

RFP No. HML / INFRA / 01 / 2021

**REQUEST FOR PROPOSAL (RFP)
FOR SELECTION OF
DESIGN & BUILD CONTRACTOR
FOR DEVELOPMENT OF PHYSICAL INFRASTRUCTURE AND
CONSTRUCTION OF ADMINISTRATIVE BLOCK AT
MEDIPARK IN CHENGALPATTU DISTRICT, TAMIL NADU**

**VOLUME IV
SCHEDULE OF WORKS**

**SCHEDULE 5
WASTEWATER SYSTEM AND SEWERAGE TREATMENT PLANT**



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SCHEDULE 5 : WASTEWATER SYSTEM AND SEWERAGE TREATMENT PLANT

1. Design Brief

The contractor shall be responsible for:

- a) **Sewerage Network System:** Designing, developing, laying, testing and commissioning the Sewerage network system at Medipark
 - i. The sewerage system shall be designed as two pipe system as per IS specifications, with ventilating the soil stack separately.
 - ii. The sewage from the soil stack shall be connected to the sewer header running below ground level provided with adequate slope to achieve the smooth flow in the system and ground floor appliances shall be separately connected to the sewer header.
 - iii. The sewage from the sewer header shall be discharged to a Manholes/Inspection chamber located near the periphery of the building.

- b) **Sewage Treatment Plant:** Designing, engineering, vetting, construction, testing and commissioning of Sewage Treatment Plant (STP) with capacity of 200 KLD
 - i. The scope of work includes design, drawings, obtaining operational approvals from statutory bodies, coordinating across the infrastructure works in the Park for execution, erection of equipment with necessary foundations, installation, testing and commissioning of all equipment, and obtaining results as committed.
 - ii. **Technology:** STP should be designed in modular capacity based on Moving bed biofilm reactor (MBBR) technology with capacity of 200 KLD shall be installed immediately for wastewater treatment
 - iii. **Capacity:** As per calculation for designing the STP, it is considered that 80% of consumed domestic water and flushing water will be converted into sewage. Based on this premise, the capacity of STP shall be 200 m³/day.
 - iv. Scope also includes civil works, internal electrification, piping and supervision of mechanical ventilation within domestic sewage treatment plant and exhaust ducting up to roof of building
 - v. The treated effluent should be fit to reuse for HVAC/Flushing/Gardening.
 - vi. The STP design should be semi-automatic for monitoring/control, and contractor should propose the minimum parameters measuring instrumentation, which will help in smooth functioning of STP.
 - vii. The contractor has to provide Sludge management system along with STP and effective disinfection system.

The Contractor must conduct a Soil Investigation survey at the location where the Water Treatment Plant is proposed, and suitably consider the findings of the survey before designing and constructing of the structure.

2. Sewerage Network System

2.1. Overview

The sewerage system shall be designed as two pipe system as per IS specifications, with ventilating the soil stack separately. The sewage from the soil stack shall be connected to the sewer header running below ground level provided with adequate slope to achieve the smooth flow in the system and ground floor appliances shall be separately connected to the sewer header. Finally, the sewage from the sewer header shall be discharged to a Manholes/Inspection chamber located near the periphery of the building.

The contractor shall be responsible for designing, engineering, vetting, providing, construction; testing & commissioning of sewage treatment plant with capacity of 200 KLD in out of which 200 KLD should be made operational. The contractor shall also be responsible for providing, supply, laying, testing and commissioning of the sewerage network.

The contractor shall be required to design and execute every such items of work which are considered required or necessary for the satisfactory completion, even if such items of work are not specified in the bid document, but are essential to complete the project.

Diameter of horizontal pipes and vertical stacks for soil pipes and waste pipes have been proposed by adopting the loading units as recommended in SP 35 – Handbook on water supply and drainage. All necessary appurtenances like manholes, drop manholes etc. shall be provided for the efficient functioning of the sewerage system compiling with the relevant authority's requirements.

All lines from the future blocks shall be connected to the header line provided in the external development line with certain connectors. All the proposed manholes chambers shall be connected with the pipes of required sizes, which will be laid at necessary gradient. Minimum diameter of external sewer is kept as 200 to 318 mm dia. pipes.

Manholes at necessary locations around the buildings shall be connected to the proposed STP for final disposal. Manholes are also provided wherever change in direction, slope and diameter of pipelines are encountered. Sizes and slopes are proposed for a peak flow and minimum self-cleansing velocity of 0.75 m/sec.

All the soil and waste coming from toilets will be collected in the Horizontal main by Waste stacks will be connected to gully trap chambers and soil stacks will be connected to the Inspection Chambers wherever required inside the plots as per the future blocks. All lines from the future blocks connected to the header line provided in the external development line with certain connectors.

2.2. Design Components

2.2.1. High Density Polyethylene (HDPE) Pipes

- a. All the proposed Manholes chambers are further connected with the pipes of required sizes, which will be laid at necessary gradient. Minimum diameter of external sewer is kept as 200 to 318 mm dia pipes of HDPE Pipes to be used.
- b. The advantages of these pipes offering smooth interior surfaces and offering relatively highest resistance to corrosion are recognized and they are available in solid wall. When laid in straight gradients without humps or depressions, they can easily offer longer life cycle.
- c. Methods of joints are usually fusion welded or flange jointed depending on straight runs or fittings.
- d. Standard specifications have been framed by the BIS in IS 14333 for sewerage application.
- e. Wherever specified, High Density Polyethylene (HDPE) pipes for general water supply, recycled water supply and landscape irrigation shall conform to IS : 4984-1978(Second Revision) (Material Grade PE-80) and be of appropriate pressure rating
- f. The pipes shall be round and shall be supplied in straight lengths with plain ends. The internal and external surfaces of the pipes shall be smooth and clean, free from other defects.
- g. Minimum parameters to be considered for detailed design work from the contractor as mentioned below:

Description of Items and works	Qty as per the drawings
HDPE – Pipes – PE 80 –	200mm -1600 m
HDPE – Pipes – PE 80 –	318mm - 6500 m
Inspection Chambers- 900 x900	35 Nos of chambers
Inspection Chambers- 600 x600	85 Nos of chambers
Manhole Min Depth 1200- 1500	75 Nos of Manholes

Description of Items and works	Qty as per the drawings
Manhole Min Depth 1500- 2000	160 Nos of Manholes
Manhole Min Depth 2000- 3500	75 Nos of Manholes
Excavation trenches	
Regular soil	4200 cu.m
Excavation in Soft rock	300 cu.m
Excavation in Hard rock	550 cu.m
Finishing around the piping works	25 cum
RAINWATER HARVESTING PITS	
1.2 m dia x 3m depth	75 Nos
1.5 m dia x 3m depth	40 Nos
2.0 m dia x 3m depth	20 Nos
HUME PIPES FOR CROSSING ON ROADS	
200mm Dia RCC Hume PIPE	180 Nos
300mm Dia RCC Hume PIPE	200 Nos
600mm Dia RCC Hume PIPE	25 Nos
Catch basins 600 x 600	48 Nos
MANHOLES HEAVY DUTY FOR RWS & FWS	10 Nos.

2.2.2. Manholes

The Contractor shall construct all manholes, chambers, etc. in first class brick work to such levels, dimensions and specifications as indicated in the Schedule.

2.2.2.1. Base Concrete, Benching and Channels

All manholes shall have a base of cement concrete 1:4:8 (1 cement : 4 coarse sand : graded stone aggregate 40 mm nominal size) 200 mm thick or as shown on drawings. Channeling and benching shall be formed to the full depth of the diameter of the pipe with cement concrete 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement.

2.2.2.2. Masonry Work

Masonry work shall be done with first class bricks in cement mortar 1:5 (1 cement : 5 fine sand). All manholes shall be plastered 12 mm thick inside with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement. Manholes shall be plastered outside with cement mortar

1:4 (1 cement : 4 coarse sand).

