concessionaire from the work and shall not be employed again on it.

2.4 Reporting and Record Keeping:

1. Maintain a periodical reporting system to provide access and retrieval of Project Facilities operating data including all such information which is necessary to verify costs and expenses incurred and otherwise to confirm that the Concessionaire is in compliance with its obligations under the terms and conditions of this Contract;
2. The Concessionaire shall maintain a record for the entire Term of the following:
 - a. status or progress report of the operation and maintenance of each of the Project Facilities;
 - b. record of all consumables, tools, equipment's manhole covers, etc. used / replaced towards operations and maintenance of the Sewerage Network;
 - c. Daily readings of the meters at the Sewage pumping stations;
 - d. identification and reporting of illegal connections on the sewerage network;
 - e. Nature and scope of any ancillary activities being carried out in accordance with the terms and conditions of this Contract; and
 - f. Provide reports on accidents in respect of the Project Facilities, if any.
3. The Concessionaire shall provide an accurate, complete and up-to-date record, report or document in relation to any aspect of modernization, expansion, operation, maintenance and management of the Project Facilities to BUIDCO as and when a request is made as soon as reasonably practicable and in any event within any time limit prescribed by BUIDCO for the production of such record, report or other document.
4. Provide a copy to BUIDCO of its annual audited accounts of expenditure by the Concessionaire in the implementation of the Project as at the end of and for that accounting period.
5. Report to BUIDCO regarding any litigation or material claims, disputes or actions, threatened or filed, concerning the Project Facilities or the obligations to be performed by the Concessionaire under this Contract;
6. Report to BUIDCO any refusal or threatened refusal to grant, renew or extend or any action pending or threatened that might affect the granting, renewal or extension of any Applicable Approval;
7. Report to BUIDCO any material information concerning new or significant aspects of the operations, maintenance and management of the Project Facilities, any material complaint about the Project

Facilities from any person or any other information received by the Concessionaire which is material to the Operation and Maintenance of the Project Facilities

2.5 Operation and maintenance manual

1. The Concessionaire shall prepare a detailed program (referred to as O&M Manual) covering the operation and maintenance of the Sewerage Network as a whole. This program shall include the work and activities described in this Chapter, as relevant to the specific items and technology.
2. The Concessionaire shall provide 6 copies of draft O&M Manual to the BUIDCO, at the time of the commissioning of the project and on approval of draft, 10 copies of operation & maintenance manual shall be supplied by the Concessionaire.
3. The O&M Manual shall include the daily, weekly, monthly, quarterly, half yearly and annual checks and remedies if necessary to be performed for effective operation of the plant, elaborate detail, all operating and maintenance procedures and policies which are required, advisable and / or necessary for the Facility to achieve full compliance with the operational guarantees and to achieve maintenance and repair standard for the Facility which will ensure compliance with the maintenance specifications. The O&M manual shall include inter alia full explanation of all plant procedures and processes. The O&M Manual shall also include the preventive maintenance activities required for SPS and Sewerage Network. This should be as specified by the Manufacturer / Supplier recommendations for equipment and also conforming to the requirements of Manual on Sewerage and Sewage Treatment (CPHEEO) Part B Operation and Maintenance.
4. Without limiting the generality of the foregoing the O&M Manual shall include descriptions, procedures; schedule of maintenance, and shall comply with the requirements, set forth in the provisions of the Bid Documents.
5. The draft of the O&M Manual shall be subject to the review and approval of BUIDCO, which shall have the right to make any changes and revisions to the O&M Manual as it may deem appropriate. The Concessionaire shall revise such draft O&M Manual prior to the commencement of the O&M period.
6. At the end of the construction period, the Concessionaire shall revise the draft O&M Manual to reflect any updates, changes or revisions it deems appropriate, inter-alia based on its experience and as necessary to reflect any modifications or adjustments to the plant. Without limiting the above, the Concessionaire shall annually fully review, revise, update and modify the draft O&M Manual as may

be necessary or appropriate. Any revision to the draft O&M Manual shall be subject to the review and approval of BUIDCO.

7. BUIDCO shall have the right to require revisions to the draft O&M Manual as it may deem appropriate. The Concessionaire shall prepare and submit to BUIDCO, for its review and approval, 30 days prior to the proposed date of commencement of O&M, a revised draft O&M Manual which reflects all changes, revisions and modifications. The Concessionaire shall prepare the O&M Manual, as approved by the BUIDCO, prior to the start of O&M.
8. During the term of this Agreement, the Concessionaire shall promptly notify BUIDCO of any revisions, additions or modifications which he, in his professional opinion, believes should be made to the O&M Manual, whether as a result of additional experience in operating and maintaining the Facility, changes in influent quality or volume, changes or modifications to any equipment part, component or structure incorporated in the Facility.
9. Such notification shall set forth the reason for the proposed revision. Any proposed revision shall be subject to the approval of the BUIDCO. In addition, during the term of this Agreement, BUIDCO shall have the right to require relevant changes, revisions, or additions to the O&M Manual as it, shall deem appropriate to ensure full compliance with the O&M Standards.
10. The Concessionaire shall submit 10 copies of the final O & M manual along with a soft copy in Microsoft Word Format.

2.6 Maintenance schedules

1. The Concessionaire shall prepare and follow a Maintenance plan, detailing the maintenance activities scheduled for each of the component of the Sewerage Network on a periodic approved by Project Engineer and / or the BUIDCO. This should include the requirements for preventive maintenance as specified in Section 2,5 Operation and Maintenance Schedule.
2. Every part of the works and all the materials to be used therein shall be subjected to such tests from time to time during the execution of the work as the BUIDCO may direct and the whole of such tests shall in all cases be made at the Concessionaire's sole expense.
3. The work shall be carried on and completed under the exclusive control direction and supervision and to the satisfaction of the BUIDCO. The BUIDCO shall likewise have full power to reject or condemn any work or material that he may deem unsuitable. In case of any work or material being rejected by the Engineer in-charge, the Concessionaire shall immediately remove and replace the same to the satisfaction of the BUIDCO or the BUIDCO shall have full powers to get the same removed and replaced and deduct the expenditure incurred in the

process from any amount due or that may become due to the Concessionaire.

4. The Concessionaire shall use only the original and genuine spares of the original equipment as per recommendations given in the maintenance booklet of the manufactures/as per directions of the BUIDCO. Adequate stock of such spares is to be maintained by the Concessionaire. Test certificate of manufacturer is required for bearings along with supplies. Test certificate of all major equipment will be submitted from the manufacturer.
5. If any material brought to the site of works, be in the judgment of the Engineer, found inferior or improper & not as per described standards, the said materials or workmanship shall where required by the BUIDCO shall be removed or amended by the Concessionaire forthwith or within such period for every breach by the Concessionaire in this clause.
6. All the steel structures and machines, if installed in open areas, should be painted after every monsoon period after cleaning the surface as per the instructions of the Engineer- in-charge. Entire plant including all civil structures, mechanical equipment, HT panel and Transformers etc. shall be repainted after every 2(1/2) years as per original painting specifications.
7. All leakages should be attended and all network blockages shall be removed within three days of them being identified and reported. All the valves/gates which are not used regularly should be operated at least once a week and make sure that they are properly lubricated /greased.
8. All safety valves should be checked daily and ensure that they are working properly. In case of any fault the same should be attended immediately without any wait. The maintenance of the plant shall be as per maintenance manuals of the manufacturer for all equipment. Concessionaire shall keep all the safety devices in working order.
9. The Concessionaire should make sure that no unwanted material should float/grow in and around different units. In case it is found the same shall be removed /cleaned immediately. He shall also be responsible for cleaning/sweeping the plant buildings inside and outside, roads, foot path etc.
10. Launderers/Weirs etc. of reactors etc. to be maintained clean round the clock. During preventive/ breakdown maintenance, the Concessionaire has to visit the unit/units as and when needed. The pumping units or other machineries required if any shall have to be arranged by the Concessionaire at his own costs for completing the work. In case of battery operated auto system panels and also system alarm etc., batteries are required to be maintained and replaced as and when needed by the Concessionaire.

11. The Concessionaire shall maintain the Supervision, Control and Data Acquisition System (SCADA) in working condition for the 15 years of O & M period. The Concessionaire shall not remove/shift any equipment/machinery even temporarily without written permission of the BUIDCO or authorized representative. Though the Concessionaire has to operate and maintain all the equipment/machineries, lighting (plant area, boundary walls, gate lightening etc.) but the machine of the equipment under warranty should not be dismantled without prior permission of the BUIDCO. The list of such equipment (Under warranty), if any, will be given by the Concessionaire.
12. Consumables such as Manhole covers, POL (petrol/Diesel Oil & Lubricants) etc. has to be arranged by the Concessionaire as and when needed as per manufactures recommendations for periodical maintenance of entire Network. The BUIDCO shall not provide such items.
13. The Concessionaire shall carry out biannual cleaning of network before and after the monsoon season including cleaning of all manhole chambers and collection network.
14. In case of major repair due to normal wear and tear/break down, the Concessionaire should bring the same to the notice of the BUIDCO immediately and necessary measures for its repair should be taken simultaneously. Breakdown, all repairs of any kind are to be attended by the Concessionaire. Any unit/equipment being irreparable in the opinion of the BUIDCO will be replaced by the Concessionaire at no cost to BUIDCO. However, if there is any unexpected population growth / high flows are observed due to urban growth, which warrants replacement of sewer with higher diameters, such cases will be brought to the attention of the owner. Upon owner's approval, at owner's cost, the same shall be executed and commissioned by the Concessionaire. In these cases no supervision or design and estimation charges will be paid by the owner.
15. The Concessionaire shall give his telephone no., contact addresses, etc. to the BUIDCO as well as shift duty shift to contact him during emergency/odd hours etc.
16. The Concessionaire will be responsible to carry day to day as well as periodic maintenance, necessary to ensure smooth and efficient performance/running of all equipment instruments installed at the Sewage Pumping Stations. He shall be responsible for maintenance/replacement of street light poles and light etc. also. All the plant, building, land, etc. shall remain the property of BUIDCO.

Schedule 17

SITE AND SITE AREA

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

The provisions under this Schedule shall be for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, as applicable.

Schedule 17- Site and Site Area

1. General Project Background: Patna City

Patna is the capital of the of Bihar and the second largest city in Eastern India (in terms of population). Patna is one of the oldest inhabited & civilized places in the world. Ancient Patna, known as Pataliputra, was the capital of the Magadha Empire under the Haryanka, Nanda, Mauryan, Sunga, Gupta, Pala and Suri dynasties. Patna is located on the south bank of the Ganga River. Patna is approximately 25 km long and 9 km to 10 km wide. The city has grown up gradually from the ancient age with the name 'Pataliputra'. The geographical location of the Patna Urban Area is on the southern bank of River Ganges between latitudes 25° 30'N & 25° 40'N and longitudes 85°0'E &85° -15'E. It is the 14th most populous agglomeration in India and 168 in the world with a population of approximately 1.8 million. It is the second largest city in eastern India, after Kolkata. Today, all major industries have a base in Patna reflecting the growing importance of the city. There has been significant enhancement in GDP of Bihar in the last decade. The growth of economy, urbanization & population trends are indicators that city shall continue to develop rapidly in next two-three decades. It is also fast emerging as a hub of higher education with institutes of national repute being started in Patna

2. History of Patna City

The history and tradition of Patna go back to the earliest dawn of civilization. The original name of Patna was Pataliputra or Patalipattan and its history dates back to 600 B.C. Ancient Patna covers area of 42 sq km. The name Patna has undergone many changes at its earliest stages like Pataligram, Kusumpur, Patliputra, Azimabad, etc., ultimately terminating to the present one. Chandragupta Maurya made it his capital in the 4 century A.D. Thereafter the city lost its importance until Sher Khan Suri rose to power in the early 16th century A.D. Another version that comes to focus is that there existed a village named Pattan or Patthan, which later turned into Patna. It has been said that Pataliputra was founded by Ajatashatru. Patna, therefore, has become inextricably bound up with the ancient Pataliputra. The ancient village was named 'Patali' and the word 'Pattan' was added to it. Greek history mentions 'Palibothra' which perhaps is Pataliputra itself. Apart from being the administrative centre of the state and its historic importance, the city is also a major educational and medical centre. The economy of Patna is based on the local service industry. Ancient Patna, known as Pataliputra, was the capital of the Magadha Empire under the Haryanka, Nanda, Mauryan, Sunga, Gupta, Pala and Suri dynasties. Pataliputra was also a famous seat of learning and fine arts. Its population during the Maurya period (around 300 BCE) was about 400,000.



The walled old area, called Patna City by the locals, is a major trading centre. The Buddhist, Hindu, and Jain pilgrim centres of Vaishali, Rajgir, Nalanda, Bodhgaya, and Pawapuri are nearby and Patna is also a sacred city for Sikhs. Guru Gobind Singh, (December 22, 1666 – October 7, 1708), the tenth Guru of the Sikhs, was born in Patna. His birthplace, Harmandir saheb, is one of the most sacred pilgrimages for Sikhs. By 1620 the city of Patna was the great centre of Northern India - "the largest town in Bengal and the most famous for trade". This was before the founding of the city of Calcutta. In present day India, Patna has the distinction of giving Dr Rajendra Prasad, as the President of the Constituent Assembly(1946-1949) & later, as the First President of the Republic of India. Image of Patna City is shown in fig. below.

3. Topography

The district can be divided into two prominent natural features comprising:-

A narrow strip of somewhat high land about 8 km in width along the Southern bank of the Ganges having very fertile soil & alluvial fertile plains in the remaining portions. Patna does not contain any hilly region. It has an entirely alluvial and flat region.

Patna is located on the south bank of the Ganga River. The town is situated at an altitude of 48 - 51 m above mean sea level.

The land in the district is too fertile to be left for wild growth. The district is devoid of any forest wealth of consequences. The alluvial text of land yields rice, sugarcane and other food grains. The area under cultivation is studded with mango orchards and bamboo clumps. In the fields adjoining the Ganges weeds such as ammannia,

citriculari, hygrophile and sesbania grow. But palmyra and date palm and mango orchards are found near habitations. Dry shrub jungles are sometimes seen in the villages away from the rivers. Trees commonly met with are bel, siris, jack fruits and the red cotton tree.

4. Climate

The district by and large is homogenous. It is of moderate type characterized by quite hot summers to moderately cold winters. The day temperature generally ranges from 21.1 °C in January to 38.7 °C in May and night temperature from 7.3 °C in December to 27.7 °C in June. The summer begins in April and peaks in June/July with the temperature soaring up to 43 °C till the moisture laden monsoon wind bring some much-needed relief to the parched fields. The rains last through August & September and continue into early October

5. Rainfall

The normal annual rainfall in the district is around 1230 mm. The timely and well-distributed rainfall during Kharif and Rabi has a deciding influence on the land use and cropping pattern of the district.

