

VOLUME: II-A PART 2
EXTENT OF WORK AND PROCESS REQUIREMENTS

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EXTENT OF WORK AND PROCESS REQUIREMENTS

2.1 Sewage Treatment Plant

The STP is to be constructed on turnkey basis such that scope includes Design, construction, supply, erection, testing, commissioning, three (3) month trial run (including defect liability period of three year) of Sewage Treatment Plant (STP) including all civil, electrical, mechanical, instrumentation and all other allied Works and 5 years of Operation & Maintenance STP as well as Network.

All works from influent received at STP site to final disposal is the responsibility of the contractor.

Technology Requirements for the following STPs are included in this contract and are described here in “Minimum Process Requirements”.

Sr. N.	Location	Average Flow (MLD)	Peak Factor	Treatment Process
1	Dhalli-II at ghati mohanpur	1.4	3	SBR Technology

2.2 Treatment Technology

The treatment process i.e. SBR technology proposed by bidder should be well established and proven process for treatment of sewage in Indian Environmental condition.

Bidder must provide all information necessary for complete evaluation of his SBR technology by the Employer, including drawings, design calculations, technical specifications, datasheets proposed construction/installation methodology and other relevant details. Any bid without above information will be considered as non responsive and summarily rejected. Bid must satisfy the Employer's performance requirements as set out in the Bid documents. Bidder shall include with their Bid evidence acceptable to the Employer of satisfactory past performance of same technology based plant designs and the associated equipment and processes offered and full details of similar plant capacities called for to enable proper evaluation of design.

Treatment Objective

Considering the raw sewage quality and the required treated sewage quality, the Contractor shall furnish a process train to achieve the following objectives –

- To achieve guaranteed treated sewage quality.
- To ensure that the offered SBR Technology is the most appropriate and state of the art in terms of both efficiencies of treatment and cost (the Bidder shall have to produce the

performance records with the same treatment systems applied elsewhere.)

- To ensure that the process is cost effective from both capital and O&M costs consideration.
- To ensure that the sludge produced is dewatered to a “spade able” or “open body truck able” consistency – so that it can be easily disposed off.
- The process preferably should utilize minimum chemical/any organic chemicals except for sludge removal process. No toxic chemical shall be used by the bidder. Bidder shall submit the toxicity test report from any govt. recognized laboratory at his own cost before using such chemical.
- Oils/lubes/fuels/media/chemicals etc. to be used will be defined by Bidder.
- The final treated sewage is to be disinfected through chlorination before its disposal.

2.3 Incoming Sewage line to Inlet Chamber/ Receiving Chamber of STP

Incoming line shall have gravity sewage unless specified. Connecting last manhole or diversion of existing sewage pipeline to receiving chamber of newly proposed Sewage Treatment Plant.

Contractor should verify the details with Shimla Jal Prabandhan Nigam Limited (SJPNL) or Shimla Municipal Corporation (SMC). Bidders are required to visit the site and assess all the works, not limited to works given in Tender documents, to be executed for construction and successful commissioning of STP as per tender specifications. Cost of all the works required for construction and successful commissioning of plant shall be included in the quoted price and no extra payment shall be made to contractor. Cost of all the works required for construction not limited to site levelling, foundation & successful completion of STP is deemed to be included in their quoted price.

2.4 Plant Outfall Details

The Location of outfall and the HFL in the receiving water body for disposal of treated sewage is to be obtained by the bidder/contractor for the planning and designing of the treatment plant. High Flood Level (HFL) of the receiving water body and the STP site will be approved by the client before approval of vendor drawings.

2.5 Influent Wastewater Characteristics

The influent wastewater characteristics to be used as the basis of design are provided below:

SN	Parameters of Raw Sewage	Values	Unit
1.	BOD ₅	250 - 375	mg/l
2.	COD	425 - 750	mg/l
3.	Suspended Solids	500 - 750	mg/l
4.	Ph	6.5 – 8.5	
5.	Total alkalinity as CaCO ₃	300 - 400	mg/l

SN	Parameters of Raw Sewage	Values	Unit
6.	Chlorides	250 - 300	mg/l
7.	Sulphate	100 - 150	mg/l
8.	Total Nitrogen	50 -55	mg/l
9.	Ammonical Nitrogen	35 - 40	mg/l
10.	Total Phosphorus	5 – 7.1	mg/l
11.	Min. Sewage Temperature for Design	10	°C
12.	Max. Sewage Temperature	30	°C

(Note: Above mentioned are the range for the parameters but contractor have to design the STP for maximum value)

2.6 Treated Sewage Requirements

The treated sewage quality requirements to be met shall be as per standards given in tender document as below:

Treated Sewage Quality Requirements (at outlet of Chlorine Contact Tank)		
Parameter	Units (max monthly average)	For each STP
pH - instantaneous range		6.5 - 8.5
BOD	mg/L	Less than 10
COD	mg/L	Less than 50
TSS	mg/L	Less than 10
NH ₄ -N	mg/L	Less than 5
N-Total	mg/L	Less than 10
Total Phosphorus (PO ₄ -P)	mg/L	Less than equal to 1
Faecal Coliforms	MPN/100 ml	Less than 100
Total Residual Chlorine	mg/L	1

All other parameters shall be as per present HPPCB/CPCB Norms for inland surface water whichever is stringent.

2.7 Dewatered Sludge Quality Requirements

The dewatered sludge quality requirements to be met are listed below:

Treated Sludge Quality Requirements (Dewatered Sludge)		
Parameter	Units	For each STP
Minimum sludge TSS (dry solids)	% w/w	20%

2.8 Treatment Process

The treatment process for STP under this contract is on SBR Process. Bidder has to adopt and use appropriate treatment process of SBR technology for this project subject to requirements of clause 2.1 of Volume II-A Part-2. However, the SBR technology selected should be such that the treatment parameters should meet the treated sewage standards as stipulated in the tender document. The treatment technology should also include sludge treatment and its safe disposal. Contractor shall provide a complete, fully functional facility designed for proper, easy, operation and to meet the stated performance requirements. This shall include any and all additional, ancillary, supporting, or other processes, components, equipment, or other items necessary to achieve these objectives, regardless of whether such items are explicitly listed in these bid documents or not.

The design/sizing criteria, minimum number of units, and other requirements for the various unit processes and components are listed below.