2.2.2.3. Footrests

All manholes above 800 mm depth, shall have orange colour safety foot rests of minimum 6 mm thick plastic encapsulated as per IS : 10910 on 12 mm dia steel bar conforming to IS : 1786 having minimum cross section as 23 mm x 25 mm and over all minimum length 152 mm and width as 165 mm with minimum 112 mm space between protruded legs and finish manhole wall. The top surface of the footrest shall be ribbed or chequered. The footrest shall be suitable to withstand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing.

The footrest shall be fixed in manholes with 20x20x10 cm cement concrete block 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete per design

The steps may be set staggered in 2 vertical runs which may be 380 mm apart horizontally. The topmost step shall be 450 mm below the manhole cover and the lowest not more than 300 mm above the benching.

2.2.2.4. Flow in Circular Sewers

If the velocity and depth of flow is the same for the length of a conduit, it is termed steady flow and as otherwise, it is non-steady flow. The hydraulic analysis of sewers is simplified by assuming steady flow conditions though the actual flow conditions are different during morning peak flows and varying flows in other parts of the 24 hours.

In the design of sanitary sewers, an attempt shall be made to obtain adequate scouring velocities at the average or at least at the maximum flow at the beginning of the design period. The flow velocity in the sewers shall be such that the suspended materials in sewage are not silted up; i.e., the velocity shall be such as to cause automatic self-cleansing effect. The generation of such a minimum self-cleansing velocity in the sewer, at least once a day is important, because if depositions are takes place and is not removed, it will obstruct free flow, causing further deposition and finally leading to the complete blocking of the sewer.

The smooth interior surface of a sewer pipe gets scoured due to continuous abrasion caused by the suspended solids present in sewage. It is, therefore, necessary to limit the maximum velocity in the sewer pipe. This limiting or non-scouring velocity will mainly depend upon the material of the sewer.

Thus, the sewers are designed on the assumption that although silting might occur at minimum flow, it would be flushed out during peak flows. Erosion of sewers is caused by sand and other gritty material in the sewer and by excessive velocity.

2.2.2.5. Drop Manholes

Difference in elevations of incoming and outgoing sewers, which would result in holding up of solids that can cause nuisance to the maintenance personnel, should be avoided. When it is necessary to drop the elevation of the sewer at a manhole, the drop should be made by means of an outside connection - in this regard, the dimensions of the related fittings govern the minimum vertical outside drop that can be made.

The designer's judgment will determine, in each case, where the difference in elevation warrants using an outside drop instead of lowering the upstream or branch sewer. The outside connection is provided for the protection of the person who may enter the manhole. Therefore, sometimes when a lateral sewer joins a deeper, sub main sewer or the use of a drop manhole will reduce the amount of excavation needed by allowing the lateral to maintain a shallow slope. The sewage drops into the lower sewer through the vertical pipe at the manhole.

Encasement of the entire outside drop in concrete or brick masonry is needed to protect it against damage during the backfilling of the trench. Maintenance may be facilitated by providing a cross instead of a tee at the top of the vertical drop, with a cast iron riser from the cross to the surface of the ground where a cast iron lamp hole frame and cover are installed. When such a drop is plugged, a ball or a chain is dropped down to break any sticks, thereby permitting the plugging material to be washed out.

When a sewer connects with another sewer, and the difference in level between the sewers of the main line and the invert level of branch line is more than 600 mm or a drop of more than 600 mm is required to be given in the same sewer line, it is uneconomical or impractical to arrange the connection within 600 mm. At that point, a drop connection shall be provided for which a manhole may be built incorporating a vertical or nearly vertical drop pipe from the higher sewer to the lower

sewer.

This pipe may either be outside the shaft and encased in concrete or may be supported on brackets inside the shaft, which should be suitably enlarged.

If the drop pipe is outside the shaft, a continuation of the sewer should be built through the shaft wall to form a rodding and inspection eye. This should be provided with a half-blank flange.

If the drop pipe is inside the shaft, it should be in cast iron and it would be advantageous to provide adequate means for rodding and a cushion of 150 mm depth should also be provided.

2.2.2.6. Junction Manholes

A manhole should be built at every junction of two or more sewers, and the curved portions of the inverts of tributary sewers should be formed within the manhole. To achieve this with the best economy of space, the chamber may be built of a shape other than rectangular. The soffit of the smaller sewer at a junction should not be lower than that of the larger sewer, in order to avoid the surcharging of the former when the latter is running full, and the hydraulic design usually assumes such a condition. The gradient of the smaller sewer may be steepened from the previous manhole sufficiently to reduce the difference of invert level at the point of junction to a convenient amount.

2.2.2.7. Construction of Brickwork Manholes

- a) If the sewer is constructed in a tunnel, the manhole should be located at the access or working shafts and the manhole chamber may be constructed of a size to suit the working shaft or vice-versa. The width/diameter of the manhole should not be less than internal diameter of the sewer + 150 mm benching on both sides (150 mm + 150 mm).
- b) The opening for entry into the manhole (without cover) should be of such minimum dimensions as to allow a work with the cleaning equipment to get access into the interior of the manhole without difficulty. A circular opening is generally preferred. A minimum clear opening of 60 cm is recommended. Suitable steps, usually of malleable cast iron shall be provided for entry.

- c) Access shaft shall be circular in shape and shall have a minimum internal diameter of 750 mm; where the depth of the shaft exceeds 3 m suitable dimensions shall be provided to facilitate cleaning and maintenance. Access shaft where built of brickwork, should be corbelled on three sides to reduce it to the size of the opening in the cover frame, and to provide easy access on the fourth side to step irons or ladder. In determining the sizes, the dimensions of the maintenance equipment likely to be used in the sewers, shall be kept in view.
- d) The manhole base slab shall be 150 mm for manholes up to 1 m depth, 200 mm for manholes from 1 to 2 m depth and 300 mm for greater depths. In all cases, the thickness shall be counter checked for uplift conditions based on maximum ground water elevations at the site on the soil side by considering empty manhole conditions.
- e) Where subsoil water condition exists, a rich mix may be used and it shall further be waterproofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications.
- f) The brickwork manholes shall be first constructed to the required invert and with circular openings to facilitate the laying of sewer pipes later on. These manholes facilitate the judgement in the field when trenches are dug up and sewer pipes are to be laid to give the levels using a levelling instrument or with boning rods.
- g) All brickwork shaft shall be in English bond and the jointing faces being well buttered with cement mortar before laying, so as to ensure a full joint and brickwork shall be in accordance with IS 2212 code of practice for brickwork. The cement mortar used shall not be weaker than 1:3 and in accordance with IS 2250 code of practice for preparation and use of masonry mortars and its revisions.
- h) The thickness of walls shall be typically one brick (23 cm) for up to 1.5 m deep manholes and one and a half brick (35 mm) for depths greater than 1.5 m. The actual thickness in any case shall be verified on the basis of engineering design in difficult soil conditions.
- i) The jointing of brickwork and plastering on both sides (20 mm) shall be in a mix of cement mortar 1:3. Admixtures for water proofing if desired shall be cement based.
- j) Salt glazed or concrete half channel pipes of the required size and curve shall be laid and embedded in cement concrete base to the same line and fall as the sewer. These can also be

finished as semi-circular channels with cement mortar 1:2 and of diameter equal to that of the sewer. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be sloped up at 1:10 towards the wall and suitably rounded off. The branch channels shall also be similar.