6. Geomorphology & Soils

Patna district is a part of the Indo Gangetic alluvium. The district forming a part of the flood plains of the Ganga has a monotonously flat relief. Patna region is underlain by alluvial sediments of quaternary age. The quaternary sediments are deposited unconformable on the Archaean basement. The district has mainly four types of soils ranging from moderately well drained to poorly drained, acidic to slightly alkaline and medium to heavy textured. The land in the district is too fertile to be left for wild growth. The district is devoid of any forest wealth of consequences. The alluvial text of land yields rice, sugarcane and other food grains. The area under cultivation is studded with mango orchads and bamboo clumps. In the fields adjoining the Ganges weeds such as ammannia, citriculari, hygrophile and sesbania grow. But palmyra and date palm and mango orchards are found near habitations. Dry shrub jungles are sometimes seen in the villages away from the rivers. Trees commonly met with are bel, siris, jack fruits and the red cotton tree

7. Demography

The population of the Karamlichak zone is 2.29 lacs, 3.05 lacs, 3.44 lacs & 4.79 lacs for 2017, 2032 & 2047 respectively. Detailed projection of the Digha and Kankarbagh is enumerated in subsequent chapters.

8. Seismicity

The project area falls in seismic zone – IV as per the BIS (1893, Part-1, 2002) category of seismic zoning map of India.

9. Ground Water Scenario

Besides State Ground Water Investigation Department, Govt. of Bihar, CGWB has established a network of observation wells under National Hydrograph Network (HNS) programme to ascertain fluctuation and quality of groundwater in the district. There are about 12 HNS monitoring locations identified and being monitored every year regularly during January, May, August and November. During pre-monsoon season, the minimum and maximum water levels were observed as 3.00 and 8.57 m bgl respectively. About 25 % of the wells have the water level in the range of 2 – 5 m bgl. In majority of the wells (76 %), the water levels remain in the range of 5 – 10 m bgl. Below figures depict water level map of Patna district post monsoon and pre monsoon in year 2006.

10. Transportation & Connectivity:

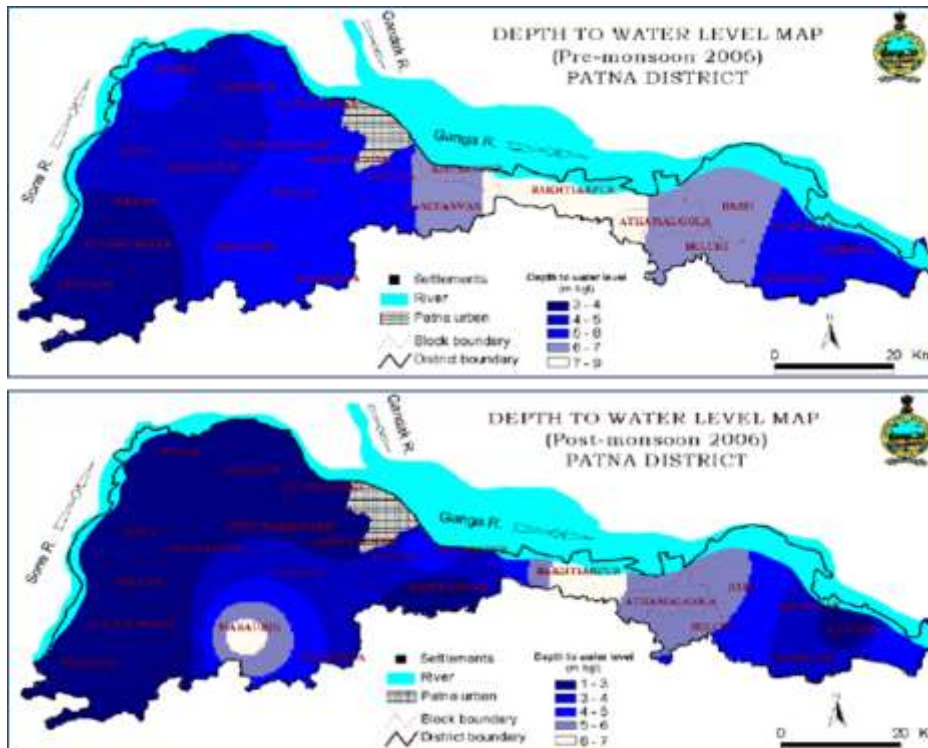
Patna was one of the first places in India to use horse-drawn trams for public transport. Public transportation today is provided for by buses, auto rickshaws and local trains. Auto rickshaws are said to be the lifeline of the city. BSRTC has started City bus service on all major routes of Patna. Recently, radio cab facility has also started.

Railway: The Patna Junction railway station is connected to most of the major cities in India by the railway network. Patna lies in between New Delhi and Kolkata which is one of the busiest rail route in India. The city is a major railway hub and is well connected with Gaya, Jehanabad Biharsharif, Rajgir, Islampur with excessive train services. The plan also includes the modernisation of Patna Junction.

Airways: There is an airport, Lok Nayak Jayaprakash Airport, which is classified as a restricted international airport. The arrival of several low-cost carriers and a number of new destinations have caused a growth in air traffic in recent years, as has an improvement in the situation with regard to law and order. For the period April to December 2009 the airport ranked first in a survey of 46 airports in the country in terms of percentage growth of domestic passengers as well as domestic aircraft movement.[44] New airport is expected to be built at Bihta. Flights are unable to land at the Patna airport during a foggy weather.

Roadways: The city is served by several major road highways and state highways, including National Highways 19, 30, 31, and 83. It is 1,015 kilometres (631 mi) from Delhi, 1,802 kilometres (1,120 mi) from Mumbai and 556 kilometres (345 mi) from Kolkata. Luxury bus service between Patna and several neighbouring cities is provided by the Bihar State Tourism Development Corporation and the Bihar State Road Transport Corporation.

Waterways: Patna has a fixed terminal on National Waterway No. 1 which was established in October 1986. This 1,620 kilometres (1,010 mi) route of navigable water runs from Haldia on the Bay of Bengal, across the extremity of Jharkhand province, across the centre of Bihar and then to Allahabad in Uttar Pradesh.



11. State Level Authority

The Government of Bihar (GOB) through its Urban Development and Housing Department (UD & HD) has been implementing the NGRBA program in the state. Bihar Urban Infrastructure Development Corporation (BUIDCo) is the executing agency for these programmes.

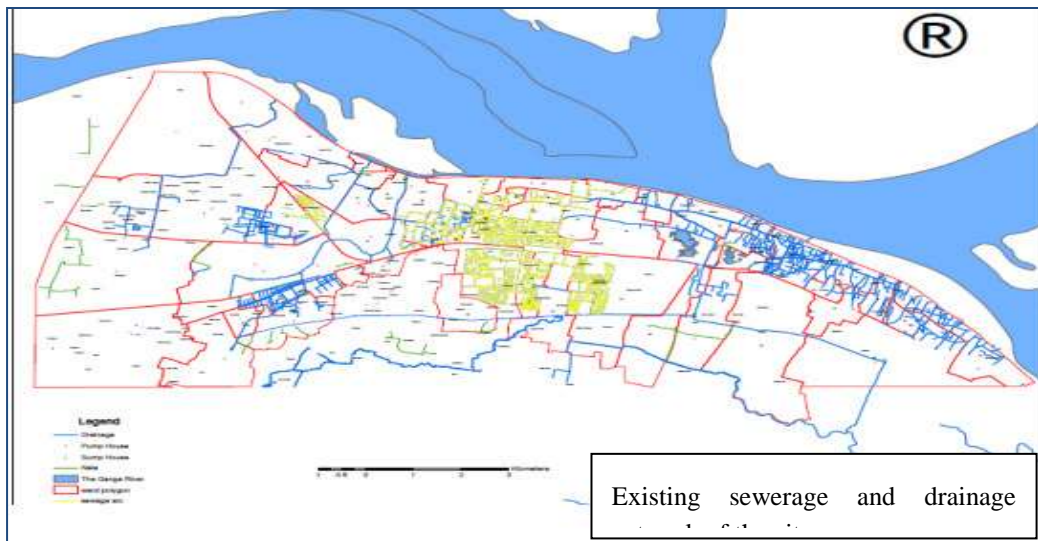
12. Bihar Urban Infrastructure Development Corporation Ltd.

BUIDCo is a Flagship company to implement and accelerate urban infrastructure projects in the State of Bihar. These projects include basic infrastructure amenities such as Solid Waste Management, Water Supply, Drainage Network and Sewerage & Sewage Treatment. Also, projects of urban beautification like River Front Development, Amusement Parks, Commercial works, Hotels etc. are also being developed by the BUIDCo.

13. Sewerage System

The sewerage system in Patna was established in 1936. The city has four sewage treatment plants located at Saidpur (45 MLD), Beur (35 MLD), Pahari (25 MLD) and Karmali Chak (4 MLD) although the quantum of sewage reaching the plants is lower than installed capacity. It can be clearly concluded that the majority of the city is uncovered by sewer network. Inhabitants living in area without sewer network have to

rely on either decentralised collection system in form of inhouse septic tanks or on unhygienic open defecation practise. Figure below depicts the existing sewerage network (Shown by yellow lines on the map):



PMC at present is sub divided into six sewerage zones namely; Digha Zone, Beur Zone, DIGHA Zone, DIGHA Zone kankarbagh and Karmali Chak Zone as depicted below:

Although sewerage systems were first started in Patna city during the year 1936-39 but its penetration at present still lags behind other Indian cities of comparable population and growth rates. The installed capacities of Sewage treatment plants is 109 MLD, but are receiving approximately 61 MLD of sewage, as the existing scheme requires renovation/ maintenance to run the STPs at their installed capacity. A ward wise summary of all the zones as per existing sewerage plan of PMC is tabulated below:

Out of the five sewerage zones depicted above, four have STPs in them whereas sewage collected from Digha zone finds its way to the Beur STP.

1. DIGHA Sewerage Zone

Digha zone is located on the western part of the Patna city. It is named after Digha Ghat on Ganga River. This zone is bounded on the north by river Ganga, on the



west by the Patna-sone canal, on the east by the Saidpur zone and the zone Beur lying on the south.

Digha Zone of Patna

Current population of this zone is about 4.5lakh with density of 137 nos/ha. Based on the identified sewerage zones and demarcated boundary, the Digha Zone covers an area of approximately 34 Square km (Consisting of ward numbers 1,2,3,4,5,6,7,8 9,20, 21,22,23, 24, 25, 26 and 28 partly). The area is characterized by the presence of large number of prominent administrative offices, government buildings, and educational institutes of repute. The Chief Minister's Secreteriat, Raj Bhawan, Indira Gandhi Institute of Medical Sciences, BIT Patna campus, IIT Patna, ICAR research complex for eastern region, Patna High court are some prominent landmarks.

As mentioned earlier, Digha zone does not have sewerage treatment facility of its own and all its sewage flow is presently routed to the 35 MLD STP present in Beur Zone. The effluent from the STP of the Beur zone is released into the Badshahi nala.

As stated earlier, Digha being highly administrative and dense populated area of Patna city, needs a special attention during design and construction. Digha Project area consist of **Patliputra Railway Junction area**, Anandpuri, Nehru Nagar, Indira Nagar, Rajapur, **Gandhi Nagar**, Mandiri Area, **Raj Bhawan Area**, **Income Tax road area**, Ashiyana Nagar, Balapur, Rajbansi Nagar, Sheikpura, Indrapuri, Vyasnagar, A.G Colony, Rajeev Nagar, Shastri Nagar, Patel Nagar, Mahesh Nagar, A. N College Area, **Boring Road**, Patel Nagar, **Airport Area**.

Ward No.	Area in hectare	Population 2011
1	529.80	35074
2	269.90	33230
3	322.40	37524
4	444.70	22509
5	202.90	37704
6	93.70	15277
7	133.50	30131

Ward No.	Area in hectare	Population 2011
8	231.70	22634
9	410.60	11653
20	158.10	16752
21	193.10	23146
22	123.10	100261
23	38.10	8769
24	73.30	16299
25	69.60	11522
26	44.10	20515
28 (50%)	56.90	8002
	3395.50	451002

KANKARBAGH Sewerage Zone

This zone is named after the Kankarbagh Colony which was Asia's largest colony during 1960s. Kankarbagh zone is created by taking part from Beur and Pahari zone. It is located at the central south part of the city. The Patna Gaya road and railway line



runs along the western boundary of this zone. The northern margin of this zone is marked by the Eastern Railway main line and the southern margin is bounded by the Bashahi nala .

Kankarbagh Zone of Patna

According to proposed Sewerage zonation, the ward number 29, 30, 31, 32, 33, 34, 35, 44 and 45 lie in this zone. This zone has historical importance as the remains of the ancient city of Pataliputra has been excavated 5 km east of Patna Junction railway station, on Kankarbagh Main Road. The major landmarks at Kankarbagh are Panch Shiv Mandir, TV Tower in Bhootnath Road and Patliputra Sports Complex etc. Today, this area is developing into an uptown area with expanding and soaring residential apartments.

As stated earlier, Kankarbagh being dense populated area within Patna city needs a special attention during design and construction. Kankarbagh Zone consist of Kankarbagh colony, Tilak Nagar, New Chitragupt Nagar, Rajendra Nagar, Lohiya Nagar, karbigahiya, Chiryatalpur, Indranagar Bank colony, Ram Krishna Nagar, Bhupati Nagar, Amardeep Nagar, Ashok Nagar, Khemni chak, Yogipur Gaon.

Ward No.	Area in hectare	Population 2011
29	147.40	24863
30 (part 50%)	94.40	19674
31	117.10	39768
32	102.40	25516
33	29.60	17564
34	79.90	17294
35	68.40	18996
44	163.10	22333
45	84.20	27381
	886.50	213389

Schedule 18

CONCESSIONAIRE'S PRICE SCHEDULE

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

The Price Schedule (Schedule 18) shall consist of the following for each of the Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, and is collectively called the Contract Price:

- Schedule 18 Part A - BOQ Price against Survey, reviewing the Designs, redesigning where necessary, build, test, and successful commissioning of the Sewerage Network, and Sewage Pumping Station etc.
- Schedule 18 Part B - Operation and Maintenance for 15 years

The above details (for Part A and Part B) will be as quoted by the Bidder in its Bid, in the format prescribed in the Annexure 8 of the RfP, consisting of:

- Network summary
- Network details

Schedule 19

TERMS AND PROCEDURE OF PAYMENT

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately. For clarification purposes, all payments, terms and procedures set out in Article 1 and Article 2 of this Schedule shall be separately applicable for each of the Sewerage Network Facilities

ARTICLE 1. Payment of Design & Build Price

1. Mobilisation Advance:

1.1 Advance payment as an interest free loan for mobilisation and cash flow support for an amount equal to 10 % of the Design-Build Price as stipulated in the contract shall be paid to the Concessionaire against 'Bank Guarantee for Advance Payment' for the same amount subject to the provisions of this Contract.

- (i) 5% within 30 days of effective date of contract; and
- (ii) 5% on mobilization at the site including setting up of the Concessionaire's office, deployment of manpower and machinery & equipment for construction

Repayment of Mobilisation advance:

The Mobilization Advance paid to the Concessionaire by the BUIDCO shall be recovered commencing from the date on which the payment to the Concessionaire 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 Concessionaire for payment. The entire amount of mobilization advance shall be recovered latest by the time payments up to 90 % of the Value of Design, Build and Commissioning Services have been claimed by the Concessionaire.