Minimum Number of Units to be Provided for Unit Processes		
Unit Process	Number of Units (W=Working S=Standby)	
	W	S
Mechanical Coarse Screens	1	1
Manual Coarse Screens (100%)	0	1
Mechanical Fine Screens	1	1
Manual Fine Screens (100%)	0	1
Grit Removal (Mechanical)	1	1
Parshall Flume	1	0
Aeration/Biological Process	2 or More	0
Chlorination with baffle	1 (Two compartments)	0
Gravity Thickening	1	0
Sludge Dewatering	1	1
Plant Specific units depending on the Process proposed in this Bid		
Primary Clarification	2	0
Anaerobic tank	2	0
Anoxic Tank	2 or More	0
Secondary Clarification	2	0
Primary Sludge Pumping	1	1
RAS/WAS Pumping Per basin/tank	1	1
Flash Mixing Tank	2	0
Flocculation Chamber	2	0
Clarifier or Clariflocculator	2	0
Sand Filters and other units	As per CPHEEO	

Other tertiary Treatment Unit	As per design
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Note: The bidder shall meet the above min. Requirement.

2.9 Land Requirement

Land requirement has to accommodate the following units.

1. STP with all the process units and associated buildings and structures of proposed capacity with tertiary treatment if required to achieve outlet parameters mentioned in this tender document, wherever applicable, to achieve treated sewage quality as mentioned in this tender and/or HPPCB, CPCB discharge norms along with Compound wall as specified in section 1.23 of volume II B and internal road of minimum 2.5 meters' width.
2. Green zone shall be provided all along compound wall.
3. Deodorization of Primary and Sludge Treatment Units.
4. Sludge drying bed (SDB) for 25% of sludge generated (only Area to be en-marked)

Note:

- a) Bidder has to visit each site of STP and assess the land requirement of mentioned STP capacity to their respective location. Accordingly, Bidder has to submit their confirmation note on the available area for the new STP within proposed STP plot will be accommodate.
- b) The confirmation declared by the bidder on the setup the new STP plant of mentioned capacity within available area shall be taken into account for evaluating the technical bid of the bidder, if required.
- c) The Bidder shall have to submit the extent of land requirement in Technical Bid duly justified in the Layout Plan. The excess usage over and above the land requirement proposed by the bidder shall be deducted from his payment towards capital cost at the prescribed land rate used in the bid evaluation.
- d) The Extent of land required will be verified and finalized during technical evaluation process and this finalized land requirement will be considered in financial bid irrespective of the area quoted by the bidder, if required.

Multi-stacking of units on one another, in any treatment technology, is acceptable. All units/buildings shall be independent with a horizontal distance of minimum 3 m between them.

Thus the STP should be designed on the technology meeting criterion of treated sewage characteristics, minimum power consumption and fit in land availability. The placement of

units should be clearly marked in plant layout to be submitted with technical bid. The available land details to be obtained from Shimla Jal Prabandhan Nigam Limited (SJPNL) or SMC.

High Flood Level (HFL) of the receiving water body and at the STP site will be assessed by the bidder and the same will be approved by the client before approval of vendor drawings.

2.10 Demolition of Interfaces and Tie-Ins with Existing Facilities

All existing facilities that are to be demolished shall be properly dismantled, removed, and appropriately disposed of by the Contractor in accordance with all applicable laws, regulations, and standards. Items, components, or materials, whether buried, exposed, submerged, or otherwise, shall not be abandoned or left on site unless explicitly indicated in the Tender Documents. For facilities that are to be eventually demolished but must remain in service until alternate or replacement facilities are constructed and commissioned, whether under this contract or a different contract, the Contractor shall ensure that the facilities are protected and remain functional until such time as the alternate or replacement facilities are constructed, tested, commissioned, and accepted by Employer.

All existing facilities that must remain in service permanently shall be protected by the Contractor such that they remain fully functional, operable, and serviceable throughout the period as indicated in the Technical Bid. Contractor shall be fully responsible for installation and, if necessary, ultimate removal of any temporary facilities or connections (piping, utilities, power, controls, etc.) that may be necessary to maintain existing facilities fully operational throughout construction and commissioning. Temporary or permanent interfaces between existing and new facilities may involve making connections or “tie-ins” to existing live structures, piping, wiring, cabling, equipment or other components. Contractor shall be fully responsible for detailed design, planning, and implementation of such interfaces in a safe and secure manner.

2.11 Plant Layout and Hydraulic Profile

The Contractor shall ensure that the layouts and hydraulic profiles submitted as part of the Contractor’s bid comply with the following specific constraints and all other requirements described in the Bid Documents:

- For STP where all or part of the influent flow is gravitate from sewer line to STP plant boundary, the Contractor shall divert / connect the incoming sewer line to the inlet chamber of the Sewage Treatment Plant (STP). The incoming pipe length to be field verified by the bidder and to be included in financial bid.
- For all structures containing water or process liquid, the minimum freeboard shall be 0.5 m unless specified otherwise. Contractor shall provide at STP all necessary facilities for manual bypass of the process liquid at various locations in the flow path as indicated below. These facilities are included in this contract and shall be provided regardless of whether or not they are shown in any drawings included in the contract

document, shall be fully functional in all respects, and shall include any and all components necessary to safely and efficiently accomplish the intended bypass. Each bypass facility shall include, but not be limited to: (i) downward opening overflow weir gates installed in the appropriate channel or structure from which the bypass is to be effected, (ii) an RCC channel or structure to receive the bypass flow over the weir gate, (iii) an appropriately sized buried (above ground piping will not be acceptable) cement mortar lined and coal tar epoxy coated ductile iron pipe to carry the bypass flow from the channel or structure in (iv) above to a manhole or junction box in the STP's main outfall pipe, (v) provision to be kept to measure and record details of all bypass events, including but not limited to date, start time, end time, continuous flow rate data for the entire duration of the event, and a totalized volume for the event.

- Bypass facilities as described above shall be provided at the following locations:
 - Grit Tank Outlet Channel to CCT
 - Aeration Basin Influent Channel to CCT (only in plants containing primary sedimentation units)
- Topographical survey information, benchmarks, contour maps, geotechnical/soil investigations, and treated sewage receiving water body high flood level (HFL) elevations shall be obtained by the bidder. Bidder shall be fully conversant with site conditions and all site information necessary. The information provided in these documents is for information purpose. However, Employer makes no guarantees or representations whatsoever regarding this information. Bidder's use of this information shall be at his own risk.
- Contractor shall independently obtain any and all site information necessary for proper planning, design, and operation of all components in the contract.

All aspects of Contractor's technical design shall also be subjected to review and approval by the Employer.