- k) Bricks on edge shall be cut to a proper form and laid around the upper half of all the pipes entering or leaving the manhole, to form an arch.
- l) All around the pipe there shall be a joint of cement mortar 12 mm thick between the pipe and the bricks. The ends of the pipes shall be built in and neatly finished off with cement mortar.
- m) The entire height of the manhole shall be tested for water-tightness by closing both the incoming and outgoing ends of the sewer and filling the manhole with water. A drop in water level not more than 50 mm per 24 hours shall be permitted.
- n) 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.
- o) The top of the manhole shall be flush with the finished road level as per IS 4111 Part I.

2.2.2.8. Covers and Frames

The size of manhole covers should be such that there should be clear opening of not less than 560 mm diameter for manholes exceeding 0.9 m depth. When cast iron manhole covers and frames are used, they shall conform to IS 1726. The frames of manhole shall be firmly embedded to correct alignment and level in plain concrete on the top of masonry. The precast frame and cover can also be of steel fibre reinforced concrete (SFRC) conforming to IS 12592 and shall be of approved make. The frame and cover shall be of LD/ MD/ HD/ EHD grade, size and thickness as mentioned in the description of the item. The standard for DI manhole covers is EN 123.

CHARACTERISTICS OF RAW SEWAGE:

BOD	350 to 400 mg / Ltr.
COD	350 to 400 mg / Ltr
TSS	350 to 400 mg / Ltr
PH	7 to 8.0

Oil & Grease

30 to 45 mg / Ltr.

TREATED EFFLUENT QUALITY

BOD	< 5 Mg / Ltr.
COD	< 50Mg / Ltr.
SS	< 5 Mg / Ltr.
pH	6.5 to 7.5.

3. Sewage Treatment Plant Treatment Scheme

3.1. Overview

- a. It is proposed to install a sewage treatment plant, to treat the domestic effluent generated from the toilets/Labs and re-use the water for gardening. The treated sewage water will be designed to meet the discharge limits as per the rules stipulated by the Tamil Nadu Pollution Control Board (TNPCB), in order to conserve water.
- b. The main source of wastewater is resulting from washrooms, food court and pantries in each of the individual buildings. The scope of work includes design, drawings, obtaining operational approvals from statutory bodies, coordinating across the infrastructure works in the Park for execution, erection of equipment with necessary foundations, installation, testing and commissioning of all equipment, and obtaining results as committed.
- c. The STP should be designed in modular capacity (2 modules), initially with 200 KLD.
- d. The STP design should be semi-automatic for monitoring/control, and contractor should propose the minimum parameters measuring instrumentation, which will help in smooth functioning of STP.
- e. The contractor has to provide Sludge management system along with STP and effective disinfection system.
- f. Scope also includes internal electrification, piping and supervision of mechanical ventilation within domestic sewage treatment plant and exhaust ducting up to roof of building.
- g. The sewage treatment plant will be designed to ensure that treated effluent characteristics are well below / within the permissible limits, even under varying flow conditions, which are typical for such systems. This implies that the selected process will be able to withstand the shock load situation.
- h. The entire treated sewage will be recycled / re-used for horticulture and external landscape.
- i. Contractor is to develop Sewerage Treatment Plant (STP) to produce treated effluent quality as per requirements &/or State Pollution Control Board (SPCB) norms, whichever is superior in quality and will be required to obtain approval from TN Pollution Control Board.
- j. Following items are within the scope of contract:
 - Site visits before, during and after completion of installation till maintenance period
 - Prepare design drawings of sewage network and STP

- Prepare complete Data Sheets with make of material / equipment documentation
 - Coordination with Contractor team across civil, electrical, plumbing component design and development works, which are related to STP works
 - Coordination with the Authority
 - Equipment testing, transportation, installation, onsite testing and commissioning
 - Collecting samples at inlet and outlet, monthly once and submitting for analysis and obtaining certificate from lab for the authority's review
 - Operation manual with trouble shooting techniques
 - Running cost per KL
- k. The Sewage Treatment Plant (STP) installed should be certified (from Anna University, IIT Madras, etc.) for its adequacy and a report in this regard should be submitted to the Authority before the project is commissioned for operation. The Contractor must explore the less power consuming systems viz baffle reactor, etc., for the treatment of sewage.
- l. The facility shall provide dual plumbing in such a way that the sewage generated shall be discharged into the Under-Ground Sewerage system.
- m. The Contractor shall provide flow meter with recording arrangement at the following points
- i. Inlet point of water uptake to monitor the daily water consumption.
 - ii. Inlet and outlet point of STP.
 - iii. At the point of disposal of treated wastewater to underground Sewer line.

3.2. Technology

STP based on Moving bed biofilm reactor (MBBR) technology with capacity of 200 KLD; shall be installed for wastewater treatment

3.3. Capacity

As per calculation for designing the STP, it is considered that 80% of consumed domestic water and flushing water will be converted into sewage. Based on this premise, the capacity of STP shall be 200 m³/day.

3.4. Size of Sewage Treatment Plant (200 KLD) – 1 No.

To treat 200 KLD of sewage effluent through MBBR technology and with all required

equipment as listed in the enclosed drawing/ details

- a) Outer dimensions (overall) – 22.2m x 7.7m
- b) Height – 6.75m (3.55m below ground and 3.20m above ground)
- c) Internal dimensions – 21.8m x 7.3m, Height – 6.30m (clear)
- d) Total Plinth Area – 170.94 Sqm.

3.5. Volume of Treated Water received from STP

As per calculation for designing the STP, it is considered that 80% of consumed domestic water and flushing water will be converted into sewage. Based on this premise, the capacity of STP shall be 200 m³/day.

3.6. Tentative Parameters

Contractor to do analysis or pilot plant study for actual effluent parameters to design the plant to obtain the required outlet values. Below parameters are tentative:

Particulars	Values
Inflow time	16 hours – 18 hours
Capacity	200 KLD
Peak factor	2.5
Type	MBBR Technology in modular

Raw wastewater parameter – (Parameters range value is given below; Contractor to consider input parameters based on experience in similar projects and project site)

Efficiency of Treatment Unit:

Biological Treatment

BOD Removal = 85 – 90%

COD Removal = 70 – 80%

Tertiary Treatment

BOD Removal = 80 – 90% of residual

S. S Removal = 90 – 95%

3.7. Maximum Daily Discharge

Consent to establish has been received for establishing the facility with the below mentioned outlets for the discharge of sewage/trade effluent.

Outlet No.	Description of Outlet	Maximum daily discharge in KLD	Point of disposal
Effluent Type: Sewage			
1.	Sewage (Treated Water From STP)	244.0	Green belt - 142 KLD, Toilet Flushing - 90 KLD, Treatment Loss - 12 KLD
Effluent Type: Trade Effluent			
1.	Within individual industrial plots of HLL Medipark	400.0	ZLD

Each individual unit will need to be provided with EMFM at the inlet of raw water supplied and outlet of sewage from the unit to common STP.

3.8. Design guideline & technology

Treatment process and units shall be designed based on parameters in “**Data sheet**”. The contractor should submit highly efficient and optimized design options with best output values.

Required civil tanks will be cast in situ and contractor to provide necessary General Arrangement (GA) drawings for civil works and related mechanical/ electrical equipment should be supplied for successful operation of treatment plant.

3.9. Drawings

The intent drawings provided are preliminary and area allocated is fixed. However, the successful contractor will be required to submit the Detailed Process drawings incorporating the thickness of various structural members. These detailed drawings shall be submitted to the Authority for their comments, incorporation of comments and final approval.

Drawings to be submitted by succeeded contractor:

1. Layout plan at various levels

2. Sections at critical places (minimum 6 sections)
3. Hydraulic flow diagram, showing levels of structure and water flow
4. Piping layout (showing color code, valves, level of pipes running and supporting details)
5. Panel layout
6. Schematic Line Diagram for panel
7. Wiring layout from panel to equipment's showing proper supports
8. Mechanical ventilation layout with location of fans and level for duct and fans
9. Minimum 2 sections need to be submitted showing equipment, piping and ducting layout.
10. Fabricating equipment detail construction drawing with construction brief

3.10. Approval of Design Drawings

The contractor shall be responsible for certification of Structural Drawing of the STP by Anna University / IIT Chennai.