1.2 Secured Advance for non-perishable materials (pipes, transformers, pumps, motors, starters, cables, D.G. set, and electric panels) brought to site

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 the BUIDCO.
- 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 the owner.

-
- d. The Concessionaire's records of the requirement, orders, receipt and use of materials are kept in a form approved by the BUIDCO and such records shall be available for inspection by the BUIDCO.
 - e. The Concessionaire has submitted with his monthly statement, the estimated value of the materials on site together with such documents as may be required by the BUIDCO, for the purpose of valuation of material and providing evidence of ownership and payment thereof.
 - f. Ownership of such materials shall be deemed to vest in the BUIDCO for which the Concessionaire has submitted an indemnity bond in an acceptable format.

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

2.1 The Concessionaire shall submit to the Project Engineer 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 Project Engineer. The Project Engineer will follow respective State's Public Works Department procedures such as measurement, check measurements, approving deviations etc. and certify such invoices for payment.

The Concessionaire 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 19, provided such items have been completed during the month.

2.2 The Project Engineer shall check the details given in the Concessionaire's monthly statement and within 14 days certify the amounts to be paid to the Concessionaire 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 para 1.2 above, deductions for advance payments, secured advance, other recoveries, adjustment on account of Liquidated Damages - Operations, and other adjustments in terms of the contract and deduction of taxes at source, as applicable under the law.

2.3 The value of work executed shall be determined by the Project Engineer after due check measurement of the quantities claimed as executed by the Concessionaire, 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 19. 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.

- 2.4 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.
- 2.5 The value of work executed shall include the valuation of Variations.
- 2.6 The Project Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- 2.7 The Concessionaire shall submit his claim for the price adjustment, if applicable to this contract as per SCC 5.1(1)(a), along with his claim for payment for the work done during the month, and price adjustment will be allowed as per formulae stipulated in Schedule 21 of the Contract.
- 2.8 The procedure for payment during Design Build Period shall be read in conjunction with Article 2 (3) and Article 2 (4) of this Schedule

ARTICLE 2. Payment of O&M Prices

1. **Payment of O&M Prices for Operations and Maintenance of Sewerage Network**
 - a. NMCG shall pay O&M prices on a Quarterly basis, from the relevant Operations Starting Date to the Concessionaire, as determined in accordance with the provisions of this Clause and other relevant provisions of this Contract Agreement. The Quarterly prices in respect of Operations and Maintenance services shall be paid during the relevant Operations period as three times the quoted monthly O&M prices after necessary price adjustments and including for Liquidated Damages – Operations (including Power Consumption Liquidated Damages) computed as per Schedule 20 of this Contract .
 - b. If the scope of O&M services is varied by the BUIDCO/NMCG owing to variation in the lengths of sewerage lines and number of pumping stations to be operated and maintained by the Concessionaire during any part of the contract period, the O&M charges payable to the Concessionaire shall be subject to adjustment on the basis of unit O&M prices provided in the Concessionaire's Price Schedule incorporated in Schedule 18 of the Contract.
 - c. In the event that the occurrence of the Operations Starting Date is delayed for any reasons, O&M prices shall be paid from the date of commencement of the Operations till the end of the relevant O&M period.
 - d. O&M price for operation of the quoted in the Concessionaire's Price Schedule comprises fixed and variable components. The said variable component shall be adjusted on the basis of actual quantity of sewage handled by the respective SPS. The adjusted variable component will be computed by multiplying the quoted units of energy per MLD of sewage pumped with the actual

quantity of sewage handled and Power Unit Rate (collectively called as Variable Price) for each SPS. If the actual units of electricity consumed exceeds the value quoted for such SPS then, the Concessionaire shall be liable to pay Power consumption liquidated damages in accordance with Schedule 20 of this Contract

2. Payments for power connection from Electricity Utility Company

The Concessionaire shall be responsible for obtaining power connection at his cost for meeting power requirements during the **Design Build Period**, and all costs of energy consumption during this period shall be borne by the Concessionaire.

For meeting power requirement during **Operation and Maintenance Period**, the Concessionaire shall approach the Electricity Utility Company for getting the required sanction and power connection. The Owner shall assist the Concessionaire on best effort basis in obtaining such power connection. The Concessionaire will make all payments required for obtaining the power connection including security deposit, if any, and such amount will be reimbursed by the Owner within 60 days of submission of Concessionaire's claim.

However, the Concessionaire shall be responsible for making payments directly to the Utility Company against all bills ("Electricity Dues") for electricity consumed in operation of the pumping stations, if are included in the scope of the contract, as the cost of electrical energy needed for O&M is included in the O&M price stipulated in the contract.

3. Certification of payments by Project Engineer

The Concessionaire shall submit all monthly statements of claims for payment during the Design-Build Period, and quarterly bills for payment of the O&M charges & also the quarterly bills relating to adjustment to O&M charges during the O&M Period to the Project Engineer. After examining these bills, the Project Engineer shall forward them to BUIDCO and NMCG along with the Interim Payment Certificate (IPC) for the amount considered payable by him as per terms and conditions of the Contract.

Each IPC submitted by the Project Engineer shall carry a stipulation that the Performance Security of the required amount furnished by the Concessionaire continues to be valid for a minimum of 120 days as on the date of **certification of payment** and the same shall be **verified by the paying authority** before releasing the **payment** against the IPC.

4. Right to withhold

The Project Engineer / BUIDCO/NMCG may refuse to approve any 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 Project Engineer 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 Concessionaire's failure to make payment properly to sub-Contractors or for labor, materials or equipment (d) of damage to another Concessionaire or to the property of others caused by the Concessionaire (e) of the Concessionaire's neglect or unsatisfactory proceeding of the work (f) Concessionaire owes a liability or a sum to Owner.

When the grounds for withholding payments are removed, payments shall be made for amounts withheld to the extent the Concessionaire is entitled to payment.

PAYMENT BREAK UP SCHEDULE OF CIVIL WORKS (EXECUTION)

This will be modified upon the approval of the Design-Build Time Schedule submitted by the Concessionaire, to include monthly milestones and corresponding timelines for achievement

PART – I, GRAVITY SEWERS LAYING BY OPEN CUT 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 II SUPPLY & LAYING OF RISING MAIN BY OPEN CUT 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%

PART III 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 run	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-10 grade Lean 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. MEP BUILDING

i.	Approval of designs and drawings	2%
ii.	Excavation	2%
iii.	Sub Structure & Super structure	
a	Raft footing/ pile foundation	10%
b	Construction of columns and beams	15%
c	Wall up to plinth level including plinth beam	3%
d	Wall up to lintel level including lintel beam	10%

e	Wall up to slab level	5%
f	Roof slab & beams including support for fixing gantry girders	13%
iv.	Doors / Windows/Ventilators/Rolling shutter	
a	Supply at site	3%
b	Fixing in position	2%
v	Flooring/ cable trunk	5%
vi	Plastering	5%
vii.	Internal electrification	2%
viii	Painting/ varnishing	5%
ix	Stair case/ M.S. ladder	5%
x	Drainage including construction of apron around the building	3%
xii	Commissioning including site clearance & Misc. finishing items	10%
	Total	100%

v. DG PLATE FORM

i	Approval of design & drawing	3%
ii	Initial open excavation	2%
iii	M-10 grade Lean concrete	5%
iv	Construction of RCC foundation for DG	25%
v	Construction of tubular shade	35%
vi	Construction of MS grill around the plate form with lobby arrangement.	20%
vii	After commissioning & trial run	10%
	Total	100%

vi. MISC.BUILDINGS

i.	Approval of designs and drawings	2%
ii.	Excavation	2%
iii.	Sub Structure & Super structure	
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- IV 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 two years 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 two years 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 two years 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 two years maintenance.

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%

BREAK UP OF PAYMENT FOR TRENCHLESS WORKS

S.N	Activity	Component wise Percentage payment in %
1	Approval of design & Drawing	2%
2	Ground Penetrating Radar survey, Seismic Survey, Electric Tomography, Laying , Jointing & Watertightness test of pipe	2%
3	Supply of Pipes	32%
4	Excavation of Shafts & Confined Excavation,Closed Planking & Rifilling of trenches, pits	4%
5	Trench Cutting & Installation of Product Pipe	40%
6	Construction of Composite Manholes	14%
7	Commissioning including site clearance & Misc. finishing items	6%
	Total	100%

Signature of Concessionaire
Name of Concessionaire
Rubber stamp with Designation
Date
Place :

Signature of Engineer:
Name of Engineer
Designation
Date
Place :

Schedule 20

LIQUIDATED DAMAGES - OPERATIONS

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

LIQUIDATED DAMAGES – OPERATIONS

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

1. Liquidated Damages (GC Section 5.4)

In case the Concessionaire fails to meet the Performance Standards listed in the Table below, payments due to the Concessionaire shall be subject to deduction on account of liquidated damages for defaults exceeding the Acceptable Limits. Such deductions shall be over and above the costs and compensation that might be required by the Owner to pay to the affected people and parties in the area where O&M of the sewerage network and Pumping Stations has been entrusted to the Concessionaire.

“Acceptable Limit” is the permissible number of instances of defaults or non-adherence to a particular Set of Performance Standards during the Quarter for which payment has been claimed by the Concessionaire.

The Concessionaire shall be required to meet all of the Performance Standards as specified herein below. He shall ensure that defaults from compliance with the said Standards shall not exceed the Acceptable Limit; otherwise Liquidated damages as specified herein shall be applicable.

1.1 Associate Infrastructure - Availability

(i) The Concessionaire shall ensure that the Availability of each Pumping Station on every day during the Network O&M Period shall be 100% (the **Guaranteed Availability**). Provided that during the period of a Scheduled Maintenance that is undertaken as per the approved Scheduled Maintenance Programme or other approved outages, the Concessionaire shall ensure that the Guaranteed Availability of the Pumping Station is at least 95%

(ii) In computing the Availability of each Pumping Station, the Concessionaire agrees that the Pumping Station shall be considered as not Available, in the case of any Overflow from Pumping Station. In the case of Overflow the Acceptable Limit is as follows: No overflow shall be allowed from each Pumping Station. This is to be rectified in 1 hour after each instance. Liquidated Damages shall be chargeable for every hour of Non-Availability beyond the Acceptable Limit of 1 hour as per 1.1(iv) of this Section.

In computing the Availability of the trunk sewer, the Concessionaire agrees that the trunk sewer shall be considered as not Available, in the case of any chokes and blockages. In such cases the Acceptable Limit is as follows: 1 per month / 10 km length of trunk sewer. The Concessionaire agrees to rectify chokes / blockages within 24 hours of reporting / complaint / identification. If rectified between 24-48 hours of reporting / complaint / identification – Liquidated Damages shall be 1.25% of the quarterly payments for each default.

(iii) If the Availability for the Associate Infrastructure Facility on any given day is less than the Guaranteed Availability,

A) BUIDCO shall issue a notice to the Concessionaire requiring the Concessionaire to cure the default causing the reduction in Availability in 3 days. Any failure to cure the default and achieve the Guaranteed Availability within 3 days of receipt of the notice from BUIDCO shall constitute an Concessionaire Event of Default.

B) for 32 days in a 12 month period, it shall constitute an Concessionaire Event of Default

(iv) Without prejudice to 1.1(iii) above, if the availability on any given day is less than the Guaranteed Availability, then the Concessionaire is liable to pay Liquidated Damages as set out below

For each Pumping Station:

Parameter	Value
Guaranteed Availability of each pumping station	100%
Hours in the month for which a specific pumping station was not Available (A)	_____
Non-Availability for the specific pumping station (B)	= [(A) / 720] x100
LDs for non- adherence for the specific pumping station (INR)	= (B) x Monthly PS Liquidated Damages (as per Table below)

Peak Capacity	Monthly pumping station (PS) Liquidated Damages
Upto 20 MLD	2000
20 MLD – 50 MLD	5000
50 MLD – 100 MLD	10000
>100 MLD	15000

v) The aggregate Availability Liquidated Damages payable by the Concessionaire in any quarter of the Network O&M Period will be deducted from the O&M Charges due for such quarter. If the Availability Liquidated Damages for a quarter exceed the O&M Charges for such quarter, then the excess amounts shall, at the discretion of BUIDCO, either be adjusted against the O&M Charges for the subsequent quarter or recovered from the Sewerage Network Performance Security.

1.2 Associate Infrastructure – Power Consumption

(A) For each Pumping Station, the Concessionaire shall be liable to pay liquidated damages to BUIDCO for any units of energy consumed beyond the Allowable Energy Consumption (whether from the grid or from the DG Sets) for such pumping station (**Power Consumption Liquidated Damages**), which will be calculated as follows:

(I) For excess power consumption up to 5% of the Guaranteed Energy

Consumption of the relevant Pumping station:

Power Consumption Liquidated Damages: (Number of power units consumed in the relevant quarter – Guaranteed Energy Consumption for such quarter) * [Power Unit Rate] * 0.25

(II) For excess power consumption between 5% and 10% of the Guaranteed Energy Consumption of the relevant Pumping station:

Power Consumption Liquidated Damages: (Number of power units consumed in the relevant quarter – Guaranteed Energy Consumption for such quarter) * [Power Unit Rate] * 0.5

(III) For excess power consumption above 10% of the Guaranteed Energy Consumption of the relevant Pumping station:

Power Consumption Liquidated Damages: (Number of power units consumed in the relevant quarter – Guaranteed Energy Consumption for such quarter) * [Power Unit Rate]

- (B) The Power Consumption Liquidated Damages payable by the Concessionaire in any quarter of the O&M Period will be deducted from the O&M Price for the relevant Sewerage Network Facility payable to the Concessionaire for such quarter. If the Power Consumption Liquidated Damages for a quarter exceed the O&M Price for the relevant Facility for such quarter, then the excess amounts shall, at the discretion of BUIDCO, either be adjusted against the O&M Charges for the relevant Facility for the subsequent quarter or recovered from the relevant Sewerage Network Performance Security for the Operations Period.

1.3 Lateral Network

For the Lateral Network facilities the Performance Standards set out below shall be applicable, beyond the Acceptable limit set out below.

If necessary action is not taken by the Concessionaire within the time specified in the Charter of Services (Schedule 15), then BUIDCO, at its discretion, may interfere to execute such works and deduct twice the charges incurred from the payments to the Concessionaire, apart from the Liquidated Damages.

Description of performance set	Acceptable limit	Reduction in payment as% of quarterly O&M Charges	Performance Standard
Sewerage Network Pipeline Breakages	1 per month / 50 km (to be repaired in 24 hours)	1% of the quarterly payments for each default exceeding the Acceptable Limit	Sewer Network pipeline breakages that are not repaired within 24 hours (will be considered as 'Breakages'. Repaired between 2 days to 7 days – 1.25% of the quarterly payments for each default
Replacement of Manhole Covers	1 per month / 10 km (to be rectified in 24 hours)	Rs 500 per number of covers not replaced in 24 hours	Replace damaged or stolen manhole covers within 24 hours after complaint/identification If not replaced between 24-48 hrs. – Rs. 1000 per number of covers not replaced.