2.11.1 Plant Layout and Orientation

The STP components shall be laid out and fully contained within the respective designated site boundaries so as to logically interface with any and all existing infrastructure that may be present at the site and that must remain in service. Bidder's proposed site layout shall clearly show the space allocated for all plant components, including those components and/or unit processes that may be designated for future construction or installation. Setbacks and clearances from the site boundary shall be provided as appropriate and as required by law. All existing utilities (including water, sewer, power, or others, whether overhead or underground and whether physically located on the site or not) requiring to be relocated to accommodate the Contractor's proposed and approved site layout shall be relocated by the Contractor at no additional cost and without interrupting provision of such utility services to users and customers. Such relocations shall be fully coordinated with Shimla Jal Prabandhan Nigam Limited (SJPNL) or SMC.

The plant layout shall adhere to the following general rules:

- Minimum clear distance provided to permit safe and convenient access for operation and maintenance shall be 3 m between adjacent treatment units or fixed structures and 1 m between pieces of equipment
- An area adjacent to all mechanical equipment shall be provided as a maintenance lay down area
- Separate land for grit conveyance to be indicated
- All electrical equipment (except for motors) shall be located above the high flood level elevation for the site or for the treated sewage receiving water body, whichever is higher.
- Minimum 2.5 m of internal road width shall be provided in the STP area.
- Multi-stacking of units on one another, in any treatment technology, is acceptable.

2.12 Modular Design, Construction, and Operation for Reliability, Redundancy, Turndown, and Easy Future Expansion

The intermediate design capacity and the ultimate build-out design capacity required are both specified in Clause 2.1.

For STP, components that are not easy to replace or expand in the future, including but not limited to header pipes, and collection and distribution and other common channels shall be designed and constructed to provide the ultimate build-out design capacity in this contract. Space for all the treatment units & sludge handling units for intermediate capacity shall be secured for future. For STP components that can be easily expanded in the future, the design and construction of the intermediate design capacity under this contract shall be performed such that future expansion to the ultimate build-out capacity can be accomplished easily and in a modular manner while maintaining the intermediate capacity fully operational at all times.

Space if available, shall be reserved within the STP site boundary for the required future modules, and the design shall include features (including but not limited to caps or blind flanges for common header pipes and knock-out and stub walls for common channels and other structures) that will allow easy future extension/expansion with minimal disturbance to initial components. The contractor submittals and drawings shall clearly show and describe such features as well as the space reserved for future expansion. The design shall ensure that all future modules can be fully integrated with the initial modules to provide a single plant and a single process stream – multiple parallel plants will not be allowed. Such integration shall be accomplished by means of common collection and distribution channels, boxes, or header pipes in between unit processes that combine the flow from multiple modules of the upstream unit process and redistribute it to multiple modules of the downstream unit process. Designs where each future module operates independently of other modules will not be allowed and will not be accepted by the Employer.

Further, for all components under this contract, the capacity to be provided shall be designed and constructed using multiple, suitably sized unit process modules to ensure reliability, redundancy, and appropriate turndown for optimum capacity utilisation and process

efficiency. The minimum number of working and standby modules or units required for each component shall be as per clause 2.7.

The Bidder shall be fully responsible to include in his bid the whole of the Works, including each individual component, designed and constructed in accordance with bid specifications and good engineering practice. The offered plant should function as a whole, a fully integrated system which is capable of achieving the required treated sewage parameters in an efficient and economical manner, and eliminate the odors and pest nuisance assignable to improper design and/or poor Operation & Maintenance. The offer shall include all buildings, plant, equipment and accessories required for the efficient, safe and satisfactory operation of the facilities. Any accessories which are not specifically mentioned in the specifications/requirement, but which are usual or necessary for completion of the Works and successful performance of the plant and facilities, shall be provided by the Bidder without extra cost to the Employer. The Bidder shall, to the maximum extent practical and feasible, endeavor to offer standardized designs and Plant and equipment keeping in view minimization of operation and maintenance requirements.

2.13 General Design Requirements

The following general design requirements shall be met for STP. These requirements shall be fully met regardless of whether or not such requirements or any related components are shown in any drawings included in the contract documents.

1. STP should be designed, such that the proposed process is meeting treated sewage requirement and with least power consumption and easy in O&M and shall fit in available land. The formation level of STP should be planned with respect to HFL of receiving water body to avoid flooding. The Formation level shall be at least 0.50 m above HFL. It is the responsibility of contractor to match the outfall chamber level with proposed disposal point of treated sewage. In case gravity disposal of treated sewage is not feasible, treated sewage pumping station shall be provided for safe disposal of treated sewage without extra cost to employer.
2. All components (including but not limited to equipment such as pumps, blowers, screens, diffusers, inline devices; instruments such as flow meters; and distribution and collection channels or pipes) shall be provided with appropriate isolation devices such as valves, gates, or other devices in order to allow isolation, drainage, cleaning, calibration, servicing, and maintenance of such components. Bypasses shall be provided around all flow meters and other in-line instrumentation such that the instrument can be isolated and removed for calibration and maintenance without interrupting the flow.
3. Where necessary, equipment shall be provided with acoustic, sound-dampening enclosures to limit ambient noise during normal operation to the limits detailed in the General Requirements.
4. All equipment shall be arranged and buildings and structures designed to permit safe and easy access to and removal of all equipment.