3.11. Data Sheets

The contractor has to submit all the technical details for equipment used for operation of plant. The contractor needs to submit details of equipment in the form of Data Sheet (template in *Appendix 2*) and necessary supporting equipment related documentation needs to be attached.

All fabricating equipment needs to be submitted with drawing and technical detail of material used for construction and IS codes or standards followed to fabricate the equipment.

3.12. General details

- a) Complete supply, erection, testing and commissioning of interconnecting piping between various units and equipment as per approved piping layout including all materials like GI pipes, fittings, valves, gaskets, flanges, nuts and bolts including all materials required for necessary pipe supports and associated civil works, etc.
- b) Supply, erection, testing and commissioning of all the equipment required for the sewage treatment plant as per the individual equipment specification and details given herewith.
- c) Supply, erection, testing and commissioning of all electrical works including all electrical motors for the various equipment, cabling, LT panel, starters, etc., also includes coordinating all necessary civil works like construction of panel foundations, cable trenches, cable supports, lighting of entire plant as per drawing etc.
- d) Supply, erection, testing and commissioning of ventilation duct with fresh air and exhaust fans as per approved ventilation layout with necessary diffusers, supports and electrical wiring. Location of receiving ventilation and exhaust jetting out of STP shall be coordinated with the authority.

3.13. Details of civil works

- a) Soil investigation survey to be conducted at the site of construction of STP
- b) Clearing the site of light jungle/ Scrub jungle
- c) Earthwork excavation for STP, to required size and depth, in all types of soil/ soft rock/ hard rock including depositing excavated earth away from the excavation area with all lead & lift, trimming the bottom and sides, all as per standard practice and structural requirement.
- d) Plain cement concrete of grade M-10 for bed concrete with necessary form work.
- e) Filling to sides of footings/ foundations and inside plinth either with available earth or with borrowed earth as per requirement including consolidation and having 100mm thick PCC M10 bed concrete on top.
- f) Machine batched and machine mixed design mix M-25 grade cement concrete for RCC works, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge.

- g) Centering and shuttering including strutting, propping etc. and removal of form for
 - Foundations, footings, bases of columns, etc. for mass concrete
 - Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.
 - Suspended floors, roofs, landings, balconies and access platform
 - Lintels, Beams, Plinth beams, Girders, Bressumers and cantilevers
 - Columns, Pillars, Piers, Abutments, Posts and Struts
 - Weather shade, chajjas, corbels etc. including edges
- h) Reinforcement to all RCC works as per design/ drawings/ details using thermo mechanically treated bars of grade FE-500D or more
- i) Masonry work for walls, piers and architectural features, in CM 1:6 for super-structure using solid concrete blocks of approved quality, size and of grade D(3.5) blocks as per IS: 2185 (Part I) - 1979 including necessary scaffolding, raking of joints, finishing, curing etc., complete with all lead & lift for all materials & labor and as directed (with minimum compressive strength of blocks should be 35 kgs./ sqcm.).
- j) Flagging concrete around the building to a width of 1000mm with PCC 1:3:6 concrete including finishing the top surface with 15mm thick cement plaster 1:4 and with a floating coat of neat cement.

3.14. Details of finishing works

- a) 52 mm thick cement concrete flooring with concrete hardener topping, under layer 40 mm thick cement concrete 1:2:4 and top layer 12 mm thick cement hardener consisting of mix 1:2 (1 cement hardener mix: 2 graded stone aggregate 6 mm nominal size)
- b) Pump room – with 1 mm thick MS sheet door with frame of 40x 40x 6mm angle iron and 3mm MS gusset plates at the junctions and corners, MS angles of 40x 40x 6mm for diagonal braces, all necessary fittings complete including applying a coat of approved steel primer after pre-treatment of the surface. Finishing surfaces with synthetic enamel paint (two or more coats) of approved brand and manufacture of required color over an under coat of suitable shade with ordinary paint of approved brand and manufacture.
- c) Pump room – Factory made ISI marked steel glazed doors/ windows/ ventilators (weighing 15 kg./ sqm.), side/ top/ centre hung, with beading and all members such as F7D, F4B, K11B and K12B etc. complete of standard rolled steel sections, providing & fixing 4mm thick glass panes with putty and glazing clips, hinges, pivots etc., including providing and applying a coat of approved steel primer, all as per approved

- design including fixing of steel frames with 15x 3mm lugs and 10 cm long embedded in cement concrete block of 15x 10x 10 cm of PCC 1:3:6. Finishing surfaces with synthetic enamel paint (two or more coats) of approved brand and manufacture of required color over an under coat of suitable shade with ordinary paint of approved brand and manufacture
- d) MS grills (weighing 15 kg./ sqm.) of required pattern in frames of windows etc. with MS flats, square or round bars etc. including priming coat with approved steel primer and finishing with synthetic enamel paint (two or more coats) of approved brand and manufacture of required color over an under coat of suitable shade with ordinary paint of approved brand and manufacture
 - e) Water proofing treatment on roofs of slabs by applying cement slurry mixed with water proofing cement compound consisting of applying a) after surface preparation, first layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/sqm. b) laying second layer of Fibre glass cloth when the first layer is still green. Overlaps of joints of fibre cloth should not be less than 10 cm. c) third layer of 1.5 mm thickness consisting of slurry of cement @ 1.289 kg/sqm mixed with water proofing cement compound @ 0.670 kg/sqm and coarse sand @ 1.289 kg/sqm. This will be allowed to air cure for 4 hours followed by water curing for 48 hours. The entire treatment will be taken up to 30 cm on parapet wall and tucked into groove in parapet all around. d) fourth and final layer of brick tiling with cement mortar (which will be paid for separately).
 - f) Pressed clay tiles (as per approved pattern 20 mm nominal thickness of approved size) on roofs jointed with cement mortar 1:4 mixed with 2% integral water proofing compound, laid over a bed of 20 mm thick cement mortar 1:4 and finished neat complete.
 - g) Providing gola 75x75 mm in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 10 mm and down gauge), including finishing with cement mortar 1:3, as per standard design
 - h) Handrails over the Standing Platform by using 10 mm GI Pipe with 40mm x 6mm MS Flat and fixed with 12mm dia. Fastener Bolt 75mm long and as directed by Authority Engineer.
 - i) Watertight Manhole frame and cover (Medium type) of size 0.60m x 0.60m in RCC 1:11/2:3 with suitable reinforcement and 50 x 50 x 6mm MS angle fixed along edges and as directed by the Authority Engineer.
 - j) Providing 110mm PVC vent cowl arrangements mosquito proof nylon net and as directed by Authority Engineer.

- k) All internal concrete/ masonry surfaces plastered with CM and finished with lime rendering/ cement rendering. All external concrete/ masonry surfaces plastered with CM and sponge finished.
- l) All cement mortar used for plastering, should be mixed with waterproofing compound in proportion recommended by the manufacturers.
- m) All internal plastered surfaces finished with distempering in two or more coats with 1st quality acrylic distemper (ready mixed) having VOC content less than 50 gms/ litre, of approved manufacture and of required shade & color, over plaster of paris putty of 2 mm thickness and one coat of water thinnable cement primer of approved brand and manufacture.
- n) All external plastered surfaces finished with Premium Acrylic Smooth exterior paint with Silicone additives of required shade (Two or more coats) including priming coat of exterior primer.