Schedule 21

Price Adjustment

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

SCHEDULE 21

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

1. GENERAL

1.1 This Schedule lays down the procedure for determining the price adjustment to be applied to the following components of the contract price:

- (i) Design-Build Price for the Network, if SCC 5.1 (3) stipulates that price adjustment will apply to Design-Build Price.
- (ii) Price for Operation & Maintenance of the Network.

1.2 For the purpose of Price Adjustment, 'Base Date' shall be the date 28 days prior to the deadline for submission of bids for the contract. Thus Base date for this contract is..... *[EA should insert the date at the time of signing the contract.]*

1.3 Deleted

2. PRICE ADJUSTMENT FOR DESIGN BUILD PRICE

2.1 If this Clause applies, the amounts payable to the Concessionaire shall be adjusted using the Construction Price Index as defined in the Concession Agreement. During the Design Build Period, the payments to the Concessionaire shall be adjusted for the Price Index Multiple applicable on the date of the relevant invoice raised by the Concessionaire

2.2 Deleted

2.3 The cost indices or reference prices stated above shall be used. If their source is in doubt, it shall be determined by the Project Engineer.

2.4 Until such time as each current cost index is available, the Project Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

2.5 If the Concessionaire fails to complete the Design-Build Services within the stipulated Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the specified Time for Completion, or (ii) the current index or price, whichever is more favourable to the BUIDCO/NMCG.

2.6 The adjustment data above shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

3. Determination of Price Adjustment Multiplier

3.1 The Payments of Design Build Price shall be adjusted during the Design Build Period to reflect the variation in the Construction Price Index occurring after the Reference Index Date immediately preceding the Bid Due Date. All Invoices to be submitted by the Concessionaire to BUIDCO for any instalment of the Construction Payments shall be the product of the relevant percentage of the Design Build Cost and the Price Index Multiple applicable on the date of the Invoice.

3.2 Deleted

3.3 Foreign Currency

The Concessionaire shall be paid the Construction Payments in Rupees. However, if, in the Financial Proposal, the Selected Bidder specified any percentage of the Design Build Cost which it would want to receive in a foreign currency during the Design Build Period, then Payments corresponding to such items in the shall be paid to the Concessionaire in the relevant foreign currency. For the purpose of payment in a foreign currency, the exchange rate shall be [].

4. PRICE ADJUSTMENT FOR O&M PRICES

4.1 The Payment for O&M Price shall be adjusted to reflect the variation in the O&M Price Index occurring after the Reference Index Date immediately preceding the Bid Due Date. All Invoices to be submitted by the Concessionaire to BUIDCO for any instalment of the O&M Charges shall be the product of the relevant percentage of the quoted O&M Charges and the Price Index Multiple applicable on the date of the Invoice.

4.2 Adjustment for Variation in Electricity Tariff

O&M prices shall be subject to adjustment on account of variation in the Electricity Tariff during the O&M period with reference to 'Base Rate of Electricity Tariff' specified at the time of invitation of bids, as mentioned in the RfP. The said adjustment shall be determined on the basis of the actual electricity consumption and the Tariff evidenced by the Electricity bills paid by the Concessionaire to the Electricity Utility Company, subject to the following provisions:

-
- a) Variation shall be limited to the Guaranteed Energy Consumption applicable for the level of effluent pumped by the SPS during the quarter.
 - b) Guaranteed Energy Consumption for the actual level of effluent handled by each SPS will be calculated based on the energy consumption/MLD for the relevant year of the O&M period as quoted in the Concessionaire's Price Schedule incorporated in Schedule 18 of the Contract.

The variation applicable as per this sub-paragraph 4.2 shall be claimed by the Concessionaire on quarterly basis.

4.3 Determination of cost of Diesel used in DG set

The Concessionaire shall use back-up power supply from the DG set referred to in the preceding sub-paragraph during the period power supply from the Electricity Utility Company is not available. The DG set which shall be equipped with standard accessories will inter alia record (i) energy supplied/generated by it and (ii) total period for which it was operated in a month/quarter. Cost of Diesel for which Concessionaire will be entitled to compensation on account of energy obtained from the back-up power supply unit shall be determined as under:

- (a) Concessionaire's representative and the Project Engineer shall jointly take the readings from the meters and gauges (sealed jointly by them at the commencement of the O&M period) of DG set every month to arrive at the total number of energy units (kWh) = E_1 obtained from the back-up power supply unit.
- (b) Number of energy units (kWh) obtained from the back-up power supply unit during the month for which Concessionaire shall be entitled to compensation (referred to as '**adjusted units of back-up energy supply**') shall be determined in a series of steps that follow.

The Owner will first determine the short-fall in supply from the Electricity Utility Company.

Short-fall in supply from the Electricity Utility Company (E_2)

= Energy Requirement as per Guaranteed Energy Consumption applicable for the level of effluent treated by STP, and for the level of effluent pumped by the respective during the month

(-) Units of energy (kWh) available/obtained during the month from the Electricity Utility Company as evidenced by the Bill of the Utility Company for the corresponding month

If the 'Short-fall in supply from the Electricity Utility Company' (E_2) works out to be a negative figure, Concessionaire shall not be entitled to compensation for using the energy supply from the back-up power supply unit.

If E_2 is a positive figure, compensation shall be based on E_1 or E_2 whichever is lower and this lower figure shall be termed as '**adjusted units of back-up energy supply**'.

- (c) Rated specific fuel consumption of the DG set specified by the Manufacturer in its Specifications will then be used for determining the estimated diesel consumption during the month for producing the 'adjusted units of back-up energy supply'.
- (d) Cost of estimated Diesel consumption in a month shall then be calculated on the basis of price of diesel prevailing at mid-point of the month in IOC or HPCL's retail outlet in the city where the SPSs are installed. Cost figures of three months shall be added to arrive at the Cost of Diesel consumption in a quarter.

4.4 Adjustment in O&M Price for energy taken from the back-up power supply unit

O&M prices quoted in the Concessionaire's Price Schedule incorporated in Schedule 18 take into account energy requirements of being met fully by power supplied by the Electricity Utility Company. Hence compensation payable to the Concessionaire for Energy supply taken from an alternate source, namely the back-up power supply Unit shall be corrected as under:

Adjustment in quarterly O&M price = Cost of Diesel consumption in a quarter determined in accordance with sub-paragraph 4.3 (d) above **minus** 'adjusted units of back-up energy supply' determined as per sub-paragraph 4.3 (b) as applicable for the quarter multiplied by the 'Base Rate of Electricity Tariff'.

The variation in O&M price applicable as per sub-paragraphs 4.3 and 4.4 shall be claimed by the Concessionaire on quarterly basis.

4.5 Quarterly claims for Price Adjustment

The variation in O&M price, after accounting for the applicable adjustments as per sub-paragraphs 4.2, 4.3 and 4.4 shall be claimed by the Concessionaire on quarterly basis using the O&M Index defined in the Concession Agreement, using the applicable Price Index multiple on the Reference Index Date During the O&M Period, the payments to the Concessionaire shall be adjusted for the Price Index Multiple applicable on the date of the relevant invoice raised by the Concessionaire.

Schedule 22

**SCHEDULE OF PERFORMANCE GUARANTEE
& ADVANCE PAYMENT GUARANTEE**

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

The formats provided under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

FORMAT OF PERFORMANCE GUARANTEE

(For Design Build Period and Operations Period)

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

Beneficiary: _____ [Name and Address of Owner]

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 Concessionaire, 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) one 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.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758 except that the supporting statement under Article 15(a) is hereby excluded.

Yours truly,

[Name of Bank]

Authorised Signature

Environmental, Social, Health and Safety (ESHS) Performance Security [*Guarantor letterhead or SWIFT identifier code*]

Beneficiary: [*insert name and Address of Employer*]

Date: _ [*Insert date of issue*]

ESHS PERFORMANCE GUARANTEE No.: [*Insert reference number*]

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead*]

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

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

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (¹), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its Environmental, Social, Health and/or Safety (ESHS) obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the Day of, 2... [*insert the date six months after the End Date, as defined in the Contract*], and any demand for payment under it must be received by us at this office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

¹ *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, and denominated either in the currency (cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

[signature(s)]

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

FORM OF BANK GUARANTEE – ADVANCE PAYMENT

[Name of Contract]

To: *[Name and address of Owner]*

Dear Ladies and/or Gentlemen,

We refer to the Contract Agreement (“the Contract”) signed on *[date]* between you and *[name of Concessionaire]* (“the Concessionaire”) concerning the Services set out in the Contract to Design, Refurbish, Build and Operate a Sewerage Network.

Whereas, in accordance with the terms of the Contract, the Owner agreed to pay or cause to be paid to the Concessionaire an advance payment in the amount of *[number]* percent (____%) of the Design-Build Cost for the Design-Build, Refurbish, Commission, Operate and Maintaining 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 the Owner 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 the Owner.

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 the Owner in accordance with the terms of the Contract. At the time at which the outstanding amount isnil, 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.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

Yours truly,

[Name of the Bank] & Authorized Signature

Schedule 23

**TECHNICAL SPECIFICATIONS FOR CONSTRUCTION AND OPERATION
AND MAINTENANCE PHASE**

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

The provisions under this Schedule shall be applicable for both Digha Sewerage Network Facilities and Kankarbagh Sewerage Network Facilities, separately.

Section 1. General

1 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 Concessionaire 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.

1.1. 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 Concessionaire shall adopt and follow necessary standards and approved Codes /specification wherever required for fulfillment of all the works under this contract.

1.2. Supplementing the General Conditions and Design-Build and Operating Services

The Technical Standards specified in Schedule 23 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 Concessionaire shall meet.

1.3. 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 the BUIDCO'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 the BUIDCO as provided to the Concessionaire;
- (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 the BUIDCO.

In the event of any conflict or inconsistency between any standards that comprise the General Quality Standard, local and national standards in the BUIDCO's Country shall prevail over international standards.

The Concessionaire 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 Concessionaire shall perform the Services to the standard of "General Quality Standards".

If the BUIDCO is subjected to fines or penalties as a result of the Concessionaire's breach of these Technical Standards, such fines or penalties shall be paid by the Concessionaire

1.4. Design-Build Services

In respect of the Design-Build Services, the Concessionaire 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 Concessionaire warrants that the Concessionaire 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.SCOPE 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.

- 2.1.** Review of BUIDCO's proposals and designs: The Concessionaire 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 the owner's proposal, (iii) review designs of sewerage system and sewage pumping proposals provided by the owner, (iv) re-design the sewers (using CAD Software) and undertake detailed design of sewage pumping systems

wherever necessary and prepare revised drawings,(v) submit the revised designs & drawings and obtain approval of the BUIDCO. The payment will be made as per the quoted rates in bill of quantities for conducting survey, reviewing and redesigning. The Bidder has to consider this aspect and make provision, while quoting the rates for Sewer pipe (less than 300mm), supply, laying and jointing item in the tender.

Conducting Survey 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. 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 before execution of the work.

Also, conducting Survey for laying of sewers (equal to or greater 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. 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 before execution of the work. The Concessionaire shall take prior approval of the BUIDCO before surveying in any changes in locations or alignments from the original proposals.

- 2.2. 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.
- 2.3. 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.
- 2.4. Providing erecting and removing sal ballah barricading with departmental sal ballah average 150 mm dia. And 2 m long sal ballah post at interval of 2.5 m c/c fixed 0.5 m average below ground, packed with earth and Brick bats, well watered and rammed with three rows of average 100 mm dia. Sal ballah horizontal runners fixed with iron spikes and wires, while washing one coat to exposed surface, dismantling the barricade after function, filling the holes, excluding carriage of sal ballah from and to godown up to 5 km lead, stacking in countable stacks in godown including cost of all labour and materials and taxes all complete.
- 2.5. 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. Bidder shall quote the rate for to & fro lead distance.

- 2.6.** 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
- 2.7.** 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 Concessionaire 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).
- 2.8.** Manufacturing / Procurement, Supplying, Laying and Jointing the specified diameters of following pipes, for sewers in DIGHA. AREA:
- 2.8.1.** Deleted
- 2.8.2.** 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) confirming to IS 12330, with rubber rings as per IS:5382, and laying as per IS:783 with latest revisions & amendments etc. complete.
- 2.8.3.** DI K-7 class pressure pipes with CM lining using SRC 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.
- 2.8.4.** Corrugated HDPE pipes conforming to BIS 16098- part 2-2013
- 2.9.** Construction 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) with SFRC 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.
- 2.10.** Interlinking the existing sewer lines with proposed lines and vice versa.
- 2.11.** 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 BUIDCO'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 EMPLOYER for conducting this survey.

- 2.12.** Providing PVC pipes for House Service Connections from Manholes / Sewer lines as per specifications and approved drawings and as directed by the Engineer 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.
- 2.13.** Construction of sewage pumping stations including Electro mechanical works
- 2.14.** Backfilling the trenches in layers of specified thickness, material as per detailed specifications and items in bill of quantities.
- 2.15.** Providing Road or Railway crossing by adopting Trench less Method (i.e. pipe ramming method/ manual pipe jacking method)) as per items in bill of quantities at locations shown in the approved drawings, specifications and as directed by the Engineer.
- 2.16.** Taking all measures for complying to the Environmental Management Plan and monitoring the same as per detailed specifications.
- 2.17.** Concessionaire shall be responsible for providing insurance as provided in Contract data.
- 2.18.** Testing and commissioning the sewers after laying and construction of manholes as per detailed specifications.
- 2.19.** Restoration of Bituminous road with WBM and 20mm thick premix carpet with liquid seal coat as per MORTH specifications and cement concrete roads as per specifications and as directed by the Engineer including preparation of sub-grade, all construction materials, tools and plants etc., complete.
- 2.20.** Submission of as built drawings of sewer lines & its appurtenances, including L-sections and plans as per specifications including existing laterals for which the Concessionaire 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, PVC pipes at road crossings, all safety measures etc.
- 2.21.** 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. The work shall be executed on item rate basis. Indicative Drawings related to the works to be done, are given for guidance of the Concessionaire. For the execution of Works, exact details will be given in construction drawings based on the alignment drawings given by the Concessionaire. The prospective bidder 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.

- 2.22.** Trial run of the System:-After commissioning of works or a section of the completed works, the Concessionaire shall conduct trial run to demonstrate satisfactory performance to the Engineer prior to declaring commencement of O&M.
- 2.23.** Noise from the construction activity shall be controlled by the Contractor by providing appropriate means such as noise barriers. The general requirement of sound barriers and calculation of sound levels shall conform to National Building Code (Part 8).

The following specification and guideline shall be used for limiting the noise due to construction activities, conforming to Ministry of Environment and Forest specifications.

- (a) Acoustic barriers should be placed near construction sites
- (b) The maximum noise levels near the construction site should be limited to 75 dB(A) Leq(5 min.) in industrial areas and to 65 dB(A) Leq(5 min.) in other areas.
- (c) There should be fencing around the construction site to prevent people coming near the site.
- (d) Materials need not be stockpiled and unused equipment to be placed between noisy operating equipment and other areas.
- (e) Constructing temporary earth bund around the site using soil etc, which normally is hauled away from the construction site.

Applicable legislation: The Noise Pollution (Regulation and Control) Rules 2000.