5. Fixed runways, lifting eyes, cranes, hoists, or other appropriate devices and means shall be provided to permit safe and easy removal of all equipment for maintenance or any other purpose
6. All liquid or sludge flow distribution shall be accomplished using one of the following options only:
 - non-submerged (i.e. with a positive free fall from weir invert to the water surface on the downstream side) overflow weirs,
 - non-submerged downward opening overflow weir gates, or
7. All structures, whether liquid-holding or not, shall be designed such that they can be fully and completely drained and will not float or move when empty, because of groundwater buoyancy or any other reason. The structures shall be designed to counteract any possible floatation without the use of any type of groundwater pressure relief valves.
8. The floors of all liquid-holding structures shall be appropriately sloped and trenches and drain sumps shall be provided at the bottoms of such slopes to facilitate complete drainage of liquid. Appropriate drain pipes and valves connected to the drain sump(s) shall be provided for all structures. Where the drain pipe connects to the structure, the top-of-pipe elevation shall be at least 150 mm lower than the lowest floor elevation for the structure. The drain piping shall be routed from the structure being drained to the Plant Drain Pump Station and shall be continuously sloped downward in the direction of flow with a minimum slope of 1 percent. For liquid-holding structures, the drain piping and fittings shall be sized such that the entire structure can be drained by gravity in no more than six (6) hours. The Plant Drain Pump Station, Plant Drain Pumps, and other related equipment and controls shall be designed and sized to allow draining of the structure with the largest volume from full to empty within six (6) hours. The highest design water level (High High Alarm) in the Plant Drain Pump Station wet well shall be at least 300 mm lower than the lowest pipe invert elevation amongst all drain pipes connecting to the wet well.
9. Non-liquid-holding areas, structures, or buildings where leakage or other wet activities can occur, whether in normal use or during maintenance, shall be provided with covered drainage channels which shall direct the spillage either to a suitable gravity drain or to a sump equipped with standard dual submersible sump pumps discharging to the Plant Drain Pump Station.
10. All concrete structures in contact with sewage and/or sludge upstream of the Aeration Basins shall be provided with full interior corrosion protection linings and/or coatings of appropriate material and thickness – to be approved by Employer. This also applies to all concrete structures in contact with any type of sewage sludge anywhere in the plant. For Aeration Basins, interior lining shall extend from the top of wall down to 1 meter below the lowest operating water level.
11. All channels carrying process liquid shall be fully covered with solid non-skid GRP/SFRC cover plates (not grating) designed for human traffic live loads at a minimum and heavy vehicle live loads wherever the channel crosses traffic paths.
12. Inlets into tanks, reactors, or other structures via pipes, channels, valves, or gates shall be designed such that the incoming flow does not cause any damage or excessive wear

whatsoever to the structure or any equipment in the vicinity under any hydraulic condition, including but not limited to the condition when the structure is empty.

13. All piping shall be of corrosion-resistant material appropriate for the service and shall be provided with interior lining, exterior coating, and other corrosion protection as appropriate. All piping shall be fully and adequately supported and braced to comply with all applicable codes and standards. All supporting hardware shall also be of corrosion-resistant material. The design of pipe supports and anchors shall fully account for static and dynamic vertical, lateral, longitudinal, and seismic loads, fluid flow, and thermal expansion. Seismic bracing, thrust restraints and/or thrust blocks, and appropriate expansion joints or loops shall be provided as needed. Pipe lengths and joints shall be assembled and arranged for ease of removal in such a way that individual runs can be changed without dismantling adjacent pipes, by providing dismantling joints at regular intervals.
14. For liquids and sludge, the maximum pipe flow velocity shall not be more than 1.5 m/s for pumped suction and not more than 2.0 m/s for pumped discharge. For gravity flow, the minimum pipe flow velocity shall not be less than 0.6 m/s and not more than 1.2 m/s. All mixed liquor and sludge lines shall be minimum 150 mm diameter and shall be provided with appropriate cleanouts and flushing arrangements for safe and easy flushing using high-pressure water. The normal pipeline flow velocity for air shall not be more than 20.0 m/s & for biogas not more than 12 m/s.
15. All liquid service pipes shall be provided with appropriate means for safe and easy drainage of the pipes when not in service.
16. All pipes shall be colour banded and suitably labelled with the stream designation and direction of flow to enable individual lines to be identified throughout their run.
17. Particular attention shall be paid to the layout of the chemical piping, which shall be arranged without clutter and shall be functional and neat in appearance. Generally, where piping is installed in ducts, it shall be supported not less than 150 mm clear of the floor.
18. All piping routed under any type of structure or equipment shall be fully and completely encased in reinforced cement concrete, with the encasement thickness beyond the outer diameter of the pipe being at least 200 mm on all sides or $D/4$ whichever is more (D -diameter). The encasement shall extend along the pipe length for a minimum horizontal distance of 1500 mm in each direction beyond the footprint of the overlying structure or equipment.
19. All piping connecting to, entering, or exiting any and all structures shall be provided with appropriate restrained flexible connections and/or joints at all such interfaces with structures to allow for differential movement between pipe and structure in all directions without stressing or breaking the pipes.
20. Appropriate restrained flexible connections and/or joints shall be provided for all pipes where they connect to any and all of the following:
 - Equipment such as pumps, blowers, or inline devices
 - Valves
 - Wall, floor, or roof penetrations

21. Where piping or other materials susceptible to damage from ultraviolet radiation are employed, they shall be protected from such radiation through the use of appropriate additives and/or coatings and shall be physically shielded from direct sunlight at all times in their normal service location using enclosures, covers, canopies, roofs, and/or other similar means.
22. Platforms, handrails/guardrails, ladders, and stairs shall be provided where necessary for proper, safe, and easy access to and/or operation of valves, gates, instruments, control panels, and other devices, equipment, or structures.
23. Appropriate sampling ports and/or sampling valves shall be provided to allow easy, safe sampling of all process streams without spillage or contamination and without the need to interrupt normal operation.
24. The influent flow meter and influent sampling location shall be selected such that the true influent flow and characteristics will be measured without inclusion of in-plant recycles or other extraneous streams. Separate flow measurement and sampling shall be provided for the recycle streams.
25. Foam, scum, fats, oil, grease, or any other floating material removed from any location in the STP shall be completely removed from the process flow path along with waste, digested, and/or dewatered solids leaving the STP and shall under no circumstances be recycled or returned to any location in the plant.
26. All units shall be interconnected by RCC overhead walkways, min. 1.2 m wide with handrail and RCC staircase.
27. Gravity sewage at STP site will be made available by the employer. Bidder to design the hydraulics to discharge the treated sewage to suit the level of the receiving body.

2.14 Process and Facilities Description

This Process and Facilities description is intended to provide a general indication of the various unit processes and type of facilities that the Contractor shall be required to design, construct, and operate, and applies to STP in this contract unless specifically indicated otherwise. The Contractor shall use this description together with other specific information for STP provided elsewhere in these bid documents, including but not limited all of which are integral to this Process and Facilities Description and are incorporated herein by reference.

The Bidder shall submit plant layout, process calculations, hydraulic calculations, hydraulic flow diagram, P&ID, mass balance calculations, electrical load list etc. along with technical bid for his proposed technology to illustrate the offer submitted with all technical details.

2.14.1 Primary Treatment Units

2.14.1.1 Inlet Chamber

The inlet chamber shall receive the flow of raw sewage from the Gravity main. The chamber shall be designed for peak flow. The MWL in the inlet chamber will be decided based on plant hydraulics with respect to HFL in the receiving water body. However, the Contractor shall be fully responsible for proper coordination to ensure proper alignments and interfaces and for proper implementation of all connections. Inlet chamber shall be of adequate size to

meet the requirements of workability inside it. It shall be water tight to prevent seepage of the sewage out of the receiving chamber. Isolation gate shall be provided on incoming line/box channel / duct.