3.15. Equipment specification

Bar Screen – Coarse	
Type	Manually cleaned
MOC	Stainless steel
Description	Size 20 mm x 6 mm with not more than 20 mm c/c spacing. With necessary flat stiffeners of 25mm x 6 mm size.
Accessories	SS Hand Rake with GI Pipe Rod

Raw Sewage Pump	
Flow	To be provided by contractor
Head	To be provided by contractor
Quantity	1 working + 1 standby + 1 provision for future
Type	Vertical Submersible cutter Type
Material	Cast Iron
Delivery Casing	Cast Iron
Impeller	Cast Iron
Seal	Mechanical seal with Magnetically coupled
Motor – E5 series	Built-in Vortex Pump
MOC	Cast Iron
Type	TEFC

Enclosures	IP 68
Class of Insulation	"F"

Diffusers	
Fine pore diffusers	Long Membranes from EPDM type or approved by authority in PVC construction with necessary accessories etc. complete
Coarse bubble diffusers	Long Membranes in PVC construction with necessary accessories etc. complete (for equalization tank, Sludge holding tank and Final tank)

Sludge Pumps	
Duty	To transfer secondary sludge from SBR tank to sludge tank
Type	Horizontal centrifugal non-clog Self-priming, open impeller, pumps
Motor E5 series	TEFC Motor, with IP-55 protection and suitable for 400/440 V, 50 HZ A/c
Material of Construction	Body and impeller in CI
Accessories	Air cock with priming funnel, magnetically Coupled with guard, Base frame, foundation bolts etc.,

PE dosing	
Material	PVC / FRP
Accessories	Foot valve with strainer, Electronic diaphragm type metering pump

Centrifuge	
Type	Automatic decanter bowl type

Blowers	
Application	Equalisation tank, reactor tank and final tank
Flow	To be provided by contractor
Head	To be provided by contractor

Type	Twin lobe compressor
Material	Cast Iron
Rotor and Shaft	One piece in forged steel
Seal	Mechanical
Drive	Machine and motor fitted with V pulley and V belt
Air filter	Suction type with wire mesh type
Silencer	Suction and discharge silencer shall be close to equipment to minimize noise.
Non return valve	To be fixed at discharge line
Pressure gauge	To be fixed on delivery line
Motor – E5 series	
MOC	Cast Iron
Type	TEFC
VFD	Blower motor shall be VFD based
Enclosures	IP 55
Class of Insulation	“F”

3.16. Details of Electrical Works

3.16.1. General Specification of Equipment

- a) 1 number LT Panel, cubicle type suitable for floor mounting and comprising incoming power control switch, Ammeters, Voltmeter, Phase Indicating Lamps, MCBs and Starters for the feeders all complete. Also, to be provided are two numbers of Automatic Level Controller for actuating the Raw Effluent /Treated effluent. Necessary Auto manual Selector Switches shall also be provided.
- b) Local push button starters shall also be provided near the Aerator equipment and mounted in weatherproof enclosures.
- c) Necessary power wiring by armored PVC Cables or by PVC insulated wire in conduit from LT Panel to equipment motors shall be provided with necessary tray/ support etc. complete and internal lighting of entire STP Plant as shown in the drawing.
- d) Necessary earthing as per I.E. rules.

- e) Lighting shall be as per IS requirements and fixtures shall be approved makes and the make and size of cables used should be approved from authority.
- f) Energy meter (approved make) should be provided in the panel
- g) 2 number of spare feeder with MCB suitable for 10 HP shall also be provided in the LT Panel.
- h) The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on medium voltage power, 3 phases 4 wire 50 cycles system.
- i) The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.
- j) Earthing from equipment to panel shall be done by STP contractor, from panel Electrical contractor will do the earthing work.
- k) Current density of bus bar shall be 0.8 A/ sq.mm for aluminum

3.16.2. Standards

Following equipment shall conform to the requirements of:

- a) Air Circuit Breaker (ACB) - IS 13947 - 1,2 / IEC 60947 - 1,2
- b) Moulded Case Circuit Breaker (MCCB) - IS 13947 - 1,2/ IEC 60 947 - 1&2
- c) Contactors - IS 13947 - 1,4
- d) Miniature Circuit Breaker (MCB) - IS 8828 - 1996/ IEC 898 - 1995
- e) Residual Current Circuit Breaker (RCCB) - IS 12640 - 1988 / IEC 1008
- f) HRC fuse link - IS 9224 and BS 8 :8
- g) Current Transformer - IS 2705 and IEC 185
- h) Potential Transformer - IS 3156
- i) Relay - IS 3231 & IS 8686 (For Static Relays)
- j) Indicating Instrument - IS 1248
- k) Cables – IS 7098 (Part 1) 1988

3.16.3. Construction

1. The switchboard shall be:
 - a) Sheet steel enclosed, indoor floor mounted freestanding cubicle type.
 - b) Made up of the requisite vertical sections modular type which when coupled together shall form continuous switchboards.
 - c) Dust, vermin and damp proof and enclosure protection not less than IP 52.
 - d) Each feeder/instrument compartment shall be provided with a hinged door interlocked with MCCB/SFU inside the compartment such that door can only be opened when MCCB/SFU in off position.
 - e) Readily extendable as required by the addition of vertical sections after removal of the end covers.
 - f) Switchboards shall have access to the feeders, bus bars, cable termination, cable alley, etc. as required.
2. Each vertical section shall comprise:
 - a) A front-framed structure of rolled/folded CRCA sheet steel angle section of minimum 3 mm thickness rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment such as circuit breaker cassettes, fuse switch units, main horizontal bus bars, vertical risers and other front mounted accessories.
 - b) The structure shall be mounted on a rigid base frame of folded CRCA sheet steel of minimum 6 mm thickness and 75 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.
 - c) A cable chamber housing the cable end connections and power/control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical / horizontal section without coming into accidental contact with live parts of the adjacent section.
 - d) A cover plate at the top of the vertical section, provided with a ventilating hood where

necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1mm diameter perforations to prevent entry of vermin.

- e) Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be ensured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.
3. The total height of the panel shall not be more than 2300 mm unless otherwise specified and maximum height of switch operating handle shall not be more than 1800mm from FFL. The total depth of the panel shall be adequate to cater for proper cabling space.
4. Doors shall be of minimum 14-gauge sheet steel and covers/partitions of 16G sheet steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws. The corners should be rounded.
5. The Components in the switchboards shall be so arranged as to facilitate ease of operation and maintenance and at the same time to ensure necessary degree of safety.
6. Components forming part of the switchboards shall have the following minimum clearances:

Between phases	-	25mm
Between phases and neutral	-	25mm
Between phases and earth	-	25mm
Between neutral and earth	-	19mm

When, for any reason, the above clearances are not available, suitable insulation barrier / shielding shall be provided. Clearances shall be maintained during normal service conditions.

Creep age distances shall comply to those specified in relevant standards.

7. All insulating material used in the construction of the equipment shall be of non-hygroscopic material treated to withstand the effects of high humidity, high temperature and tropical ambient service conditions.
8. Functional units such as circuit breakers, fuse switches, MCCBs, etc. shall be arranged in multi-tier formation except that not more than two air circuit breakers shall be housed in a single vertical section.

9. Metallic/insulated shrouding shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:
10. Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
11. Cable terminations of one functional unit, when working on those of adjacent unit/units.
12. All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
13. Provision shall be made for permanently earthing the frames and other metal parts of the switchgear by two independent distinct connections.
14. Only CRCA (Cold Rolled Close Annealed) steel sheets shall be used for fabricating the cubicle.
15. Thickness tolerance for sheets shall be as applicable in relevant IS.

3.16.4. Metal treatment and finish

- 1 After fabrication the panel shall undergo 7-tank treatment/sand blasting for removing Grease, Rust etc.
- 2 The panel shall be coated with zinc chromate primer (Applicable for outdoor panels).
- 3 After coating of primer, the panel shall be coated with Epoxy powder with shade RAL7032 prior to the approval of shade from the authority.