Section 3. Concessionaire's Inspection of Sites

The Concessionaire 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 Concessionaire of his prima facie obligation and responsibility under the Contract to carry out and successfully complete the contract. The BUIDCO will entertain no monetary or other claims, made by the Concessionaire on the grounds of 'want of knowledge'.

Section 4. Work plan

The Concessionaire shall prepare the work plan for the execution of works, which includes procurement of pipes before starting of the works. The Concessionaire 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 Concessionaire.

Section 5. Alignment Survey and the L-Sections

The Concessionaire 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. Concessionaire 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 Concessionaire 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 Concessionaire 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 OWNER, for re-design of that particular stretch and take up the work on receipt of approved designs from OWNER.

Also, the Concessionaire 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. Concessionaire 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 Concessionaire 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 Concessionaire 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 OWNER, for re-design of that particular stretch and take up the work on receipt of approved designs

from OWNER. 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 OWNER.
- b) Field attribute collection for Mapping with respect to existing sewerage network does not require any digging in the field. The existing maps / OWNER field staff knowledge can be utilized by the Concessionaire 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 Concessionaire shall communicate regularly, with the OWNER regarding the GIS mapping survey data and for clarifications.

Section 6. 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 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 Concessionaire shall be responsible to follow the appropriate standards.

Section 7. 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 Concessionaire and submitted to the Engineer at least 28 days prior to the date when the Concessionaire desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Concessionaire shall comply with the standards specified in the documents.

Section 8. Samples and Tests

- a) The Concessionaire 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 Concessionaire 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 Concessionaire 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 Concessionaire, and the Concessionaire 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 Concessionaire 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 Concessionaire 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 Concessionaire's quality control programme is not adequate to ensure the quality of the Works, the Concessionaire shall produce a revised program as desired by the Engineer, which will be adequate to ensure satisfactory quality control.

8.1. 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 Concessionaire 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.

8.2. Third Party Inspections

The Concessionaire 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.

The BUIDCO 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 OWNER to the Third Party Inspecting and certifying Agency. The Concessionaire 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.	<p>1. Visual and dimension check.</p> <p>Quality of raw materials as per IS: 458 with latest revision and amendments.</p> <p>Physical requirements as per IS: 458 with latest amendments.</p> <p>Hydrostatic Test</p> <p>Three edge bearing Test & permeability test as per IS: 458 with latest amendments.</p> <p>All other Tests as may be found necessary as per relevant Indian standards.</p> <p>Rubber ring for corrosion/elongation as per relevant IS Code and</p> <p>All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.</p>
2).	Deleted	Deleted
3).	PVC pipes and Specials	<p>General Quality, Visual and dimension check as per as per relevant IS with latest revision and amendments.</p> <p>Hydraulic test as per relevant IS with latest revision and amendments.</p> <p>Acid and Alkali resistance test as per as per relevant IS with latest revision and amendments.</p> <p>All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.</p>
4).	DI Pipes, rubber rings & Specials.	<p>Visual and Dimensions Check</p> <p>Review of Chemical and Physical test certificates as per relevant IS standards.</p> <p>Hydraulic Test</p> <p>Checking of Cement Mortar lining/ coating for strength, thickness, cracks etc,</p> <p>Rubber Ring for Corrosion / Elongation as per IS code</p> <p>Three edge bearing test / Bursting Test and</p> <p>All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.</p>
5).	HDPE Pipes, Corrugated HDPE pipes & Specials	<p>Visual and Dimensions Check</p> <p>Review of Chemical and Physical test certificates as per relevant IS standards.</p> <p>Hydraulic Test and</p> <p>All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.</p>
6).	SFRC manholes covers and frames (Heavy Duty)	<p>Tests conforming to IS 12592 part I-1989 and part II-1991 with latest amendments, Load test etc. and</p> <p>All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.</p>

Sl. No.	ITEMS	STAGES OF INSPECTION
7).	Valves.	Visual and dimension check Review of material test certificate for valve body and internals. Operational Smoothness. Hydraulic test / leakage test as per applicable codes. and All other tests as per relevant standards as mentioned in this Technical specifications and approved QAP.

Section 9. Sign Board

The Concessionaire 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 the BUIDCO, Concessionaire 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. Concessionaire 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.

Section 10. Protection of Utilities

- 10.1.** The Concessionaire is required to examine carefully the locations of the works and their alignments. Concessionaire 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.
- 10.2.** The Concessionaire 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 Concessionaire's own cost. Shifting of any utilities if required will be taken up by OWNER or any other agency separately after site inspection.
- 10.3.** 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 Concessionaires for the safety of the structures, the cost of the item shall be paid to the Concessionaire as per approved Bill of Quantities item rates in the contract.
- 10.4.** In case the alignment of the pipeline crosses the high tension electrical transmission lines belonging to the other authorities/ departments, the Concessionaire shall take all precautions necessary to see that the work is carried out with care and safety, without disturbing such transmission lines. The Concessionaire will be responsible to carry out all construction

activities in such reaches in consultation with the owners of such facilities. However, satisfactory completion of the entire work will be the responsibility of the Concessionaire.

Section 11. Performance Requirements:

The performance requirements have been spelt out in various parts of the Contract specification. The Concessionaire 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 Concessionaire 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 Concessionaire in writing and which is final. The Concessionaire shall fully comply with Engineer's decision on the matter. The Concessionaire 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.

Section 12. Concessionaire's Obligations:

The Clauses in this section are meant to provide general guidelines and Compliance requirements to the Concessionaire. It does not however relieve the Concessionaire 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.

12.1. Environmental Management Plan and Monitoring.

The Concessionaire shall be responsible for the mitigation measures to be taken for complying to the Environmental management plan and monitor as described below.

12.2. Environmental Management Plan - Construction Phase

Attached as Appendix 1 to SCC

Section 13. Penalty on account of non-compliance

If the Concessionaire 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 operator and penalty as per liquidated damages clause in conditions of contract and contract data shall be imposed upon approval by the concerned engineer, owner.

Section 14. Confined Space Safety Procedure:

The Concessionaire 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 Concessionaire has to develop and implement his own safety

procedures. He should also provide necessary insurance to the workers involved in the execution of work.

Section 15. Special Traffic Precautions

Concessionaire'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.

Section 16. Working in Restricted areas

In addition to the clause stated in other section of the special specification the Concessionaire 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 Concessionaire 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 Concessionaire. The Concessionaire shall discuss these arrangements with the occupants of houses affected to ensure that their disruption is kept to a minimum. The Concessionaire 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 Concessionaire 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 Concessionaire'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 Concessionaire at his cost if night working is adopted.

Section 17. Interfaces with other packages

If this contract Package will have interface with other contracts, the Concessionaire 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 Concessionaire shall lay the bedding and backfill for sewers in normal manner.

Section 18. MEASUREMENTS & PAYMENTS

18.1. MEASUREMENTS

18.1.1. Quantities

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Concessionaire in fulfillment of his obligations under the Contract.

18.1.2. 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 Concessionaire 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 Concessionaire'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 Concessionaire 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 Concessionaire, 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 Concessionaire does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Concessionaire, 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.

18.1.3. Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

18.2. PAYMENTS

No part payments will be made for all items of works under this contract, except for pipeline works, which will be paid as mentioned in contract data.

Section 19. Earthwork excavations

19.1. 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 Concessionaire 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 Concessionaire 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).

19.1.1. 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 scarifiers to loosen and not offering resistance to digging, greater than that offered by the hardest of any soil mentioned above.

19.1.2. Disintegrated Rock (D.I.R.) soft rock and medium hard rock includes,

- (a) Ordinary rock comprising of lime stone, sand stone, hard laterite fissured rock, conglomerate or other soft or disintegrated rock which may be quarried or split with crow bars.
- (b) Un-reinforced cement concrete which may be broken up with crow bars or pick axe and stone masonry in cement mortar below ground level.
- (c) Boulders which do not require blasting having maximum diameter in any direction of more than 300 mm; found lying loose on the surface or embedded in river bed, soil, talus, slope, wash, and terrace material of dissimilar origin.
- (d) Hard laterite does not require blasting. It is to be classified under ordinary rock which does not require blasting.

19.1.3. Hard Rock includes,

Any rock or cement concrete or RCC, excavation of which require the use of mechanical equipment or chiselling.

19.1.4. 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,

19.1.5. 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 Concessionaire's risk, also, manual excavation is to be adopted at the possible locations of underground utilities to safeguard against damage.

19.1.6. 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

19.1.7. Disintegrated Rock, Soft Rock and Soft Shale

This category includes excavation in disintegrated rock, soft rock, soft shale and in medium rock comprising of lime stone, hard shale, schist, fissured rock, and all types of laterite with varying densities and composition requiring chiseling which can be cut by shovel and but without resorting to blasting.

19.1.8. Hard Rock

This category includes excavation in hard rock requiring hand and/or mechanical chiselling. In case of difference in opinion between the classifications of rocks, the decision of the Engineer shall be final and binding on the Concessionaire.

19.1.9. Shoring and Bracing

- a) As per Specifications and directions of the Engineer, the Concessionaire 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 in 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 Concessionaire's request. In any case, the Concessionaire 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.

19.2. Excavation in Rock

Excavation in rock shall be carried out without resorting to any kind of blasting, to a depth, 150 mm more than the bottom level of pipe and to a width equal to the diameter of the pipe plus specified working space on either side as given in drawing / as mentioned above. Unless otherwise directed by the Engineer, rock excavation shall be progressed at least by 20 m in advance of the pipe length proposed to be laid.

19.3. 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) Notwithstanding (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. Unless otherwise specified in the drawings or directed by Engineer, for providing of sheet piling as per specifications in Bill of quantities, the top widths for excavations up to 2 meters depth shall be equal to bottom width (i.e. vertical side cuts.) and for depths beyond two meters depth, for all types of soils/rock, steps shall be provided of 0.30 m width on either side of the trench at every lift of 2 meters and as per the directions of Engineer. The quoted rates for excavations in accordance with the above specifications shall include all shoring and strutting for all depths.

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 Concessionaire shall not excavate beyond the dimensions specified as above. Should the excavation occur beyond the dimensions specified therein, because of the negligence of the Concessionaire, the Concessionaire shall fill the excess space with granular material or concrete as directed by the Engineer. Nothing extra shall be paid to the Concessionaire on account of this. The Concessionaire 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.

19.4. Trial pits

Trial pits shall be excavated by the Concessionaire, 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 Concessionaire has to take the permission of the concerned Executive Engineer, OWNER, 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 Concessionaire's own cost. The Precautionary measures shall be taken by the Concessionaire while making trial pits and shall inform the Engineer before commencing such works. The Concessionaire will be paid as per the item in BOQ on account of this work.

19.5. 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 Concessionaire 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 Concessionaire 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. 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 Concessionaire shall conduct ground studies if found necessary and the cost for such studies has to be borne by the Concessionaire himself. The Concessionaire 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 Concessionaire shall replace and repair the sub-grade as directed to the satisfaction of the Engineer, at his own cost and responsibility. Should the Concessionaire 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.

19.6. 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 be considered.

19.7. Well pointing

In this method, well points are installed at regular intervals on one or both sides of the trench and linked parallel to a header main connected to a pump. Well points are usually installed at 0.6 to 2.0m centre to centre by jetting them in ground with dense layers or cobbles & boulders it may be necessary to pre bore the layers. The efficiency of the well points is increased by sanding in the well point and riser using a column of sharp sand. This Method has an advantage of drawing water away from the trench and in suitable conditions is effective in lowering the water by 4 to 6m. It will also reduce the hydrostatic heads on the trench support system. It is of greatest use, in sand, the heavy flows in permeable ground, such as gravels, the well points should not be so close together that the method becomes impractical. In clays the rate of seepage is too small for the system to be properly effective. Silts can be stabilized in certain conditions by using special procedures.

The well pointing shall be either single sided well point or double sided well point. For higher depths double sided well point with multi stage shall be considered. Should the Concessionaire select to use a gravel sub-grade to facilitate flow of water to pumps or other points of disposal, such gravel sub-grade shall not be measured or paid for as an extra item. Concessionaire should assess the availability of extra earth required for refilling in case of shortage in any particular reach well before quoting rates. Even in case the Concessionaire resorts to mechanical excavation, the Concessionaire should take care of proper refilling, consolidation and disposal of surplus earth. Disposal of ground water is to be away from the area of influence of the pipe laying area Suitable temporary pipelines are to be laid to existing watercourses.

19.8. Slips and slides

The Concessionaire 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 Concessionaire 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.

19.9. 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 Concessionaire 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.

19.10. Barricading

The Concessionaire 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 be paid as per the item in the BOQ.

19.11. 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. Bidder 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 Concessionaire, in coordination with the OWNER. 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 Concessionaire, only after the approval and proper directions by the concerned Engineer, OWNER. The work will be paid as per the item in BOQ.

19.12. Safety measures

Pursuant to Specifications in bill of quantities, relevant Indian standards or directions of the Engineer, the Concessionaire 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 Concessionaire 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.

19.13. Progress of Excavation

- (a) The Concessionaire 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.
 - (b) Unless otherwise directed by the Engineer, the following limitations for lengths of open trenches shall rule for a pipeline in one continuous reach.
 - (c) Not more than 50 m in built up area and 150 m elsewhere shall be opened in advance of pipe laying.
- (a) Not more than 50 m of pipeline left uncovered after pipe laying in built up areas and not more than 150 m elsewhere.

19.14. Excavation for Manholes, Other Appurtenant and Structures.

- (a) Excavation for Manholes and other appurtenant structures shall be done in accordance with the applicable clause 19 of this Section. The Concessionaire 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) If the excavation is in rock, the Concessionaire shall excavate all rock at least to the minimum limits shown in approved drawings.
- (c) 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.
- (d) The Concessionaire shall excavate the trench / pit to provide necessary working space on all sides and for accommodating any sheathing, shoring or bracing etc.

19.15. 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 bidder 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.

19.16. Sheet piling

- (c) Trenching at locations along the alignments of Trunk sewers or other locations where vertical cutting of trenches is necessary as directed by Engineer, Sheet piling shall be provided as per the item in bill of quantities and the specifications in this section.
- (d) The Concessionaire 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 Concessionaire 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.
- (e) The location and extent of sheet piling shall be got approved by the Concessionaire from the concerned Engineer, OWNER 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.

19.17. Measurements

- (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. Concessionaire 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 Concessionaire 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 Concessionaire's expense.
- (c) Backfilling for trenches shall be measured and paid separately. Volume of rock excavated shall be calculated on the basis of length, breadth and depth of excavation indicated on the construction drawings and the limits of excavation clause of this section. No payment will be made for excavation/over break beyond payment line specified. Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by the Engineer and the volume of rock stacked will be calculated on the basis of stack measurements after making appropriate allowance for voids. The allowance to be made for voids shall be decided by the Engineer.
- (d) Excavation in paved roads, pavements and concrete shall be billed separately and will be measured in cubic meter. 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.

Section 20. Deleted

Section 21. REINFORCED CEMENT CONCRETE PIPES

21.1. 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.

21.2. 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.

21.3. 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 – DURABILITY	
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

21.4. 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 the engineer.
- 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.

The pipes shall be coated either at pipe factory or at other department-approved coating yard prior to actual laying

21.5. 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.

21.6. 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 the owners 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 atleast equivalent make.