2.14.1.2 Coarse Screens

Mechanical coarse screens along with manual standby shall be provided at upstream of fine screens for removal of floating and oversized material coming with the sewage. The coarse screens should be capable to screen out most of the medium and large floating and oversized material such as plastic rags, debris, weeds, paper, cloths etc which could clog the wastewater pump impellers. The screenings removed by the screens shall be discharged at the appropriate elevation above ground on to a conveyor. A belt conveyor positioned above ground level shall convey the screenings through a galvanized steel chute to a trolley positioned at ground level.

2.14.1.3 Fine Screens

The fine Screens shall receive sewage from the upstream coarse screening. Mechanical fine screens along with manual standby shall be provided. The screenings removed by the screens shall be discharged at the appropriate elevation above ground on to a conveyor. A belt conveyor positioned above ground level shall convey the screenings through a galvanized steel chute to a trolley positioned at ground level.

2.14.1.4 Grit Basins and Grit Washers and Classifiers

A complete grit removal facility shall be provided, with integrated fats, oil, and grease (FOG) removal. All equipment and components (including but not limited to conveyors, pumps, and blowers) necessary for a fully functional system shall be provided regardless of whether or not such items are specifically listed or described in the bid document. Dewatered grit shall be collected in a trolley positioned at ground level below the Grit Classifier discharge. De-gritted sewage shall exit the Grit Basins over the outlet weir. Liquid streams from grit washers and classifiers shall be returned to the de-gritted sewage stream or to the Plant Drain Pump Station. Any FOG skimming's removed shall be routed to the sludge storage tanks or safely disposed off. Each Mechanism shall be provided with Organic return pumps. This shall be suitably located to return organics back to Grit Chamber. The de-gritted sewage shall flow through open channels from the grit separators and confluence into a single channel of suitable width for provision of Parshall flume. Separate land for grit conveyance shall be indicated in the layout.

2.14.1.5 Parshall Flume

A Parshall flume shall be provided at downstream of Grit Chamber. There will be one no. Parshall flume in R.C.C channel, which shall be designed for measuring peak flow in the STP as mentioned above in this section. There will be an approach channel, a throat, and a downstream channel. At the throat, there will be a hydraulic jump and a corresponding head loss. An Ultra sonic flow meter shall also be provided for flow measurement shall be mounted above the channel to measure the flow, record it and integrate it. Recorder and

integrator will be housed in the control room. Parshall flume shall be designed as per IS: 14371:1996.

2.14.2 Secondary Treatment Units

Secondary treatment processes included but not limited to the following options shall be considered for organic removal along with Biological Nutrient Removal (BNR) to achieve the treated sewage quality specified in section 2.6.

Sequential Batch Reactor (SBR) (optional coagulant dosing system)

2.14.2.1 Aeration Basin Influent Channel

Influent after fine screen and Grit chamber shall flow by gravity to the Aeration Basin Influent Channel from where it shall be distributed to the aeration basins. Appropriate isolation gates and/or valves shall be provided to allow isolation of each basin. A bypass mechanism shall be designed and constructed such that channel contents will be bypassed around the aeration basins only if inflow to the channel exceeds the combined peak hydraulic design capacity of all aeration basins in service. The bypass flow shall be routed to the receiving water body via the plant outfall pipe.

SBR Basins

SBR process shall be designed to treat peak flow sewage for organic load reduction along with built-in nitrification-denitrification and biological phosphorus removal. SBR designs shall strictly comply with the minimum sizing and all other requirements specified in the bid documents. Process air blowers as well as air piping and valves for SBRs shall be configured such that one or more blowers are dedicated to each SBR basin that is in the aeration phase at any given time. The discharge from any given blower shall be routed to no more than a single SBR basin at any given time. **In case of any other type of Aeration Equipment one total set of the equipment should be provided as standby.**

For SBR process, the recirculation of activated sludge (RAS) may or may not be provided depending upon bidder's design/proposal. Minimum HRT of SBR shall be as per Biological Process Design Requirements and HRT of anoxic zone shall not be clubbed with HRT of aeration Tank.

No. of WAS (waste activated sludge) pumps shall be minimum 1W+1S for each basin.

2.14.3 Tertiary Treatment Units, if required to achieve outlet parameters of treated sewage as mentioned in Tender document.

2.14.3.1 Coagulation & Flocculation

STPs where phosphorus is treated by physico-chemical process, Flash Mixer along with complete coagulant dosing system followed by Flocculation and Clarifier as separate units or combined clarri-flocculator shall be provided as per specifications.

2.14.3.2 Rapid Sand Filtration

Sand filters shall be provided for further reduction in SS and/ or residual organics. Filtration system should be designed such that filtration rate shall be within the acceptable range as per CPHEEO while operating at average as well as peak flow rate. Filtration system shall include feed tank, feed pumps, filter beds with under-drain system as per design specifications along with pipe gallery, platform and necessary piping, valves/ Gates, gauges/ meters etc as per design and required for filter operation.

Pressure Sand Filters (PSF) shall be preferred for STP capacities less than 10MLD and Rapid Sand Filters (RSF) for STP capacities above 10MLD. Cloth Media Disk Filtration is also acceptable or any other proven technology.

Contractor to show calculation for filter operation during avg and peak flows without exceeding filtration rate. The inlet and outlet control arrangement to RSF shall be designed to permit 100% over load for emergency occasion.

Shape, size and quality of filter sand shall satisfy the following norms.

- (a) Sand shall be of hard and resistant Quartz or quartzite and free of clay Fine particles soft grains and dirt of every description.
- (b) Effective size shall be 0.45 to 0.70 mm.
- (c) Ignition loss should not exceed 0.7 percent by weight.
- (d) Uniformity coefficient shall not be more than 1.7 nor less than 1.3
- (e) Soluble fraction in hydrochloric acid shall not be more than 5% weight.
- (f) Silica content should be not less than 90%.
- (g) Specific gravity shall be in the range between 2.55 to 2.65.
- (h) Wearing loss shall not exceed 3%.

IS: 8419 (Part-1)1977 entitled filtration media sand and gravel may be referred for details.

For backwash purpose air scouring followed by backwash with wash water shall be provided. For back washing of filters, a back wash water tank should be constructed or provided on chemical house/ filter gallery which shall be filled with filtered water by backwash pumps. It must be able to back wash for minimum 10 minutes for minimum 2 units. The back wash head should be 9 to 10 m from bottom of tank to under drain of filter with necessary sluice valve. Wash water pumps with valves, piping etc., shall be per design and requirement. Air scours system with Air blowers, valves, piping etc., as per design and requirement.