3.16.5. 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 Standard Specifications and as directed by the Authority's Engineer. The testing frequencies set forth are desirable minimum and the Authority's Engineer shall have full authority to get the additional tests carried out by the Contractor as frequently as he may deem necessary, to satisfy himself that the Materials and Works comply with the appropriate Specifications.

Third party inspection are to be arranged by the Contractor at their cost, as and when required by the Authority Engineer. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering / Good Industry practice to the directions of the Authority's Engineer.

3.16.6. Commissioning/Handing over

During trial runs as described above, the contractor shall satisfy the Authority in all respects regarding the satisfactory quality of effluent, quality of materials, equipment and workmanship used in the plant. Only after satisfactory commissioning of the above points, the Authority shall deem the date of commissioning for all purposes, guarantees, and payment terms mentioned elsewhere in this RFP. The guarantee period described elsewhere in the RFP should start from the date of commissioning.

3.16.7. Training of operator

The contractor shall provide necessary training for operator during commissioning period. The contractor shall certify the operator performance to carry over the plant operation and maintenance efficiently after handing over the plant. The authority to provide 3 operators during commissioning stage for training purpose.

3.16.8. Guarantee

The under mentioned clauses shall govern in case of any contrary provisions given elsewhere in the document.

A. Manufacturer's Guarantees

The manufacturer's guarantee for design, workmanship and performance for all bought out items shall be made available to the Authority and shall be valid at least for the entire defect's liability period. In the event of failure of any particular equipment, which fails more than three items during the guarantee period as mentioned in clause below, the contractor shall replace at his own cost that equipment. Manufacturer's/Contractor's guarantee, as mentioned in clause above, for such replaced equipment shall also be made available to the Authority and should be kept at least for one year from the date of last replacement.

B. Performance Guarantee

The Contractor shall give guarantee for a period of Two years from the date of successful commissioning of the treatment plant against design, defective materials, workmanship, performance and guaranteed effluent quality.

In case of quality of treated water supplied from STP is unsatisfactory for the end user, than Contractor shall supply the good quality of water (Parameter values as accepted) at their own cost from outside for same quantity, to operate the project without hassles until the quality of STP treated water falls within accepted parameter value.

The Contractor shall carry out testing and commissioning of the plant during the Defects Liability Period. Any defects found in the workmanship, materials or performance of the plant shall be made good by the Contractor at his own expense within the time specified by the authority.

Oxygenation Capacity of Diffusers.

The contractor, if directed by the authority, shall at his own cost prove the Oxygenation capacity guaranteed by him for the diffusers provided by conducting Oxygenation capacity tests on the unit by any standard and internationally recognized method to be approved by the authority.

C. Mechanical guarantees

The Contractor shall guarantee for a period of **Two year** for the failure of any particular part of the equipment. In the event of failure of any particular part of the equipment more than three times during the guarantee period, the Contractor shall replace it. In case it is found that the above-mentioned failure is due to some other connected part of the equipment, that part shall also be rectified or replaced by the contractor to avoid such failures in the future. The guarantee for such replaced parts shall be extended by one year from the date of last replacement.

3.16.9. Makes and Models

SL. NO	ITEM DESCRIPTION	MAKE
01	uPVC PIPES – SCH -80	ASTRAL / ASHIRWAD/ SUPREME/PRINCE/
02	uPVC FITTINGS– SCH -80	ASTRAL / ASHIRWAD/ SUPREME/PRINCE/
03	BUTTERFLY VALVE (50mm to 100mm)	INTERVALVE / AUDCO / NORMAT
04	NON-RETURN VALVE	INTERVALVE / AUDCO
05	BALL VALVE (15mm to 40mm)	ASTRAL / ASHIRWAD/ SUPREME/PRINCE/
06	AIR RELEASE VALVE	RB / TBS / CIMBRIO
07	RCC HUME PIPES	Np3 or Local brand
08	STONE WARE PIPES	MYSORE STONE WARE / TSL
09	PVC PIPES (Agricultural series)	PRINCE / SUPEREME / FINOLEX
10	PVC FITTINGS (Fabricated)	CLARION / SRI VINAYAKA
11	PVC FITTINGS (Moulded)	PRINCE / SUPEREME / FINOLEX
12	MANHOLE COVER - Cast iron	BIC / NECO
13	MANHOLE COVER - (RCC Precast)	RAJVAIBHAV / SFRC
14	ENAMEL PAINT	ASIAN PAINTS / SHALIMAR
15	PRESSURE REDUCER VALVE	HAWK / TBS / CIMBRIO
16	Y' STAINER	RB / TBS / CIMBRIO
17	DWC PIPES & FITTINGS	ASTRAL / ASHIRWAD
18	HDPE PIPES – PE -80	MAKE: RISHI/ ASHIRWAD/ SUPREME

For civil and finishing works, the list of approved makes of materials are as follows:

a. Civil & Finishing Works

- Cement (43/ 53 Grade) – ACC, Birla Super, Ultra-tech, Ramco, Bharti, Coromandel
- Reinforcement Steel – TISCO, IISCO, SAIL, JSW
- Structural Steel – TISCO, IISCO, SAIL, JSW
- Ready Mix Concrete – ACC, Ultratech
- Concrete Ad-mixtures – FOSROC, Roff, Sika, Dr. Fixit
- Water proofing compounds – FOSROC, Roff, Sika, Dr. Fixit
- Concrete Blocks – Approved Sample having minimum compressive strength 35 Kg./ Sqcm.
- Table Molded Bricks – Approved Sample
- Vitrified Tiles – NITCO, Johnson, Somany, Kajaria
- Ceramic Tiles – NITCO, Johnson, Somany, Kajaria
- Granite Slabs/ Tiles – Approved Sample
- Galvanized steel door frame – Size 125 x 60mm and Approved Sample
- Flush Door Shutters – Both sides commercial ply veneered and 35mm thick and Approved Sample
- UPVC Windows/ Ventilators – Powder Coated finish and Approved Sample