21.7. Physical & chemical properties & testing methods

TABLE A – PHYSICAL PROPERTIES

Property	Allowable Standard	Method
Tensile Strength	Longitudinal 17.25 Mpa	ASTM D 638
	Transverse 17.25 Mpa	
Elongation at break	Longitudinal 225%	ASTM D 638
	Transverse 225%	
Hardness	54-62	Din 535.5
Plasticier 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%

21.8. 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.

21.9. 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.

21.10. Carting & Handling

All Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as approved by Engineer in lengths not more than the length of the transporting vehicle. The Concessionaire shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fittings/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber skids with steadying ropes and / or by any other approved means. Padding shall be provided between pipes, fittings/specials and timber skids to avoid damage to the pipes. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. As far as possible, pipes shall be unloaded on one side of the trench only. The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for replacement. Any pipe, which shows damage in the opinion of Engineer, shall be discarded and replaced by new one without extra cost. Dragging of pipes and fitting/specials along road or pipeline alignment shall be prohibited.

21.11. 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 19 . 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.

21.12. Bedding

Necessary bedding (granular, concrete cradle, concrete arch etc.) shall be provided in accordance with approved construction drawings and specifications in the following clauses 24.1 to 24.6 of this specifications before laying of RCC sewer pipes.

21.13. 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. 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 per Sub-Clauses 24.1 to 24.6 of this section.

21.14. 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

21.15. 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 centimetre.

21.16. 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 in clause 27 of this specifications and as approved by the Engineer.

21.17. Backfilling

Backfilling shall be in accordance with requirements specified in clause 24.9 & 24.10 of backfilling.

Section 22. DUCTILE IRON (DI) PIPES

22.1. 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 / Concessionaire 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 Concessionaire 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.

22.2. Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS: 8329 and IS: 9523.

22.3. 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.

22.4. Coatings

22.4.1. General

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.

22.4.2. Bitumen coating

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.

22.4.3. 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.

22.4.4. 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 conforming 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.

22.5. Testing of pipes at manufacturing unit

During manufacture, tests on pipes shall be carried out in accordance with clause 8.2 of this technical specification by the Third party inspecting agency.

22.5.1. 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.

22.5.2. Carting & Handling

All Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as approved by Engineer in lengths not more than the length of the transporting vehicle. The Concessionaire shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fittings/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard

surfaces. They should be unloaded on timber skids with steadying ropes and / or by any other approved means. Padding shall be provided between pipes, fittings/specials and timber skids to avoid damage to the pipes. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. As far as possible, pipes shall be unloaded on one side of the trench only. The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for replacement. Any pipe, which shows damage in the opinion of Engineer, shall be discarded and replaced by new one without extra cost. Dragging of pipes and fitting/specials along road or pipeline alignment shall be prohibited.

22.5.3. 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 19. 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.

22.5.4. Bedding

The type of bedding (granular, concrete cradle, concrete arch etc.) shall be as per approved construction drawings and specifications in the following clauses 24.1 to 24.6 of this section.

22.6. 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.

22.7. Jointing of pipes

22.7.1. General

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.

22.7.2. 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 Concessionaire shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Concessionaire 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.

22.7.3. 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.

22.7.4. 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.

22.7.5. 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.

22.7.6. 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 in clause 27 of technical specifications and as approved by the Engineer.

22.7.7. Backfilling

Backfilling shall be in accordance with requirements specified in clause 24.9 & 24.10 of backfilling.

22.8 Corrugated HDPE pipes:

Manufacture, factory testing and laying and jointing of Corrugated HDPE pipes used for this contract shall be conforming to BIS 16098- part 2-2013.

Earthwork excavation, backfilling, etc. shall conform to relevant clauses applicable for SWG pipes. Field testing shall conform to clause 27.

Section 23. BEDDING, ENCASING, SUPPORTS & BACKFILLING FOR SEWERS.

23.1. 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. When rock is met with, along the alignment, sewers shall be invariably provided with gravel / murrum bedding.

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 Concessionaire shall execute the work, are specified below.

23.2. 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 murrum / 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.

23.3. Gravel Bedding.

Wherever bottom of the trench at sewer foundation level at the specified gradient is met with rock or found to be unsuitable as decided by the Engineer, the rock or earth shall be removed up to minimum 150 mm below the bottom level of the pipe to a minimum width as specified, equal to the width of the trench as per the approved construction drawing and the resulting space shall be filled up with good quality gravel/murrum and compacted to desired density as per approved drawings and item in Bill of quantities. The granular material shall be filled in the trench up to the level of $\frac{1}{4}$ the outer diameter of the pipeline above the bottom of trench, and well compacted and as in the approved drawing. Unless otherwise directed by the Engineer, rock excavation shall progress at least 20 m in advance of the pipe length proposed to be laid.

The graded granular bed material 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 %

Local Sand Bedding- Local sand to be used shall confirm the specification of r River Ganga sand in the vicinity of Patna as per direction E/I .

- 23.3.1.** 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.
- 23.3.2.** 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.
- 23.3.3.** 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.

23.4. 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.

23.4.1. 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.

23.4.2. The materials used in the concreting works shall comply to 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, and the pipes laid in 4.50m and below depths, the pipeline shall be encased / bedded. The concrete encasement shall be of RCC/PCC as specified.

23.5. Special bedding in poor sub grades

During the progress of work, if the sub grade is observed to be of poor quality which is unsuitable for laying the pipe line and which is not the result of the Concessionaire's negligence, the Engineer may direct the Concessionaire 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 complying to the specifications in clause 43 for concrete or as directed by the engineer .

23.6. 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.

23.7. pipe support structures.

23.7.1. 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 Concessionaire should make his own arrangement for any dewatering or bailing out of water.

23.7.2. 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 stretches 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.

23.8. 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.

23.9. Backfilling of Trenches and around foundations of structures

23.9.1. General

Filling of the trenches for sewers shall not be commenced until the sewers are tested and passed. The Concessionaire 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.

23.9.2. 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.

23.10. 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 Concessionaire with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of trench excavation and the Concessionaire shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If Engineer considers that the Concessionaire 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 in Zone A shall be done by hand 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 in Zone B shall be done by hand or approved mechanical methods, special care being taken to avoid injuring or moving the pipe. The 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 in Zone C 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. After the backfill material is placed in Zone A and Zone B as specified above, the remaining portion i.e., Zone C of the trench may be machine backfilled. 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 Concessionaire shall take the necessary precautions to prevent flotation 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 Concessionaire shall include the above under backfilling rates. Also for backfilling of trenches, where the excavation is in the rock, refilling shall be made with the surplus soft soil with all lead and lifts. Accordingly, the same shall be taken into account by the Concessionaire 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 Concessionaire shall make good the same at his own cost.

23.11. 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 with all lifts to a lead distance detailed in bill of quantities, from the site. For this, payment will be made as per the item in BOQ. The landfill site is to be identified by the Concessionaire 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.

23.12. 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 in clause 19.4 and deducting the volume occupied by the sewers, bedding, encasement etc as applicable. The payment for backfilling will be made only after the Concessionaire 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 Incharge.

Section 24. Ancillary STRUCTURES – MANHOLES, DROP MANHOLES AND VENTILATING SHAFTS

The Concessionaire 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.

24.1.1. Excavation

Earth work excavations for the Manholes, Drop arrangements and C.I. Ventilating shaft arrangements etc. shall be carried complying to specifications in clause 19 and specifications in bill of quantities.

24.1.2. Backfilling

Backfilling for sewer ancillary structures shall be in accordance with requirements specified in clause 24.9 and 24.10 of Backfilling.

24.2. 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 Concessionaire 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, 110/160mm PVC pipes shall be placed during construction of manholes as per specifications in Clause 26. and items in BOQ, if the provisional pipes for House service connections are not placed due to the negligence of the Concessionaire, the Concessionaire 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 Concessionaire, for which payment shall be made at the quoted rates.

24.2.1. Wire cut Brick Manholes

24.2.2. Construction

The work shall be executed in accordance with the approved construction drawings and specifications involving,

- a). Providing and constructing of 1:3:6 Cement 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 Concessionaire. 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 (SFRC) manhole frame and covers of 560 mm diameter conforming to IS 12592 and the payment for providing of SFRC 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.

24.2.3. Testing

All Brick Manholes shall be tested as per relevant provisions in CPHEEO Manual & relevant IS with latest revisions & amendments and specifications in clause 27 of Testing and commissioning.

24.2.4. 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 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 actuals**, 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 excluding manhole frame & cover and **including** encapsulated footsteps rate Rs. X.

Rate for 2 M depths Manhole excluding manhole frame & cover and **including** 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**

24.3. RCC Manholes

24.3.1. 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 Cement conforming to IS: 12330. The type of manhole to be constructed shall be as approved by OWNER, Concessionaire 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, tying 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) manhole frame and covers of 560 mm diameter conforming to IS 12592 and the payment for providing of SFRC 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 only, confirming to IS:12330.

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 & 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, tying 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.
- 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) manhole frame and covers of 560 mm diameter conforming to IS 12592 and the payment for providing of SFRC heavy duty manhole frame and covers shall be paid separately as per quoted rate for the item in bill of quantities.
- 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:12330.

24.3.2. Testing

All RCC Manholes shall be tested as in specifications in clause 27 of Testing and commissioning.

24.3.3. Measurement & payment

The depth of manhole both for Cast In-Situ / Pre-Cast RCC manholes 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, RCC floor & roof slab, shaft walls, plastering, footsteps, fixing SFRC 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 actuals**, 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 excluding manhole frame & cover and **including** encapsulated footsteps rate Rs. X.

Rate for 2 M depths Manhole excluding manhole frame & cover and **including** 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.**

24.4. 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.

HDPE Grade PE-100 pipes confirming to PN 6 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.

24.5. 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 PVC pipes and specials, with proper bedding, 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).

SECTION 25. House service connections (hsc) and existing sewerage system survey

25.1. 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 PVC pipes with proper bedding 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. This needs to be co-ordinated with the STP construction, which should be ready to receive flows from the house connected house connections.

25.1.1. 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 110/160mm PVC 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 PVC 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 110mm dia 6 ksc PVC pipes or 160mm dia 6 ksc PVC 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 PVC pipe joints are to be made with suitable solvents as per relevant IS Code.

25.1.2. 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 GSW Junctions, GSW pipes, of specified sizes. The pipes, specials and laying shall confirm to IS 651:1992, IS 4127 with latest amendments and specifications in BOQ.

The cement used for jointing shall be of Sulphate Resisting Cement confirming to IS 12330-1988 with latest amendments.

25.2. Location and Protection of Existing Public and Private Utilities

Prior to excavation, the Concessionaire 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 Concessionaire 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 Concessionaire 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 under heading "Miscellaneous works" in bill of quantities. The decision in this matter made by the Engineer in charge of work / concerned Engineer of OWNER shall be final and binding upon the Concessionaire. 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 Concessionaire shall make good the same at his own cost. No extra payment towards this will be made.

25.3. Existing sewerage system Survey

It is anticipated that in the existing sewerage system, leaving the portion executed by OWNER, 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 OWNER has been included in this tender. It is 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.(The Manholes and sewers will be de-silted and cleared using sewer cleaning machine by OWNER, Levels shall be carried by the Concessionaire, from the nearest Bench mark given by OWNER).

OWNER 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 Concessionaire 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 the OWNER.

The Concessionaire 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 Concessionaire 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.

Section 26. TESTING AND COMMISSIONING

26.1. 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 Concessionaire at his own cost. Any damage during testing shall be Concessionaire's responsibility and shall be rectified by him free of cost. Water for testing shall be arranged by the Concessionaire at his own cost.

26.2. Water Test for Sewers

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 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) Exfiltration 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.

26.3. 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.

26.3.1. 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 misalignment will not give a clear image in which case the pipeline will again be cleaned / rectified and the tests re-done.

26.3.2. 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 prevents 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.

26.3.3. 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.

26.3.4. 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 Concessionaire. All completed Test records/documents shall be submitted to the Engineer before submission of bills.

26.4. 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.

Section 27. Final Finishing

The Concessionaire 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.

Section 28. As Built Drawings

The Concessionaire 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 and 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 Concessionaire, 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.

Section 29. 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.

Section 30. Design & Submittals

30.1.1. Design

The Concessionaire 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 will be reviewed by the Engineer but this will not relieve him of his responsibility for the adequacy of the design.

30.1.2. Submittals

In addition to the applicable requirement of this Specification, the following shall be submitted by the Concessionaire 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.

30.1.3. 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.

Section 31. Railway Crossings

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

Section 32. Site Investigation

After award of the Contract, the Concessionaire 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 Concessionaire'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.

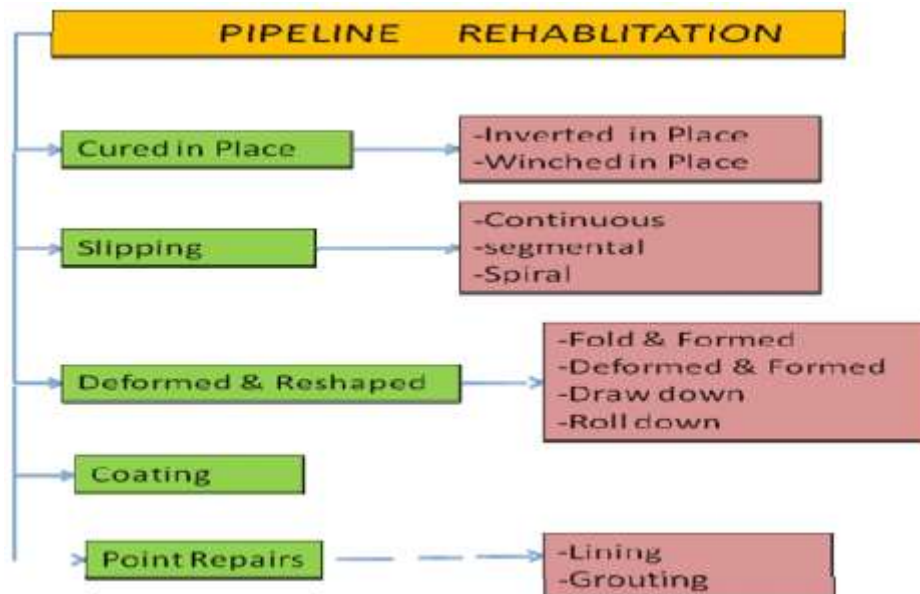
The Concessionaire shall be responsible for obtaining existing utility structures information after Conducting Ground Penetrating Radar Survey in a corridor of 4-6 meter width to detect buried utilities like pipes, cables etc. in such corridor, Marking of the detected utilities on the map of corridor 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.

32.1. Utility Service structures

The Concessionaire shall replace at his own cost towards damage of any utility service structures during the excavation and rehabilitate if necessary at his own cost.

