

RAJKOT MUNICIPAL CORPORATION

e-TenderNo.: RMC/2024/WW/25MLD WTP/NYARI



Tender Documents For
ENGINEERING, PROCUREMENT, CONSTRUCTION, COMMISSIONING AND 2 YEARS
OPERATION & COMPREHENSIVE MAINTENANCE OF 25MLD CAPACITY WATER
TREATMENT PLANT AT EXISTING NYARI WTP SITE, RAJKOT

VOLUME-II TECHNICAL SPECIFICATIONS

JUNE - 2024

:: Milestone dates of e-Tendering ::	
1. Downloading of e-Tender documents	07-06-2024 to 27-06-2024 up to 17.00 Hrs.
2. Pre-bid Meeting (Queries also to be submitted by e-mail ID ammitra@rmc.gov.in & mjtank@rmc.gov.in before 18-06-2024 up to 10:00 Hrs.)	18-06-2024 at 11.00 Hrs. at Central Zone Office -RMC
3. Online submission of e-Tender	01-07-2024 up to 18.00 Hrs.
4. Physical submission of EMD, Tender fee, Documents required for pre-qualification and other necessary documents. (To be submitted by Speed Post or RPAD Only).	05-07-2024 up to 18.00 Hrs.
5. Verification of submitted documents (EMD, Tender fee, Documents required for pre- qualification and other Necessary documents.)	06-07-2024 at 10.30 Hours onwards
6. Opening of online Primary Bid (Technical Bid)	05-07-2024 at 10.30 Hrs. onwards
7. Opening of online Commercial Bid (Price Bid) for technically qualified bidders only.	08-07-2024 at 10.30 Hrs. onwards (If possible)
8. Bid Validity	180 Days

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1. BACKGROUND

1.1 ABOUT RAJKOT

Rajkot is a city and a municipal corporation within the state of Gujarat, India. Rajkot is the fourth largest city in the state of Gujarat.

Rajkot is connected to major Indian cities by Air, Railway and Road. It is well connected by broad gauge railway line with Delhi and Bombay and all important cities of India. It is connected with broad gauge railway lines of western railway between Viramgam-Okha-Porbandar, Jetulsar-Veraval-Bhavnagar. NH-8A and State highways connects Rajkot to other important towns of the region. The city has a domestic airport which links by air with Baroda, Bhuj, Bombay, Delhi and Ahmedabad.

1.2 PHYSICAL CHARACTERISTICS

1.2.1 Location and Topography

Rajkot is situated in the middle of the Saurashtra peninsula in central plains of Gujarat State of Western India at height of 134 m above mean sea level. Rajkot is located at latitude 22.30° N longitude 70.78° E. The city is located on the bank of Aji River and which is seasonal river.

Rajkot area is rocky and deep excavation is difficult because of the massive rock at very shallow depth. In the northern part, topography is plain with gentle slope towards north and west. The general topography of RMC area is highly undulating with level difference from 158 m to 125 m from South East to North West.

Soil of the entire Rajkot area can be broadly classified as medium black to shallow black. The black soil, being rich in minerals and organic matter is more fertile. These soils have been formed even from granite and gneiss parent materials. The depth of the top soil is generally 25 cm to 50 cm deep. The color of soil surface varies from light gray to dark gray and is clayey in texture. The soil reaction is neutral to alkaline with Calcium Carbonate. Beyond 50 cm depth the underground strata are soft & hard rock. The vegetative cover is minimal in the open area due to lack of adequate topsoil. The topsoil is underlain with hard rock formations thereby limiting the growth of vegetation in the region

1.2.2 Climate

Rajkot has a semi-arid climate, with hot, dry summers from mid-March to mid-June and the wet monsoon season from mid-June to October. Winters are mild and pleasant whereas summers are extremely hot. Minimum temperature ranges from 10 to 12 degrees in winter and maximum temperature ranges from 42 to 44 degree Celsius in summer.

The region experiences a lot of rainfall and high-speed winds during the time of the year after the normal monsoon season as well as the months of May and June. However, June experiences lesser amount of rainfall and winds than the post-monsoon time. Thunderstorms are another important part of the Rajkot weather in the months of June and July. The average annual rainfall of Rajkot city is about 650 mm.

The city along with the Rajkot Urban Development Authority (RUDA) faced acute water shortage.

1.3 PROPOSED WATER SUPPLY SYSTEM

In spite of having adequate drinking water source potential, at present the consumers in Rajkot are getting intermittent water supply and that too for about 20 minutes per day. After inclusion of Rajkot in the list of proposed 100 smart cities in country, it has been decided that basic infrastructure facilities need to be upgraded and provision of adequate Water Supply is to be made available to citizens of Rajkot.