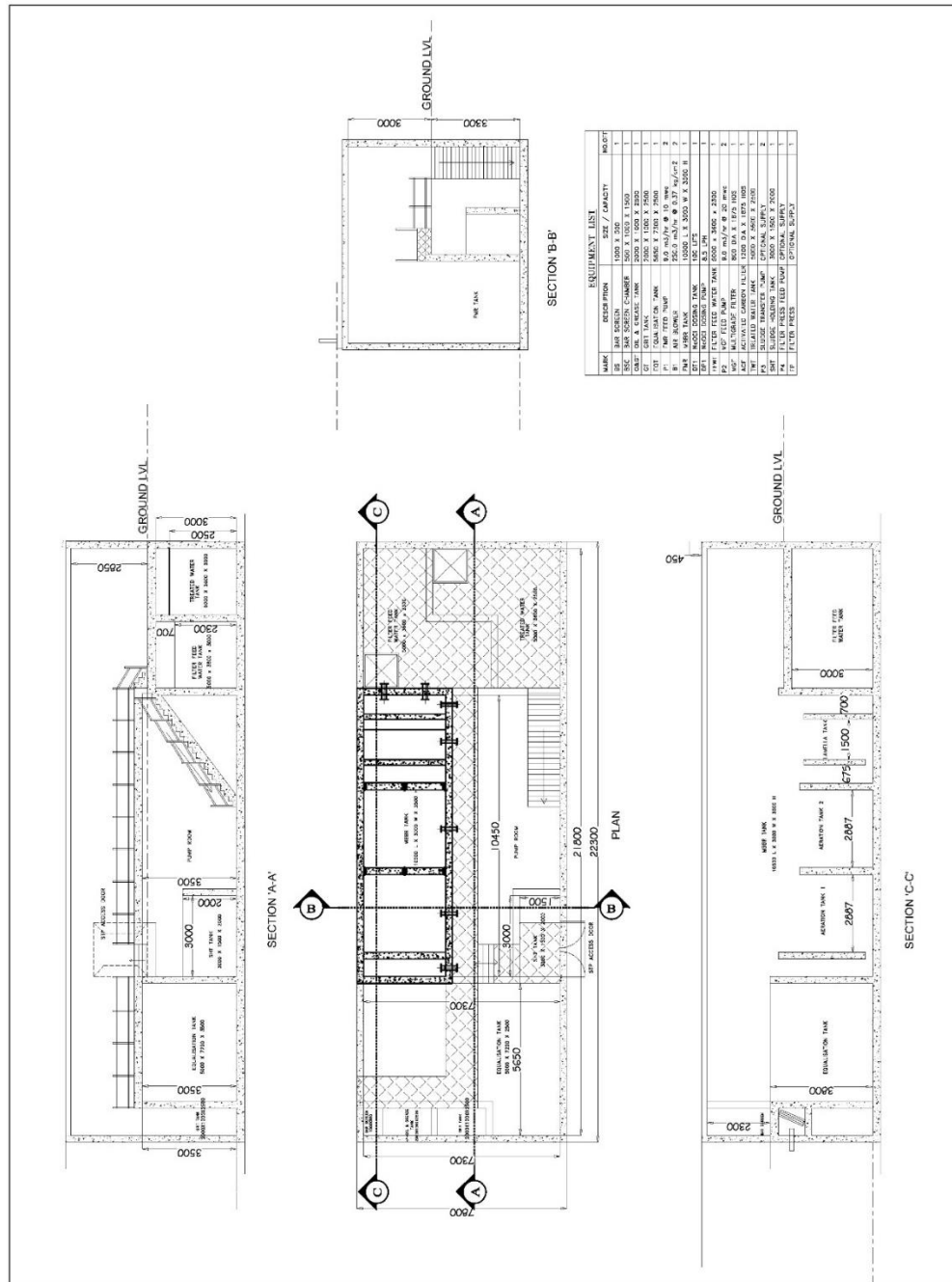
- Hardware fixtures for Doors (Administrative Building) – Stainless Steel finish and Approved Sample
- Paints/ Primers – Asian, Berger, Nippon

3.17. Technical specification for civil works

Please refer section 6 of Schedule 4 for detailed technical specifications for civil works

3.18. Intent Drawings: MBBR 200 KLD

Please refer to Appendix 1 for reference to the Intent Diagrams (in A3 size)



4. Testing

The contractor shall have to test each equipment used for the plant for at least 72 hours continuous running with designed load and to the full satisfaction of authority & authority engineers. Any defects found, has to be rectified by the contractor at his own cost immediately and within reasonable time as decided by the authority.

Third party testing of material such as Steel, Cement, Cubes, Design Mix, Bricks / Solid Blocks, Electrical Wires / Cables, pipes, and any other item must be facilitated by Contractor as per the directions of Authority's Engineer. Testing will have to be arranged by Contractor for every batch of material (such as cement, steel, electricals wires/cables, pipes etc.) that is brought to the site, and approved by the Authority Engineer before the material can be used.

During trial running and commissioning of plant necessary consumables, Instruments, Gauges, Labor / Supervisory Staff, Laboratory analysis etc., are to be furnished / provided by the contractor at free of cost to the authority.

During trial runs as described above, the contractor shall satisfy the authority in all respects regarding the satisfactory quality of effluent, quality of materials, equipment's and workmanship used in the plant. Only after satisfactory commissioning of the above points, the authority will take over the plant and such date of taking over shall be deemed as date of commissioning for all purposes, guarantees, and payment terms mentioned elsewhere in this tender. The guarantee period described elsewhere in the tender should start from the date of commissioning.

Additional specifications for quality of materials and tests to be conducted (as applicable) is provided in **Appendix 3**.

Appendix 1: Intent Drawings Reference

For intent drawings (A3 size) relevant to this Schedule, the following references may be referred in Schedule 8 of the RFP

Schedule number	Reference number	Title
8	6.1	Sewerage network
8	6.2	STP – Plan and Section

Appendix 2: Data sheet template

FILTERS

Material	
Capacity	
Design Flow	
Size of inlet/outlet	
Type of vessel	
Diameter of vessel	
Design pressure	
Height	
Dished end thickness	
Shell thickness	
Corrosion allowance	
Diameter of man way	
Internal protection	
External protection	
Applicable code for design and fabrication	
Rate of filtration	
Filtering area	

Material	Cum. Vol	Layer	Thickness	Size	Uniformity Co-efficient

Valves to be supplied by the filter supplier shall be furnished in the following table:

Sl.no	Diameter	Type	Make	Number	Material	Applicable Code

BRINE TANK

Material	
Capacity	
Type of Vessel	
Diameter	
Height	
Design Pressure	
Shell Thickness	
Corrosion Allowance	
Diameter of Man Way	
Internal Protection	
External Protection	
Applicable Code for Design and Fabrication	

CHEMICAL DOSING UNIT WITH METERING PUMP TANK:

Capacity in Liter	
Diameter	
Height	
Design flow	
Chemicals required at	
Design flow rate	
Holding period	
Diameter of Inlet	
Diameter of Outlet	
Diameter of Drain	

MATERIAL OF CONSTRUCTION

Tank	
Valves	
Piping	

METERING PUMP

Make	
Model No	
Construction detail	
Duty Conditions	
Accessories Included with the pump	

RAW PUMP

Make	
Type	
Flowrate litres/Sec	
Discharge pressure	
Material	
Casing	
Impeller	
Seal	
Motor	
Type	
Make	
Rating	
RPM	
Enclosure	
Class of Insulation	

Note:

- 1) All information to be filled by Contractor
- 2) This Data Sheet to be filled for each unit separately

Appendix 3: Additional specification for quality of materials and tests to be conducted (as applicable)

S.No.	Material to be Tested	Sampling		Name of test	Permissible Limits	Standards
1	Water	Lab Test: Local Source: Once in three months Outsource: Once in a month	a) b) c) d) a)	To neutralize 100 ml of water using Phenolphthalein as an indicator (Acidity) To neutralize 100 ml of water using mixed indicator (Alkalinity) Solids: (i) Total dissolved solids (ii) Sulphates (as SO ₂) (iii) Chlorides (as Cl) (iv) Suspended Matter pH value pH value	Not more than 5 ml (or 50 mg/Lit) of 0.02 normal NaOH Not more than 25 ml (or 250 mg/lit) of 0.02 normal H ₂ SO ₂ 3000 mg/Lit 400 mg/Lit 2000 mg/Lit for Concrete not containing embedded steel and 500 mg/Lit for Reinforced Concrete work 2000 mg / Lit Not less than 6 Not less than 6	IS 456 - 2000, Clause 5.4
2	Cement (43 Grade)	One test for every 300 tonnes of single brand (Test to be done, if there is change in brand)	 a) b) c) 	 Initial setting time Final setting time Fineness of Cement (i) By permeability method	 Not less than 30 minutes Not more than 600 minutes Not less than 225 m ² /kg	IS 269 - 2015