Section 33. REHABILITATION OF SEWERS

Trenchless Techniques for Pipeline Rehabilitation Pipeline rehabilitation is done by inserting another pipe section within the confines of existing buried pipeline. Trenchless techniques for pipeline rehabilitation range from non-structural lining to structural for the buried pipeline. Major techniques are:



Applicable IS codes :Specification of trenchless techniques shall be as per the Codes of Practice Suiting Indian Conditions published by the Indian Society for Trenchless Technology from time to time. The list of applicable codes are:

1. IndSTT:101-2009 code of practice for horizontal direction drilling technique suiting Indian conditions.
2. IndSTT:102-2009 code of practice for Micro-tunneling and pipe Jacking technique suiting Indian conditions.
3. IndSTT:201-2009 code of practice for Cured in Place pipe technique suiting Indian conditions.
4. IndSTT:202-2009 code of practice for Glass reinforced pipe (GRP) technique suiting Indian conditions.
5. IndSTT:301-2009 code of practice for Pipe Bursting.
6. ASTM F 1697 - Standard Specification for Poly (Vinyl Chloride)(PVC) Profile Strip for Machine Spiral Wound Liner Pipe Rehabilitation for Existing Sewers and Conduit
7. ASTM F 1741 - Standard Practice for Installation of Machine Spiral Wound Poly (Vinyl Chloride)(PVC) Liner Pipe for Rehabilitation of Existing Man Entry Sewers and Conduits
8. Standards and Guidelines of IndSTT(Indian Society for Trenchless Technology).
9. Standards and Guidelines of iSTT(International Society for Trenchless Technology).
10. Latest edition of Manual on Sewerage & Sewage Treatment of CPHEEO.
11. If Standards and Guidelines are not included in above referral document then Concessionaire must follow direction given by BUIDCO.

MATERIALS

Concessionaire must execute the work as per direction of BUIDCO. Concessionaire must follow the technical specification. Concessionaire should follow steps mentioned below:-

1. Concessionaire must conduct a colored CCTV survey of existing sewer in which rehabilitation need.
2. Concessionaire must submit CCTV survey data along with design of lining to OWNER for analysis. Design of lining must approved prior to execution of work on site.
3. During execution of lining, Concessionaire must conduct CCTV footage of the whole process which must be submitted to BUIDCO.
4. After completion of lining process, Concessionaire must conduct CCTV of executed rehabilitated sewer line.

Special Condition of Work:-

Concessionaire must follow condition given below:-

1. Desilting of sewer must be done by the Concessionaire on his cost. No extra payment or part payment will be given for this work.
2. **During whole process, bypass arrangement should be done for sewage flow.**
3. Cost of electricity shall be bared by Concessionaire on his own cost.

Section 34. SPECIAL CONDITIONS FOR PIPE RAMMING (PR)

34.1. 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.

34.2. 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 designed and 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.

34.3. 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.

34.4. 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 (Concessionaire 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. (Concessionaire will make his own arrangements for procuring water for testing)

34.5. Construction

34.5.1. 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.

34.5.2. Equipment

Equipment used for this method shall have the basic operations of boring, removing tailings, and jacking pipe.

34.5.3. 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.

34.5.4. 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 piling 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 the owner's plans. If instructed, temporary beam guardrail shall also be installed according to the current owner'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 Concessionaire shall construct and operate safe access pits according to all applicable regulatory requirements.

34.5.5. 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.

34.5.6. 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.

34.6. 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.

34.6.1. 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 Concessionaire 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 Concessionaire shall obtain approval of his method statement from the Engineer before commencement of the work.

34.6.2. Design

The Concessionaire 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.

34.6.3. Submittals

In addition to the applicable requirements of this specification, the following shall be submitted by the Concessionaire and approved by the Engineer prior to commencement of any works;

-
- 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.
- 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 overbreak
 - j) grout mix design and method of grouting

34.6.4. 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.

34.6.5. 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 conforming 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 (Concessionaire 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 conforming 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. (Concessionaire will make his own arrangements for procuring water for testing)

34.6.6. 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

34.6.7. Delivery Storage and Handling

All materials shall be properly protected so that no damage or deterioration shall occur during a prolonged delay

34.6.8. Site Investigation

Soil conditions and ground conditions shall constitute the Concessionaire's risk. After award of the contract the Concessionaire 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 Concessionaire'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.

34.6.9. Health and Safety

The Concessionaire shall adopt safe working practices for pipe jacking in accordance with appropriate standards. Only authorized persons shall be allowed access to the site.

The Concessionaire shall provide a safety officer suitably experienced in tunneling operations and with adequate authority to control and implement safe working practices.

The Concessionaire 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.

34.6.10. Skilled Concessionaires and Supervision

All Concessionaires in the employment of the Concessionaire 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 spalling 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 Concessionaire 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 standalone pipe, capable of withstanding installation and grouting forces and soil, traffic and groundwater loads subject to the method.

34.7. Grout

34.7.1. 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.

34.7.2. 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.

34.8. 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 Concessionaire 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 Concessionaire 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.

34.9. 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.

34.10. 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 from 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 flow, 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 Concessionaire, based on calculations submitted by the Concessionaire and approved by Engineer and on consideration of the behavior 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.

34.11. 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.

34.12. 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 Concessionaire 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 Concessionaire 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 Concessionaire should report immediately and submit a proposal to rectify the road surface and prevent further settlement.

Section 35. INSPECTION

a). 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.

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- 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: _____

b) 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 attach Inspector's Daily Report (IDR).

Section 36. Other Related works

36.1. 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 Concessionaire shall then immediately report the amount of settlement to the Engineer with all records.

36.2. 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, owners of private property, pedestrians, vehicular traffic, or the work of other Concessionaire's. Any pumping methods of dewatering 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 owner. 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, owners of private property, pedestrians, vehicular traffic, or the work of other Concessionaire.

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.

36.3. 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 flowable fill.

36.4. 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.

36.5. 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.

36.6. 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 owners 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 Concessionaire shall remove and properly dispose off all access materials and equipment 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.

36.7. 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.

36.8. Interface between contracts

The Concessionaire 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 Concessionaire shall lay the bed and surround and backfill the trench in the normal manner.

Section 37. 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.

Concessionaire 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 Concessionaire has to rectify the surface by redoing the restoration work at no extra cost to the owner 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 with the adjoining carriageway surface. Reinstatement of the wearing courses shall match as nearly as practicable the colour or other characteristics of the existing surface.

37.1. WATER BOUND MACADAM SUB – BASE / BASE.

37.1.1. 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).

37.1.2. 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.

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

37.2. Table 400 – 8, Grading for screenings

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 murrum 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 m ³	Type A 13.2 mm	0.27 to 0.30 m ³	Not Uniform	0.30 to 0.2 m ³
Grading - 2	63mm to 45 mm	75 mm 0.91 to .7m ³	Type A 13.2 mm	0.12 to 0.15 m ³	- do -	0.22 to 0.24 m ³
- do -	- do -	- do -	Type B 11.2 mm	0.20 to 0.22 m ³	- do -	- do -
Grading-3	53mm to 22.4 mm	- do -	- do -	0.18 to 0.21 m ³	- 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.

37.3. 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 performing functions of separation and drainage may be used over the prepared subgrade as directed by the engineer. Section 700 shall be applicable for use of geo-synthetics.

(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 clause 37.1.2 ., . 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 brooming 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.

37.3.1. 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.

37.3.2. Arrangement for traffic

During the period of construction, the arrangement of traffic shall be done by the Concessionaire in accordance with the applicable clause of this section.

37.3.3. 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.

37.4. PRIMING OF BASE COURSE WITH BITUMINOUS PRIMERS

37.4.1. 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.

37.4.2. Materials

The bituminous primer to be used should be such that it can penetrate into the base course to perform its intended function.

37.4.3. 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 or SC-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.

37.4.4. 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.

37.4.5. Quantity of primer

The primer shall be applied at the rate of 0.75 kg/sqm.

37.5. 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 clause 37.4.5

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.

37.6. Tack Coat

All specifications in the clause 37.4 shall apply to this item of work and the specific scope of work involves 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.

37.7. Specifications for single coat bituminous surface dressing (20mm thick pre-mix bituminous surfacing).

37.7.1. 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.

37.7.2. 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 11.4.1.

Table 11.4.1

Property	Value	Method of test
Abrasion value, using Los Angeles Machine or	Max. 35%	IS: 2386 (Part IV)
Aggregate impact value	Max. 30%	- do -
Flakiness index	Max. 25%	IS: 2386 (Part I)
Stripping value	Max. 25%	IS: 6241
Water absorption (except in case of slag)	Max. 1%	IS: 2386 (Part III)
Soundness: Loss with sodium sulphate – 5 cycles (in case of slag only)	Max. 12%	IS: 2386 (Part V)
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 11.4.2.

Table 11.4.2

Sieve designation nominal size of aggregate	Specification
For surfacing water-bound macadam - first coat	100 percent passing through 20 mm square mesh sieve and retained on 10 mm square mesh sieve
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.

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.

37.7.3. Construction methods

a. Weather and season 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 "fating-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 as per clause 37.6 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.

37.7.4. 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).

37.8. SPECIFICATIONS FOR CONSTRUCTION OF CONCRETE ROADS

37.8.1. 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.

37.8.2. Materials

a. Ordinary Portland Cement - This should comply with the requirements of IS - 8112 with latest revisions (Specification for Ordinary Portland Cement)

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 per cent for concrete wearing course and sub -base course respectively. In 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 1/4th of the pavement slab thickness. In case of pavements having reinforcement, maximum size of aggregate should also not exceed 1/4th of minimum clear spacing between reinforcing bars.

c. Coarse aggregates

Continuousgrading- 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. Fineaggregate - 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. Dowelandtiebars - Dowel and tie bars shall be plain round steel bars conforming to the requirements of IS: 432 -1966.

g. Premoulded joint filler –Premoulded 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)."

37.8.3. Water content and workability

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.

37.8.4. Tools, equipment and appliances

37.8.5. 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.

37.8.6. 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 -base 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

37.9. 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.

37.10. 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.

Settingoffforms - 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.

37.11. 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 $6 \pm$

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 –

(i) **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.

(ii) **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.

(iii) **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. The details of different types of joints are shown in Appendix B.

37.11.1. 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.

37.11.2. 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.

37.12. 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.

(i). 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.

(ii). Re-tempering - The re-tempering of concrete i.e. remixing with or without additional cement, aggregate or water shall not be permitted.

37.13. Control of workability and strength

a. Workability of concrete - The workability 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 paving 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.

37.14. 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.

37.15. 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. Loadtransferdevices - 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 joint 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. Tiebars - 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.

37.16. **Compactionandfinishing**

37.16.1. **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 –

(i) 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.

37.16.2. Floating - As soon as practicable after the concrete has been compacted, its surface shall be smoothed 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.

37.16.3. 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 re-finished. 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.

37.16.4. 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.

37.16.5. 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.

37.16.6. Initialcuring - 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.

37.16.7. Finalcuring- 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,

37.16.8. Removingforms - 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.

37.16.9. Concretingduring 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.

37.16.10. 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 minimise 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.

37.16.11. 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.

37.16.12. 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.

37.16.13. 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.

37.16.14. Openingtotraffic - 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.

Specific Civil/Structural Work Requirement

Section 38. 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 Concessionaire 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.

38.1. 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.

38.2. Sections for excavation for all underground structures and pipe lines

Concessionaire 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 clause 19 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 Concessionaire. The Concessionaire shall comply with the Engineer's directions without any extra charge or payment.

38.3. 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.

38.4. 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 confirming to IS: 12330 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 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 Concessionaire 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.

38.5. 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 Concessionaire 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.

Section 39. Design Submissions:

Complete detailed design /hydraulic calculations & drawings of foundations and superstructure together with general arrangement drawings and explanatory sketches

shall be submitted to the BUIDCO. 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 Concessionaire shall also take care to check the stability of partly.

39.1. 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 the BUIDCO or BUIDCO'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.

39.2. 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.

39.2.1. 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/m ³
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39.2.2. 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 the BUIDCO'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.

39.2.3. Wind Load: Wind loads shall be as per IS: 875- 2002 Part-III.

39.2.4. 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.

39.2.5. 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.

39.2.6. Earthquake Load: This shall be computed as per IS: 1893 – 2000.

39.3. 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 gauge/PVC water stops of suitable type and minimum 230 mm width, 6 m thick shall be used for walls and base slabs.

39.4. Waste 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 2 meter below the average natural ground level.

39.5. 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.
- 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 the BUIDCO.
- 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.

39.6. Design Requirements

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 **M 30** 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 Sulphate resistant Cement.
- All Buildings, Pipe Pedestals, Thrust Block, Pump Foundation & other structures shall be designed as per IS-456. The minimum grade of concrete shall be M25.
- 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)

MINIMUM COVER TO MAIN REINFORCEMENT

S.No.	Member	Details	Cover (mm)
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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

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
11	Slab – Distribution Bars	8
12	Wall – Main Bars	10
13	Wall – Distribution Bars	8

S.No	Member	Diameter (mm)
14	Minor elements such as chajjas, Lintel Beams etc	8

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.

Section 40. 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 Concessionaire for incorporation in the Works.

Except 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 Concessionaire shall inform the BUIDCO’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 the BUIDCO’s Representative which may be withheld until samples have been submitted and satisfactorily tested. The Concessionaire shall thereafter keep the BUIDCO’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.

40.1. Cement

The Cement shall be Sulphate Resistant Cement grade-53 in all water retaining structures and OPC 53 grade cement for other structures, conforming to the relevant B.I.S. codes and approved by the BUIDCO’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

40.2. Reinforcement Steel

Reinforcement Steel shall conform 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 the BUIDCO.

Minimum Cement Content

The minimum cement content for each grade of concrete shall be as per table below.

S.No.	Grade of Concrete	Minimum Cement Content in Concrete (Kg/m³ of finished concrete)
1	M15	240
2	M20	300
3	M25	300
4	M30	320

Please refer IS code 456–(latest version)

Section 41. SAMPLES AND TESTS OF MATERIALS

The Concessionaire shall submit samples of such materials as may be required by the BUIDCO and shall carry out the specified tests directed at the site or at the supplier's premises or at the laboratory approved by the BUIDCO or the BUIDCO's Representative. Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the BUIDCO.

The Concessionaire shall give the BUIDCO seven days' notice in writing of the date on which any of the materials will be ready for testing or inspection at the supplier's premises or at a laboratory approved by the BUIDCO. BUIDCO or the BUIDCO'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 Concessionaire, failing which the test may proceed in his absence unless instructed by the BUIDCO's Representative to carry out such a test on a mutually agreed date in his presence.

The Concessionaire shall in any case submit to BUIDCO within seven days of every test such number of certified copies (3) of the test results as the BUIDCO's Representative may require.

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

Section 42. 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 Concessionaire to alignments approved by the BUIDCO's Representative.

42.1. Buildings and Structures

All the building and structure works shall generally comply with the following BUIDCO'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, chlorination building, 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 Concessionaire'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 conforming 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 Concessionaire for approval of Engineer. The minimum size shall be as per below:
- i. a. Door of opening size 1.2m x 2.1m
 - ii. b. Door of opening size 0.75m x 2.1m for toilets
 - iii. c. Glazed widows of minimum size 1.2m x 1.2m
 - iv. d. 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, 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 43.11.
- 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) 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.

- j) 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.
- k) 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.
- l) All the walkways in shall have minimum 1 m width and shall be covered with mosaic tiles.
- m) Hand railings shall be made up of G.I “C” Class Pipe confirming to latest Indian standards.
- n) 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.
- o) If the High flood level is more than 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.