Dirty Backwash water from filters shall be collected in waste water collection tank and pumped back to STP head works.

2.14.3.3 Chlorine Contact Tanks

Chlorine Contact Tanks shall be provided for disinfection of treated sewage from the secondary and/ or tertiary treatment as per design. Chlorine shall be injected via an inline vacuum educator placed in the biologically treated sewage pipe just upstream of the Chlorine Contact Tanks or through diffusers in Chlorine Contact Tank. Disinfection shall be done by gas chlorinator.

A Chlorination Building shall be provided to house all chlorination equipment including chlorine cylinders, chlorinators, and all associated equipment.

2.14.3.4 Chlorination System

A complete Chlorination system with necessary safety accessory and controls shall be provided as per IS code. A pit and absorption system shall be provided to contain and neutralise chlorine in the event of a leak. **(Chlorination system should be operated by automation system during decanting)**

2.14.3.5 Overhead Tank

Surface water from public water main shall be stored in sump for adequate storage and pumped to overhead tank of chlorination building or separate OHT structure for potable use. All water and plumbing connections shall be provided as per requirement.

2.14.4 Sludge Handling, Treatment and Disposal**2.14.4.1 Gravity Sludge Thickeners (if required)**

Gravity sludge thickeners shall be provided for thickening of the sludge generated (secondary clarifier sludge) from the biological treatment. Provision of polyelectrolyte dosing (DWPE) shall be made in thickener as well as dewatering facility. The thickened sludge shall be conveyed by gravity to sump of thickened sludge pump house. The overflow (supernatant) from the thickeners shall be conveyed back to inlet of STP (gravity/collection and pumping).

2.14.4.2 Thickened Sludge sump and Pump Station (if required)

Thickened sludge sump shall be provided for the collection of thickened sludge from thickeners. The sump shall be equipped with Agitator assembly to facilitate mixing of sludge content. Thickened sludge pump station and pumps shall be provided for pumping of thickened sludge from the sump to sludge dewatering unit.

2.14.4.3 Dewatering Building

A Dewatering building shall be provided along with mechanical dewatering units (centrifuge/belt press) and all associated/ancillary equipment, including feed pumps, a complete polymer dosing system, dewatered sludge conveyors, sludge storage/loading hoppers, and truck access and loading facilities. Sizing of the dewatering unit all related equipment shall be based on the operating schedule.

2.14.4.4 Sludge Drying Beds

Space for provision of sludge drying beds for 25 % Sludge generation as per detailed specifications & drawing as per volume II B & IV (Construction of sludge drying bed shall be taken up at a later stage)

2.14.4.5 Treated Sewage Disposal

The treated sewage, post chlorination shall be conveyed to the disposal point as per site condition to nearest receiving water body not exceeding length of 500 meters.

2.14.4.6 Plant Drain Pump Station

A Plant Drain Pump Station shall be provided to collect supernatant/ centrate/ filtrate from sludge treatment and other miscellaneous waste flows such as tertiary filter backwashing; cleaning and wash-down flows generated in the plant and pump them back up to the head works for treatment through the plant.

2.14.5 Instrumentation and Automation

SCADA based Instrumentation and Automation System shall be installed for proposed plant for various treatment units. Specification for Instrumentation, Automation and SCADA is given in Volume II C, Part 4.

2.14.6 Administration, Laboratory, Maintenance, and Other Related Buildings/Facilities

An administration building, a laboratory, a maintenance workshop, a storage facility, a guard house, and other miscellaneous buildings and related equipment and furnishings shall be provided as needed for a fully functional facility.

All units shall be interconnected by RCC overhead walkways, min. 1.2 m wide with handrail and RCC staircase.

All units/ buildings shall be independent with a minimum 3 m distance apart.

All the treatment units should be on the ground floor (no multi-stacking) except admin and laboratory, which can be accommodated in a building unit.

Compound wall as specified in section 1.23 of volume II B

Space for Sludge Drying Beds as specified in volume II B & II E

Minimum 2.5 meters of internal road width shall be provided in the STP area

There should be Future space provision along with the following;

- Deodorization of Primary and Sludge Treatment Units

2.15 Design/Sizing Criteria and Other Requirements

<p>Minimum Sizes for Various Building Associated with STP (LXBXH) in Meters</p>
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Sl. No	Buildings	Sizes (M)
1	Administration Building + Toilet Block :Ground Floor	8 x 4 x 3.5
2	Laboratory + SCADA :First Floor	8 x 4 x 3.5
3	Process Air Blower Building (Depending on the Aeration Equipment)	12 x 5 x 5
4	Sludge Pump & Blower House	5 x 5.5 x 4.5
	Chlorine Building Min	8 x 5 x 3.5
5	Sludge Dewatering Building – Ground Floor	6 x 4 x 4.5
6	Sludge Dewatering Building – First Floor	6 x 4 x 5
7	Diesel Generator (DG) Room	As per the size of DG sets and other mechanical requirements
8	Maintenance Workshop	6 x 4 x 3.5
9	Guard Room	3 x 3 x 3
10	MCC Room	9 x 6 x 3.5
11	Indoor HT Substation	5 x 5 x 4.50

All units in the STP should be interconnected by overhead walkways. In addition, appropriate number of staircases should be provided for ease in O&M and there should be access to influent and treated sewage and sludge sampling.

2.15.1 Biological Process Requirements:

Biological Processes – Design Requirements					
Treatment Processes	SRT (d)	F/M (Kg BOD / Kg MLVSS. D)	MLSS (mg/L)	Aeration Tank HRT (hr)	RAS (% of influent)
SBR Continuous Flow and Intermittent Decant	15-20	0.05-0.08	3000-4000	Min 14	As per Bidders Design

SBR Intermittent Flow and Intermittent Decant	4-20	0.05-0.3	3500-5000	Min 14	
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2.15.2 General Design Requirements:

Items	Unit	Values
Inlet Chamber		
Design flow	-	Peak flow
HRT	sec	60
Min. no. of unit	No.	1
Coarse Screen Channels (Working)		
Design flow	-	Peak flow
Screen type	-	Bar screen/ Mat screen/ Step screen/ escalator type with mechanical cleaning.
MOC – Channel	-	RCC
MOC – Screens (all screen components)	-	SS 316
Angle of inclination of screen	deg.	As per CPHEEO Manual
Max SWD at peak flow	M	
Approach velocity in channel	m/sec	
Velocity through openings at peak flow	m/sec	
Velocity through openings at average flow	m/sec	
Minimum Bar thickness	mm	
Clear spacing between bars	mm	20
Coarse Screen Channels (Standby)		
Design flow	-	Peak flow
Screen type	-	Bar screen with Manual cleaning
MOC – Channel	-	RCC
MOC – Screens (all screen components)	-	SS 316
Angle of inclination of screen	deg.	As per CPHEEO Manual
Max SWD at peak flow	M	
Approach velocity in channel	m/sec	
Velocity through openings at peak flow	m/sec	
Velocity through openings at average flow	m/sec	

Minimum Bar thickness	mm	
Clear spacing between bars	mm	20
Fine Screen Channels (Working)		
Design flow	-	Peak flow
Screen type	-	Bar screen/ Mat screen/ Step screen/ escalator type with mechanical cleaning
MOC – Channel	-	RCC
MOC – Screens (all screen components)	-	SS 316
Angle of inclination of screen	deg.	As per CPHEEO Manual
Max SWD at peak flow	M	
Approach velocity in channel	m/sec	
Velocity through openings at peak flow	m/sec	
Velocity through openings at average flow	m/sec	
Minimum Bar Thickness	mm	
Clear spacing between bars	mm	6
Fine Screen Channels (Standby)		
Design flow	-	Peak flow
Screen type	-	Bar screen with Manual cleaning
MOC – Channel	-	RCC
MOC – Screens (all screen components)	-	SS 316
Angle of inclination of screen	deg.	As per CPHEEO Manual
Max SWD at peak flow	M	
Approach velocity in channel	m/sec	
Velocity through openings at peak flow	m/sec	
Velocity through openings at average flow	m/sec	
Minimum Bar Thickness	mm	
Clear spacing between bars	mm	10
Grit Basins		
Design flow	-	Peak flow
Type	-	Mechanical Detritor or Vortex or Aerated Type with center drive, full diameter scraper
MOC – Equipment/Mechanism	-	SS 304

Design particle dia (sp gr – 2.65)	mm	0.10
Max Design SOR at peak flow	m ³ /m ² /day	As per CPHEEO Manual
Min HRT at peak flow	sec	60
Organic return pump and organic wash pump	-	To be provided as per requirement (for each Detritor type grit chamber separately)
Grit Washer and Classifier		
Type	-	Reciprocating rake mechanism or screw conveyor
Aerated Grit Chamber		
Transverse velocity at surface	m/s	0.6-0.8
Depth-to-width ratio	-	1.5:1 to 2:1
Air supply	-	4.6-7.7 l/m/s of length 0.3-0.4 m ³ /m ³
Detention time at peak flow	Min.	3-5
Quantity of grit	ml /m ³	7.5-75
Max Design SOR at peak flow	m ³ /m ² /day	1,555
Vortex- Type Grit Chamber		
Minimum Velocity	m/s	0.15
Detention Time @ peak flow	sec	20-30
Parshall Flume		
Min No of Units	No.	1
MOC	-	RCC
Design flow	-	Peak flow
Minimum freeboard	m	0.5
Size	-	As per CPHEEO
Anoxic Basin		
MOC – Structure	-	RCC Tank equipped with mixers
Min SWD	m	5
Min Freeboard	m	0.5
Min HRT at Average flow	Hrs	As per CPHEEO Manual
Aeration Basin (Refer Table above for Biological Process requirements)		
MOC – Structure	-	RCC
Min SWD	m	5
Min Freeboard	m	0.5
Specific sludge yield	kg sludge production/ kg BOD	As per CPHEEO Manual
Min HRT at Average flow	Hrs	Refer Table above for Biological Process requirements

Recycle Configuration		
RAS Ratio – hydraulic design	-	As per CPHEEO Manual
Aeration System		
BOD oxidation oxygen requirement	kg/d	1 to 1.2 x Inlet BOD load avg.
*Type of Aeration	-	Diffused Aeration or Aspirator Aeration.
*Note- - The proposed aeration system shall be in successful operation in STP since last three (3) years in India.		
Diffused Aeration System		
Max Alpha Factor, α	-	0.60
Max Beta Factor, β	-	0.95
Max Fouling factor, F	-	0.80
Oxygen demand peaking factor	-	1.0
Aeration system sizing basis liquid temperature	-	Max liquid temp
Aeration system sizing basis air temperature	-	Max air temp
Aerobic basin DO (min)	mg/L	2
Diffuser type	-	Fine bubble diffuser (Disc or Tube type)
Diffuse Installation	-	Retrievable / Fixed type
Diffuser material	-	PU/EPDM/Silicon elastomer with anti-microbial coating'
Min no of diffusers – Uninstalled shelf spares	%	10
Max. SOTE per unit diffuser submergence at peak air flow (for design calculations)	%/m	5
Process Air Blowers		
Blower type	-	Rotary lobe PD with Variable frequency drive (VFD) with acoustic enclosure
Capacity	%	110 (All systems shall use Dissolved Oxygen/Oxygen Uptake Rate control with VFD driven Blower)
No of blowers – Working	Min.	1
No of blowers – Standby	Min.	1
Process Air Blower Building		
Structure	No.	1

MOC – Roof, columns, beams	-	RCC
Aspirator Aerator		
Capacity	%	110
Aerobic basin DO (min)	mg/L	2
Max Alpha Factor, α	-	0.85
Max Beta Factor, β	-	0.95
Oxygen Transfer Efficiency	Kg O ₂ /kWh	1.2 to 2.4
Mixing Power Requirement	W/m ³	15-26
SBR Basins		
SBR Basin	No.	2 (minimum)
MOC – Structure	-	RCC
Max. SWD	m	As per CPHEEO
Min Freeboard	m	0.50
Cycle time	hrs	As per CPHEEO Manual
Min. Aeration time, Settling time and Decant time	hrs	As per CPHEEO Manual
Min. HRT of Aeration Tank (Excluding Selector zone)	hrs	14 minimum
Decanting mechanism	-	Swing down / float type
Decanting depth shall be designed to meet the specified performance standards for treated sewage. Any shortfall in meeting the performance standards due to decanting depth observed during commissioning and operation of the plant shall be corrected by successful bidder at his own risk and cost.		
No. of RAS pumps	per basin	1 W+1 S
Selector Zone HRT.	Hrs.	As per CPHEEO Manual
Specific Sludge Yield (for all technologies)	Kg sludge production / kg BOD	
Flash Mixer		
Detention time	sec	As per CPHEEO Manual
Velocity Gradient	s ⁻¹	
Mixing Mechanism	-	Mechanical as per IS 7090-1985
Flocculator		
Detention time	min.	As per CPHEEO Manual
Velocity gradient	s ⁻¹	
Mixing Mechanism	-	Mechanical as per IS 7090-1985 (Type C)
Total Area of Paddles	-	As per CPHEEO Manual
Max. Peripheral velocity of blades	m/sec	
Surface loading rate	liters/hour/sq.m	
SWD	m	