RMC is planning the water supply scheme but in order to meet immediate water demand RMC proposes to set up a 25MLD capacity water treatment plant at existing Nyari WTP (Filter Plant) Site, Rajkot to cater to the drinking water demand for these surrounding areas.

The raw water for proposed treatment plant shall be tapped from Raw Water Pipe line catering to existing Nyari Filter Plant and which has adequate capacity to meet this additional raw water demand for treatment.

The required space for proposed WTP is already available at exiting Nyari WTP site. See the tender drawings. However, bidder shall be responsible to study the existing site conditions on his own, acquaint himself with the same properly and obtain necessary data or clarifications from required authorities / on his own prior to bidding for this work.

Bidder shall offer their bid as per the treatment scheme speicifed in this tender documents and shall note that alternative treatment proposal is not acceptable.

02- CHAPTER SCOPE OF WORK

2.1 EXTENT OF SCOPE OF WORK

The scope of work under this Single Responsibility Contract includes construction of all works as described in subsequent paras to achieve the objective to treat the raw water as per the stipulated treatment quality / standards as per good and acceptable engineering practices and workmanship manner.

The scope of work will be in general but not limited to Design & Detailed Engineering, Procurement & Construction of Civil, Piping, Mechanical, Electrical, & Instrumentation / Automation works including erection, testing, trial runs, commissioning, guaranteeing and operation and comprehensive maintenance of 25 MLD capacity water treatment plant and all other work forming part of scope of work of this tender as per detailed technical specifications and data sheet.

For the purpose of this tender, wherever 25 MLD capacity of the proposed WTP is mentioned, it shall be meant & considered as 25 MLD net output after treatment excluding 4 % treatment losses at outlet of the plant. While the treatment is planned to operate for 24 hours, considering the time for backwash of each bed once during 24 hours, **the treatment Plant shall be designed considering 22 hours WTP run time in a day** to treat and produce requirement water quantity of a day (i.e 24 hours) and provide net output of 25 MLD excluding losses at output of WTP i.e. treatment plant to be designed for 25MLD @ 22 Hour + 4% losses.

Bidder to also note that the reference of WTP or Plant or Treatment Facility in this tender is understood to include all the work mentioned within this tender scope of work and specifications including the 25MLD capacity treatment plant, etc.

The proposed water treatment plant will have to be designed & constructed considering the given hydraulic levels i.e. FSL of clear (treated) water sump (reservoir) and the permissible head loss for WTP and the raw water level (FSL) at first unit of WTP shall be maintained accordingly. Adequate margin shall be provided at all stages in hydraulic design. FGL to be maintained is also indicated in enclosed tender drawings / as mentioned in specifications.

Bidders to also note that the WTP being proposed is to be constructed within existing Nyari Filter Plant Site of RMC and the plot for the proposed works is divided in two parts (Say Plot A which is near to existing substation / entry of existing plant / south of existing new GSR-2 and Plot B which is near to existing old GSR-1 (west of existing GSR-1) where staff quarters are provided at present. Bidder to refer attached tender drawings). The proposed WTP and all works forming part of this tender is to be constructed in available plot / area as per site condition. Bidder to also note that in available space of both the plots A & B there are existing structures (buildings, staff quarters, etc.) which require to be demolished and all debris to be suitably relocated as directed by engineer-in-charge prior to constructing the proposed WTP (Bidder to refer attached tender drawings and shall visit site positively to assess and familiarize with the site conditions prior to bidding). Generally it is proposed that the WTP units upto clariflocculator viz. primary treatment unit (i.e. inlet unit, flash mixer, bypass channel / arrangement, etc.), clariflocculator, and the administration cum chemical building to be constructed in Plot A and remaining units viz. filter house with overhead backwash tank, chlorine contact tank with pump house / panel area, blower room, dirty water sump and pump house, any other rooms/building/structures as required, etc. shall be constructed in Plot B. Also certain work/units and equipment are to be located within existing WTP area / buildings as applicable and explained elsewhere in tender.

The work will require demolition of existing structures at site, relocation of debris / material lying on proposed plot, relocation of existing pipe lines, valve chamber, electric lines, etc. and same shall be carried out by bidder at no extra cost as per site conditions and to be stored / stacked at location within plant premises as directed by client engineer. Bidder shall carry out thorough study of site for this purpose prior to bidding.

Bidders to also note that both the plot area A and Plot area B are at different levels with Plot A at higher level and Plot B at lower level and that the FGL (bidder to refer attached tender drawings for reference) and units shall be located / hydraulic desing shall be carried out accordingly.

The tentative schematic planning of proposed water treatment plant with proposed infrastructure is shown in layout drawing and Hydraulic flow Diagram, enclosed with tender for general guidance only.