42.2. Site Drainage

The Concessionaire shall provide a site drainage system. The system shall comprise of the following:

- Storm Water Drainage
- Foul Drainage (if any)

42.2.1. 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.

42.2.2. 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 or a new soak pit followed by septic tank shall be constructed.

42.3. 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.

42.4. 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.

42.5. Landscaping

- (a) The site shall be landscaped once the works are substantially complete. Landscaping area shall be marked in the layout plan of Sewerage Network.
- (b) Landscaping shall include planting of suitable trees and development of lawn/grassed areas. Landscaping in general shall meet ecological and environmental conditions of the site. Road widths shall determine the size of the tree height and spread to be selected for planting. Trees suitable for local conditions shall be selected as approved by the Engineer. Medicinal and fruit trees shall be avoided. Landscaping shall be maintained in good condition till the completion of the contract.

42.6. Tree Planting

- (a) Pits dug a few days in advance of actual planting shall be allowed to weather and be filled with top soil mixed with manure. Size of the pit shall be as per standard requirement. Only one tree shall be planted in each pit. A guard made of bamboo with wire mesh or bricks or M.S. ring as approved by Engineer, shall be provided.

Section 43. CONCRETE

43.1. 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 Concessionaire. The Concessionaire'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 the BUIDCO's representative or any other person duly authorized by him. The Concessionaire'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 the owner's representative for final inspection and approval and for which purpose at least 24 hours' notice shall be given by the Concessionaire. The Indian Standards wherever referred to herein shall be the latest edition of such Standards.

Cement

Cement shall be ordinary Portland cement as per I.S. 269 or Sulphate Resistance Cement as per IS 12330. Cement tests shall have to be carried out at Concessionaire's expense as and when directed.

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 the BUIDCO.

Reinforcement

The reinforcement conforming to latest relevant Indian Standards shall be of tested quality. It shall also comply with relevant part of IS. 456. All the reinforcement shall be clean and free from dirt, oil, paint, grease, mill scale or loose or thick rust at the time of placing. 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 Concessionaire 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.

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 Concessionaire's expense.

43.2. 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) 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 Concessionaire at his own expense. The Concessionaire shall use appropriate water proofing compound during the process of pouring of concrete in required proportion.

43.3. 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 noted 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 Concessionaire's expense in an approved laboratory.

43.4. Formwork

The formwork shall conform to IS: 456.

43.5. Curing

The concrete shall be cured according to IS: 456 or as directed.

43.6. 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 Concessionaire shall if so instructed, remove unwanted projecting parts by chipping and smoothen the surface with cement rendering at his own expense.

43.7. 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.

43.8. 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 fine sand 60%
- b) Hot bitumen emulsion 33%
- c) Cement 5%
- d) Fine chopped hemp 2%

43.9. Concessionaire’s Supervision

The Concessionaire 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.

43.10. 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.

43.11. Protective Epoxy Paint Treatment:

Epoxy Paint of standard specifications manufactured/purchased from a reputed firm approved by IS shall be applied to the outside Concrete surface and all mild steel works within the sewage pumping station. The coverage capacity of layers shall be at 125 Microns D.F.T. 7.60 sq. mt. /Litre.

43.12. 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 the BUIDCO’s Engineer during the execution of the work, without extra charge. The Concessionaire 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 not extra payment will be made to the Concessionaire for placing the inserts position.

43.13. Load Testing of Structures

Load tests shall be carried out in accordance with IS: 456, if required by the Executive Engineer.

Section 44. BRICK WORK

44.1. General

Applicable provisions of Conditions of Contract shall govern the work under this section. The Concessionaire 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.

44.2. Materials

Bricks	The bricks used shall generally conform to IS: 1077
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Cement	The cement used shall conform to IS: 269
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

44.3. 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

44.4. 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.

44.5. 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 Concessionaire shall set out & build all brickwork to the respective dimensions, thickness and height, as shown on the drawings.

The Concessionaire shall build all brickwork uniformly, no one portion being raised more than 1 meter above another at one time. The Concessionaire 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 radial to the curve. The joints shall not exceed 12 mm in thickness and should extend the full thickness of the curved brickwork.

44.6. 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 45. FLOORS AND PAVEMENTS

45.1. 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.

45.1.1. 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)

45.2. Materials

45.2.1. Cement

Ordinary Portland cement and white and colored cement shall conform to IS: 269.

45.2.2. 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.

45.2.3. 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.

45.2.4. 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.

45.2.5. Water

Water shall be clean and free from injurious amounts of deleterious materials. As far as possible, water shall be of potable quality.

45.3. 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.

45.4. 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 46. PLASTERING AND POINTING

46.1. 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.

46.2. Cement Plaster Materials

- Cement : Cement shall confirm to IS: 269.
- 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.

46.2.1. 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.

46.2.2. 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.

46.2.3. 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 47. PAINTING AND GLAZING

47.1. 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.

Painting of Iron and Steel Work

Painting of iron and steel work shall generally be carried out as per IS: 1447 (Part I).

47.2. 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.

47.2.1. 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.

47.2.2. 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).

47.3. Glazing Materials

47.4. 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.

47.4.1. Putty

Putty for use on wooden frames shall conform to IS: 419 and on metal frames to IS: 420.

47.4.2. Workmanship

All glass be 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 Concessionaire shall thoroughly clean all glass and replace all putty or glass damaged during the work.

Section 48. MISCELLANEOUS STEEL AND IRON WORK

48.1. 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.

48.2. 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 Concessionaire 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.

48.3. 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.

48.4. Collapsible Gates

Collapsible gates shall be of the size and type as specified by the BUIDCO'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 49. WOODWORK AND JOINARY

49.1. 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.

49.2. Jointing Materials:

All nails, screws, fixtures shall be of standard quality as approved by the BUIDCO.

49.3. Cutting Edges:

Cutting edge for well to be fabricated as per the drawing approved by BUIDCO'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 mill 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.

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 BUIDCO.

BUIDCO 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 Concessionaire. 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 contactor, 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 Concessionaire shall provide all equipment necessary to carryout maintenance on the lighting installation and demonstrate its operation to the satisfaction of BUIDCO

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 with 1.5 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.

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 of 1.5 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 50. Section IV Electro Mechanical Works

50.1. 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 Concessionaire 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.

50.2. IS codes for electrical Works:

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
Code No.	Title
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 galvanising of iron & steel
IS : 2633	Methods of testing uniformity of coating
IS : 4759	Hot dip zinc coatings on Structural steel and other allied Products
Code No.	Title

IS2026/BS 171/IEC76	Power Transformer
IS3639	Fittings and Accessories
IS1180	Auxiliary Transformer
IS6600/BS CP.1010/I EC354	Loading of oil immersed transformer
IS335/BS 148/IEC29 6	Transformer Oil
IS2099/BS 223/IEC13 7	Bushings for > 1000V, AC
IS7421	Bushings for ≤ 1000V, AC
IS13947 (Part 1) / IEC947-1	Degree of Protection
IS3637	Buchholz Relay
IS 1271/BS27 57/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.

In addition, refer the Schedule 11 (Part D) Electrical System General and Particular Specifications of “*Concession Agreement*”.

50.3. Specifications for mechanical equipment: Mechanical equipment: will be required for following units

1. Screen channels, mechanically cleaned fine screens.
2. Sluice gates
3. Grit chambers with mechanical grit removal equipment
4. Parshall flumes
5. Various sizes of interconnecting piping.
6. Fire-fighting equipment as per state Government department of Fire services.

All mechanical equipment such as screens, degritting devices, sluice gates, etc which comes into contact with sewage 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 hand rails. 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 Shaftless 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.

The deposited grit will be removed from the grit chambers by appropriate and efficient removing mechanism. Grit removal shall be accompanied with a grit classifier and grit washing system to ensure the grit is free from organic matter before disposal.

Parshall flumes downstream of each grit chamber structure shall be required where an ultrasonic flowmeter will be installed for measuring and adding the total flow of raw sewage entering the site.

Isolation weir gates and bye pass shall be required to control and/ or isolate flow to anyone units

50.4. IS codes for mechanical equipment:

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 equipment

IS 10261 – Requirements for settling tank for wastewater

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 Concessionaire 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 custom performance reports for management reporting. In addition, refer the Schedule 11 (Part E) Instrumentation Works of “*Concession Agreement*”.

50.5. Design Criteria for Main Screening and Intermediate Pumping Station (IPS)

Process Unit	Minimum Design Parameter (at PFF)
Main Screens	
Flow	Maximum Instantaneous Flow at pumping station
Bar spacing (Maximum)	50 mm
Differential head at maximum flow with screen clear	0.15 m
Differential head at maximum flow with screen 50% clogged	0.30 m
IPS Pumpsets	
Fluid to be pumped	Raw Sewage
Number of pumpsets (Minimum)	Suitable numbers to pump from minimum to peak flow with at least two standby pumps and standby for each rating pumps
Pumpset shall be suitable for	Minimum 6 number of starts / stops per hour
Pumping station sump design suitable for	Maximum 6 number of starts / stops per hour
Pump shall be suitable to pump sewage with solids content / maximum particle size	100mm sphere

Main Screens

The Concessionaire shall provide front-raked screening equipment suitable for open channel type flow. The Concessionaire shall provide automatically front raked screens with openings not exceeding 50mm and each capable of meeting the performance requirements. The Concessionaire shall provide front-raked screening equipment suitable for open channel type flow. The Concessionaire shall provide automatically front raked screens with openings not exceeding 50mm and each capable of meeting the performance requirements. The screens shall be equipped with an automatic

cleaning system to prevent blockage and the screens shall be designed to handle from zero to fully submerged condition. The Concessionaire shall ensure that the screen cleaning system can be operated intermittently and can be controlled by both an adjustable timed cycle and a pre-set differential head across the screen using ultrasonic level sensors. The screens shall be equipped with multiple rakes such that the maximum time between raking any point on the screen is 20seconds.

Each screen shall discharge on the downstream side of the screen into a belt conveyor system that shall discharge into skips for disposal. Suitable numbers of conveyors shall be provided with each serving screens, with their discharges into skips. The conveyors shall be equipped with covers from the screen discharge to the skips. Suitable stop log gates /Penstock shall be provided for the control and maintenance of the equipment.

IPS

The Concessionaire shall design the proposed IPS to convey Peak flow without surcharging the incoming tunnel. The IPS wetwell shall be in divided in to at least two compartments to ensure maintenance. The IPS shall design such that the pumped rate matches the rate of inflow to pumping station wet well. This can be achieved by maintaining a fixed range of sewage levels within the wet well and the pump control system shall also include the facility to draw down the water level up to low level on a timed basis during low flow condition to reduce the accumulation of floating material and scum.

The emergency condition refers to the operating condition which will occur following a power failure resulting in the wet well filling to the level of the upstream overflow. When power is restored the pump system shall be capable of operating in this emergency condition. Valve shall be provided in the discharge pipework of each pump to enable throttling of flows. Should the Contractor provide a pump that is capable of cutting the emergency system curve without throttling of valves then consideration shall be given to replacing the throttling valve with non-return valves. In this event, the dynamic losses would need to be revised to account for the change of valve.

The Concessionaire is required to guarantee the pump efficiency at the rated duty point (the Guarantee Point).

In addition, refer the Schedule 11 (Part C) Mechanical Equipment General and Particular Specifications of “*Concession Agreement*”.

50.6. Power Connection

Main power supply connection from the nearest Source of Bihar state Electricity Board to SPS premises i/c Poles,cables,HT jointing Kit and all associated works as per Technical specifications shall be done by the contractor as per the direction of EIC.

The payment towards power connection shall be made by the department as per actual bill produced directly to agency granting connection

Section- V TRAINING AFTER COMMISSIONING

Section 51. Training of BUIDCO's Personnel

The Concessionaire shall be responsible to provide practical training in all aspects of the operation, maintenance, and facilities to all personnel selected by the BUIDCO, who will ultimately be responsible for the operation, maintenance and repair of the system and its facilities after defects liability period.

For this purpose, the Concessionaire shall provide a comprehensive training program for the BUIDCO's personnel during the entire period of the trial run, and for as long thereafter as may be reasonably required to ensure that the designated personnel are adequately trained to take up their responsibilities.

All costs for the Concessionaire's personnel and the training facilities required for the training during trial run period, and any incidental training expenses, shall be borne by the Concessionaire.

Section 52. Trial run of the system

0After commissioning of works, the Concessionaire shall maintain the works for 3 (three) months to demonstrate satisfactory performance to the Engineer prior to taking over by the BUIDCO. The cost of electricity, if required for operation & maintenance of works during the period of this trial run will be borne by the BUIDCO. The cost towards Concessionaire's Engineer and other operating personnel during the said period of trial run, along with cost of tools and spare parts which are required for operation and maintenance of the works and equipment during the trial run period shall be borne by the Concessionaire and shall be included in the quoted bid price. In the event that the system or any of the facilities do not satisfactorily achieve the required performance standards during this period, the trial run period shall be extended until such time as the Concessionaire has satisfactorily rectified any deficiencies as may be necessary to satisfy the performance requirements. No additional compensation will be paid to the Concessionaire for such extension.

Note:- For trenchless work the bidder may quote rate and technology as per the existing site condition.

Schedule 24 [DELETED]
Special Conditions of Contract

**Project MOU between the Central Government, State Government and
the ULB and State Guarantee on Payments**

**SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND
BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN
DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN,
CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL
APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF
SEWERAGE NETWORK AND PUMPING STATION TILL END OF
CONCESSION IN PATNA, STATE OF BIHAR, INDIA**

Schedule 25

Allowed and Suggested alignments / Locations for design of the Sewerage Network

SURVEY, REVIEW THE DESIGNS, REDESIGN WHERE NECESSARY AND BUILD NEW SEWERAGE NETWORK OF ABOUT 303 KM LENGTH IN DIGHA AND 150 KM IN KANKARBAGH, INCLUDING SURVEY, DESIGN, CONSTRUCTION OF 04 Nos. PUMPING STATION AND ALL APPURTENANT STRUCTURES, AND OPERATION & MAINTENANCE OF SEWERAGE NETWORK AND PUMPING STATION TILL END OF CONCESSION IN PATNA, STATE OF BIHAR, INDIA

List of Drawings

List of Standard Drawings

Layout Drawings

1. LOCATION MAP OF PATNA CITY
2. WARD MAP OF Digha Zone and Kankarbagh Zone
3. PATNA DEVELOPMENT PLAN-2011
4. POPULATION DENSITY MAP - 2020
5. POPULATION DENSITY MAP - 2035
6. POPULATION DENSITY MAP - 2050
7. EXISTING SEWERAGE SYSTEM
8. PROPOSED TRUNK SEWER & PUMP HOUSE, 303 km and 150 km / 2 nos in Digha and 2 nos in Kankarbagh

Standard Drawings

SI no.	Name of Drawing	Drawing No.
1	MANHOLE, DEPTH UPTO 2 M, 25	
2	. 910 MANHOLE, DEPTH 2-4 M,	
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5	TYPICAL DRAWING FOR DIFFERENT CLASSES OF BEDDING FOR SEWER IN TRENCHES	
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