Filtration System		
Type	-	Pressure Sand Filters for STP capacities less than 10MLD Rapid Sand Gravity Filters with shed for capacity above 10MLD only. Cloth media disk filtration is acceptable or any other proven technology
Rapid Filtration		
Filtration rate	M ³ /m ² /h	As per CPHEEO
Area per bed	M ² / individual bed	
No. of beds	-	Minimum 2 Nos of beds shall be provided.
Min. depth of water over sand top	m	2 m (Without free board).
Min. Free board	m	0.5
Depth of Sand media	m	As per CPHEEO
Depth of Gravel media	m	
Area of orifices	-	0.3% filter bed area The perforations vary from 5 to 12 mm. In diameter and should be staggered at a slight angle to the vertical axis of pipe.
Area of laterals	-	2 x Area of Orifices
Area of Manifold	-	1.5 x Area of laterals
The inlet and outlet arrangement to RSF	-	designed at 100% over load to permit for emergency occasion
Wash Water Tank	-	Separate O/H wash water cum service water tank suitable for backwashing minimum 2 Nos. of filter beds at a time with 8 to 10 Mtr. Head
Wash Water Pumps	-	100% standby Rate 36m ³ /m ² /h or 600LPM per Sq.m. for 10min
Air Blowers	-	Rate 45-50 m ³ /h per sq.m of free air flow at 0.35 to 0.4 Kg/sq.m for 5min at the under drains (100% standby)
Wash Water Recycle Pumps	-	2 x 100 % capacity pumps suitable to empty the wash water collection tank in 4 hours

Chlorine Contact Tanks		
MOC	-	RCC
Min HRT at Average flow	min	30
Min effective L/W ratio	-	40
SWD/Pass Width ratio	-	1
Min freeboard	m	0.5
Chlorination System		
Type	-	Chlorine Gas Feed System
Minimum chlorine dose	mg/L	5
<u>Chlorine Ton Cylinders</u>		
Min storage period	days	15
Max withdrawal rate per 900 kg cylinder	kg/hr	9
Min no of cylinders – total	-	As per requirement
Min no of cylinders – manifold with automatic switching-		As per requirement
<u>Chlorinators</u>		
Type of Chlorinator	-	Vacuum
Min no of units – Working	No.	1
Min no of units – Standby	No.	1
<u>Chlorine Ejector</u>		
Type	-	Inline vacuum induction or diffuser
No of units – Working	No.	1
No of units – uninstalled spares	No.	1
Chlorine Building		
Min no of units	No.	1
MOC – Roof, columns, beams	-	RCC
Gravity Sludge Thickener (if required)		
Min No of Units	No.	1
Type	-	Circular, center column supported with central drive
MOC – Structure	-	RCC
Conical bottom minimum slope	-	1 to 10
MOC – Center Column	-	MS Epoxy coated
MOC – Bridge	-	MS Enamel painted
MOC – Scraper	-	MS Epoxy coated
Max Surface loading rate	kg/m ² /day	25-35
Max center column velocity	m/sec	0.9
Minimum SWD	M	4
Min Freeboard	M	0.5
<u>Check for Hydraulic Loading</u>		
Max hydraulic loading rate	cum/d/sqm	20

Thickened Sludge Pumping Station(if required)		
Min no of units	No.	1
MOC – Roof, columns, beams	-	RCC
HRT in Sump	hrs	4
Type of Mixing	-	Coarse bubble/Mechanical mixers
Feed Sump & Pump (Dewatering Influent, DWI)		
Min no of Sumps	No.	1
MOC – Roof, columns, beams	-	RCC
Min. HRT	hrs	10
Type of Mixing	-	Coarse bubble/Mechanical mixers
Operation schedule	hrs/day	12
	days/week	6
Min no of pumps – Working	No.	1
Min no of Pumps – Standby	No.	1
Type of Pump	-	Progressing Cavity
Mechanical Dewatering Unit		
Min no of units – Working	No.	1
Min no of units – Standby	No.	1
Type of Sludge dewatering Equipment	-	As per bidder proposal Centrifuge/belt Filter press Auto operated with minimum sludge man contact Bag Filter is acceptable only for plant capacity below 3MLD
Min dewatered sludge (DWSL) TSS required	% w/w	20%
Min solids capture required	%	90%
Polymer System		
Type	-	Dry polymer / Liquid polymer
Minimum polymer dose	kg/ton dry solids	2
Note: Provision for dosing Dewatering Polyelectrolyte (DWPE) shall be made in thickener as well as dewatering facility.		
Dry Polymer Storage		
Type	-	Covered bin
MOC	-	GRP
Minimum storage period	days	30
Polymer Batch Tanks		
MOC	-	GRP/ HDPE
Poly solution strength	% w/w	0.10%

Min no of tanks – Working	tank	1
Min no of tanks – Standby	tank	1
Polymer Tank Mixers		
Min no of mixers per tank	No.	1
MOC - Impeller and shaft	-	SS316
Type	-	Turbine
Polymer Metering Pumps		
Type of Pump	-	Hydraulic double diaphragm
Min no of pumps – Working	No.	1
Min no of pumps – Standby	No.	1
Dewatering Facility Building		
Min no of units	No.	1
No of levels	No.	2
MOC - Roof, columns, beams	-	RCC
Plant Drain Pump Station		
Plant Drain Pump Station	Type	Wet well
MOC		RCC
Design flow	-	5% of average flow of STP
Min HRT at peak flow	min	10
Min operating depth	m	1.5
Plant Drain Pumps		
Min no of pumps – Working	No.	1
Min no of pumps – Standby	No.	1
Type of Pump	-	Submersible
Sub-Station for STP		
Min no of units	No.	1
MOC - Roof, columns, beams	-	RCC
Switch Gear Room	-	As per requirement
Min height	m	5
Transformer yard	-	As per requirement
DG Set		
DG capacity for minimum 50% electrical load or load necessary for continuous aeration process, whichever is more shall be provided to run plant successfully with desirable quality of treated sewage in case of power failure.		

End of Part 2