The R.L. of ground level is as indicated only for indicative reference of bidder. All levels are shown in R.L with respect to reference benchmark as specified. The scope also includes geotechnical survey of plot to derive soil bearing capacity, strata classification and details of water table etc. However, bidders to note that all tender drawings and data are indicative for bidder's guidance only and RMC shall not be held responsible for the correctness of same and bidder shall be responsible to obtain all required data on their own prior to bidding.

The scope work for WTP commences from taking necessary connection from existing raw water pipe line at Nyari WTP site and providing and laying 600mm dia. (610mm OD x 6.3mm thk) MS raw water rising main pipe line (approx. 40m length or as required as per site condition based on tapping point and bidder's plant layout / inlet unit arrangement) with required specials / fittings from tapping point upto inlet of WTP along with required electric actuator operated sluice valve with metallic expansion bellows (housed within RCC valve chamber of suitable size) for flow isolation / control as well as an electro-magnetic flow meter with metallic expansion bellows (to be housed within RCC flow meter chamber or as required) to measure raw water feed.

The raw water @CLF bypass / clarified water after clari-flocualtor at Plot A to Plot B / filter house inlet channel shall be conveyed by providing and laying 800mm dia. (813mm OD x 8mm thk) MS gravity pipe line (approx. 130m length or as required as per site condition based on bidder's plant layout for tapping point / CLF location and filter house arrangement, etc.) with required specials / fittings from tapping point upto inlet of filter.

The treated water from CCT outlet to existing GSR-1 shall be conveyed by providing and laying 800mm dia. (813mm OD x 8mm thk) MS gravity main pipe line (approx.. 20m length or as required as per site condition based on bidder's plant layout for tapping point / CCT location and existing old GSR / GSR1) with required specials / fittings from tapping point upto inlet of GSR-1.

The clari-flocculator sludge from clari-flocualtor at Plot A to Plot B / Dirty Water Sump shall be conveyed by providing and laying 200mm dia. DI K-9 gravity pipe line (approx. 135m length or as required as per site condition based on bidder's plant layout for tapping point / CLF location and dirty water sump arrangement, etc.) with required specials / fittings from tapping point upto inlet of dirty water sump.

The dirty water from dirty water sump (clarifier sludge + dirty wash water from filter house) shall be disposed in to dirty water disposal open drain of existing plant for onwards disposal in to RMC storm water drain (near to filter house-2, bidder to refer tender drawing / layout) or shall be recycled back ti inlet unit of WTP as per client's requirement and water quality. The dirty water from dirty water sump shall be recycled back to inlet of WTP conveyed by pumping main with a tapping provided form this line of same size to the dirty water disposal open drain of existing plant by providing and laying 200mm dia. (219.1mm OD x 4.5mm thk) MS header/rising main pipe line (approx. 230m length or as required as per site condition based on bidder's plant layout for inlet unit, dirty water sump arrangement, etc.) with required specials / fittings from tapping point upto inlet unit of WTP with a tapping line of same size tapped form this rising main and provided upto dirty water disposal open drain of existing plant for onwards disposal in to RMC storm water drain and an isolation sluive valve along with metallic expansion bellows shall be provided tow locaitons, one of tapping line to dirty water disposal open drain of existing plant and another on main rising main onwards line to inlet unit unit of WTP after the tapping point for flow control.

11KV HT electric supply as per requirement shall be provided by RMC from any one point from existing substation near to pump house-1 or other sutiable location within Nyari WTP premises as directed by

engineer-in-charge. The power shall be tapped from existing GOD structure or as required for further distribution after required step down or as required. Bidders to further note that the PCC/PMCC including APFC panels requires to be provided within existing building / panel room adjacent to pump house-2 from where the power shall be further distributed to other various downstream loads of water treatment plant (Plant / WTP panels) located at Administration cum Chemical building (for catering to Plot A and around loads) and at pump house above CCT or other suitable building / room at Plot B (for catering to Plot B and around loads). The RMU shall be located near to existing existing substation near pump house-1 and transformer yard shall be located adjacent to existing DG Shed near to existing GSR-1 or other suitable location within Nyari WTP premises as directed by engineer-in-charge. Bidder to refer attached tender drawing / layout.

All M.S. Pipeline within the scope of this work shall be spirally welded and having outer coating with epoxy paint & inner coating with food grade epoxy paint. The minimum thickness for all MS pipe lines shall be as per IS:3589:2001 (Table – 5) or higher as specified in tender specifications.

Where ever reference is made to Alum (Coagulant) dosing, bidder can also consider to coagulant dosing of PAC or Alum as required by client. RMC is generally using PAC as coagulant..

Where ever reference is made to provide CI pipe line, bidder can also consider to provide pipe line in DI K-9 of equivalent end connections as an alternative to CI pipe line.