S.No.	Material to be Tested	Sampling		Name of test	Permissible Limits	Standards
				(Or)		
				(ii) By Standard Sieve Test	Retained not more than 10%	
			d)	Soundness of Cement		
				(i) By Le-Chatelier Method	Expansion not more than 10 mm	
				(Or)		
				(ii) By Auto Clave Test	0.80%	
			e)	Compressive Strength of C.M (1:3) Cube		
				(i) 3 days (72 +/- 1 hr)	Not less than 23 Mpa (or) 230 Kg/Cm ²	
				(ii) 7 days (168 +/- 2 hrs)	Not less than 33 Mpa (or) 330 Kg/Cm ²	
				(iii) 28 days (672 +/- 4 hrs)	Not less than 43 MPA (or) 430 Kg/Cm ²	
3	Steel					
	a) Mild Steel (Grade 1 – Fee 250)	Each Load and Each Diameter (Min. 3 Samples)	a)	Yield Stress	Min 250 N/mm ² (Or) 25 Kg/mm ²	IS 432 (Part-1) 1982
			b)	Elongation	Min 23.0%	
	b) High Strength Deformed Bars (Fe 415)	Each Load and Each Diameter (Min. 3 Samples)	a)	0.20% Proof Stress / Yield Stress	Min. 415 N/mm ² 41.50 Kg/mm ²	IS 1786 - 2008
			b)	Elongation	Min. 14.50%	
			c)	Tensile Stress	10% more than the actual proof stress. But not less than 485 N/mm ² (or) 48.50 Kg/mm ²	
	c) High Strength Deformed Bars (Fe 500)	Each Load and each Diameter (Min. 3 Samples)	a)	0.20% Proof Stress / Yield Stress	Min. 500 N/mm ² (or) 50.0 Kg/mm ²	IS 1786 - 2008
			b)	Elongation	Min. 12.0%	
			c)	Tensile Stress	8% more than the actual 0.2 percent proof stress. But not less than 545 N/mm ² (or) 54.50 Kg/mm ²	
4	Sand	Each Load		Clay, Fine Silt and Fine Dust	Not more than 5% by mass	IS 2116 - 1980
5	Coarse Aggregate	Every Quarry				IS 383 - 1970
			a)	Either Crushing Value (or) Impact Value		
				Crushing Value		

S.No.	Material to be Tested	Sampling		Name of test	Permissible Limits	Standards
				Aggregates used for concrete other than wearing surfaces	Not more than 45%	
				Aggregates used for concrete for wearing surfaces (such as roads, pavements)	Not more than 30%	
				(Or Alternatively)		
				Impact Value		
				Aggregates used for concrete other than wearing surfaces	Not more than 45% by weight	
				Aggregates used for concrete for wearing surfaces (such as roads, pavements)	Not more than 30% by weight	
			b)	Abrasion Value		
				For Aggregates to be used in concrete for wearing surfaces	Not more than 30%	
				For Aggregates to be used in other concrete	Not more than 50%	
6	Bricks	Lot Size – For Every One Lakh Bricks – (Number of Samples 20 Nos.)		For Class 35		IS 1077 - 1992
			a)	Compressive Strength	Not Less than 35 Kgf/cm ² (or) 3.50 N/mm ²	
			b)	Water Absorption	Not more than 20% by weight	
			c)	Efflorescence	Rating not more than Moderate	
				For Class 50		
			a)	Compressive Strength	Not Less than 50 Kgf/cm ² (or) 5.0 N/mm ²	
			b)	Water Absorption	Not more than 20% by weight	
			c)	Efflorescence	Rating not more than Moderate	
7	Hydraulic pressed tiles	One test for area upto 1999 sq.m and one additional test for every 1000 sq.m and part thereof				IS 2690 - 1993
			a)	Water Absorption	Shall not exceed 15%	
			b)	Flextural Strength	Shall not be less than 20 Kg/cm ²	

S.No.	Material to be Tested	Sampling	Name of test	Permissible Limits	Standards
8	Electric Cable	One test for each brand, each size	Conductor resistance at 20°C		IS 664-1990
			For 1.5 Sq.mm cable	Max allowable limit 12.10 Ohm/Km	
			For 2.5 Sq.mm cable	Max allowable limit 7.40 Ohm/Km	
			For 4.0 Sq.mm cable	Max allowable limit 4.95 Ohm/Km	
10	Wood	One sample for each work	Lab test – Moisture test	Not more than 12%	IS 287 - 1993
			Field test – Visual observation	Free from rotten, unsound knots (or) knots in cluster	IS 3629 - 1960
11	Cube test in lab		Compressive strength of 150 mm cube		IS 456 - 2000
		1 to 5 m ² – 1 set	M20 (1:1.5:3)		
		6 – 15 m ² - 2 sets	7 days	Not less than 135 Kg/cm ²	
		16 – 30 m ² – 3 sets	28 days	Not less than 200 Kg/cm	
		31 to 50 m ² – 4 sets	M20 (1:1:2)		
		> 50 m ² – 4 plus one for each add 50 m ²	7 days	Not less than 170 Kg/cm ²	
		(1 set = 3 cubes)	28 days	Not less than 250 Kg/cm	
			M30		
			7 days	Not less than 205 Kg/cm ²	
			28 days	Not less than 300 Kg/cm	
12	Slump Test Slump test at site for all reinforced concrete at regular intervals (Slump in mm)	Type of work Mass concrete, large section, roads and pave RCC foundation, substructures, thick walls and other heavy section	With vibration 10 to 25 26 to 50	Without vibration 50 to 75 40 to 115	
13	M-Sand	Thin vertical sections such as walls, beams, columns with congested reinforcement	40 to 50	100 to 175	

S.No.	Material to be Tested	Sampling	Name of test	Permissible Limits	Standards
		When using concrete pump	50 to 100		IS 383 – 2016 (3 rd Revision) For Zone-II
13.1	Test for size and grading of aggregate		IS sieve size in mm		IS: 2386 (Part – I) 1963
		a)	10 mm	Shall be 100%	
		b)	4.75 mm	Shall be between 90 & 100%	
		c)	2.36 mm	Shall be between 75 & 100%	
		d)	1.18 mm	Shall be between 55 & 90%	
		e)	600 micron	Shall be between 35 & 59%	
		f)	300 micron	Shall be between 8 & 30%	
		g)	150 micron	Shall be between 0 & 10%	
13.2	Test for Specific Gravity			Shall be between 2.1 and 3.2	
13.3	Test for water absorption, %			Shall not be more than 5%	
13.4	Test for bulk density				IS: 2386 (Part-III) 1963
		a)	Bulk density in KG/1-loose condition	Limit not specified	
		b)	Bulk density in KG/1-compacted condition	Limit not specified	
13.5	Test for deleterious materials				
		a)	Coal and lignite	Shall not be more than 1%	
		b)	Clay lumps	Shall not be more than 1%	
		c)	Material finer than 75 mm IS sieve	Shall not be more than 10%	
		d)	Organic Impurities	Shall pass the test	
		e)	Silt content	Limit not specified	
13.6	Test for soundness of Aggregate				
			% loss of weight of the material after 5 cycles when tested with sodium sulphate solution	Shall not be more than 10%	
13.7	Test for Total Alkali Content				
			Total alkali content as Na ² O equivalent percentage	Shall not be more than 0.3%	

S.No.	Material to be Tested	Sampling	Name of test	Permissible Limits	Standards
13.8	Test for Sulphate content		Test for sulphate content as SO ₃	Shall not be more than 0.5%	
13.9	Test for Acid Soluble Chloride content		Acid Chloride content percent	Shall not be more than 0.04%	
13.10	Test for Alkali Aggregated reactivity		Acceleration mortar bar method The average expansion of accelerated mortar bar after 16 days of casting percentage	1. Expansions of <0.10% - Indicates Innocuous behaviour of aggregate 2. Expansions between 0.10 and 0.20% includes both Innocuous and deleterious aggregate 3. Expansion >0.20% indicative of Potentially deleterious aggregate	
13.11	Test for bulking of sand percentage		Bulking of sand percentage	Limit not specified	IS: 2386 (Part-II) 1963

Note: Arriving at the quantities and items (Pipes and other items mentioned) are sole responsibility of contractor which should be based on their detail design