Trial run of water treatment with allied works for a period of three (3) months and operation and comprehensive maintenance of water treatment plant (WTP) a period of Two (02) years (coinciding with 12 months defect liability period) after successful completion of trial run, commissioning and acceptance of the plant by employer. Only raw water, power & chemicals as specified (i.e. PAC/Alum & Chlorine) shall be supplied free by client during trial run and O&M period and rest all expenses including manpower, repairs including spares / equipment replacement as required, other chemicals including for laboratory, consumables, software license renewal / upgrade as required, mobile SIM card / Internet and such communication expenses as applicable, etc. shall be borne by the successful bidder

Following also to be noted by bidder:

- Bidder shall submit labour license prior to commencement of Trial run of the plant.
- On completion of O&M period, the spares brought at site by bidder shall be returned to the bidder. Bidder shall keep necessary records / stock register for the same duly verified / certified by Client engineer.

Wherever reference is made of the employers design, drawings, or concept, it may be understood that these are concepts of the employer and the responsibility for correctness of designs, drawings and safety of equipment/structure shall rest on the contractor. Bidders are advised to inspect the site for further clarifications and to understand the scope of work. It is the bidder's responsibility to carry out all the works required to complete the scheme under this project whether it has been mentioned or not.

All the material / bought-out items shall be procured as per approved make / vendor list only and in absence of such a list for any item, the same shall be procured with prior approval for such make from client.

2.2 MAJOR COMPONENT OF WORK

The major treatment units proposed to be provided for water treatment plant (water works facility) shall comprise of the following component as a minimum requirement:

- Tapping from existing raw water rising mains line and providing required pipe line along with isolation valves, flow meter, etc. on the tapping line as explained above for providing raw water to inlet of WTP / Inlet (Stilling) Chamber of WTP
- Inlet (Stilling) Chamber with FM & CLF bypass channel / arrangement. Bypass arrangement to provided for 100% of design flow with suitable isolation gates.
- Flash Mixer (FM) – 1 No.
- Clari-Flocculator (CLF) with gravity sludge draw off system – 1 No.
- Filter Bypass Channel / Pipe Line with isolation gate / valve for 100% of design flow.
- Filter House comprising of 3 Nos. (3W) declining rate type twin rapid gravity sand filters with cast in-situ RCC false floor underdrain system incorporating virgin PP Nozzles
- Overhead backwash tank (above filter house) with backwash tank filling pumps. Backwash tank filling pumps housed in CCT/Chlorination Sump (or as specified in process design criteria and specifications below) with superstructure / pump house above sump.
- Chlorination Sump. The Chlorination Sump (CCT) shall also house overhead backwash tank filling pumps, booster water (pre- and post-chlorination) and service water pumps with superstructure / pump house above CCT. The superstructure / pump house shall also consider to house LT panels to cater to electrical load of Plot B area as per bidder's design / requirement and availability of space within pump house to accommodate the same or else bidder shall consider to provide separate room / building to house the LT panels adjacent to or above the air blower room.
- Gravity main pipe line from CCT to existing GSR-1.
- Dirty Water Sump & Pump House with recycling pumps (recycle to inlet unit for re-use and with tapping line for disposal into existing dirty water disposal drain channel).
- Control (PLC/SCADA System) Room with SCADA furniture, Laboratory Room, Officer & Staff Office rooms along with necessary office furniture, etc
- Administration cum Chemical Building (Two Storey) including LT (MCC) Room, Chlorinator Room & Chlorine Tonner Room, Chemical (Alum/PAC) Storage Room, Chemical (Alum/PAC) Dosing Tanks / Area, Control (PLC/SCADA System) Room with SCADA furniture, Laboratory Room, Officer & Staff Office rooms along with necessary office furniture, Toilet Block (separate for ladies and gents), etc. Administration cum Chemical Building shall be Two Storey building.
- Air Scour Blower Room.
- Electric HT Sub station comprising of HT Switchyard / Four Pole Structure, Outdoor RMU Panel with RMU Otta, HT room (if required as per statutory norms), transformer yard, etc.
- DG Set with DG Otta / foundation
- Service / Drinking Water network / piping at Admin. Cum Chemical Building, filter house, etc. as required.
- Service / Drinking Water Tanks of adequate capacity at Administration cum Chemical Building.
- 2 Nos. (1W + 1S) submersible centrifugal pumps (horizontal mounting) each of 1000 M³/HR flow and min. 10m head (or higher as per design / pump head calculation) shall be provided / installed in GSR-1 (in the compartment adjacent to Plot-B) with required cut-out in top slab of existing GSR and other required civil modification works and providing removable covers (FRP / MS) and providing required structure for lowering and lifting of pumps. Monorial along with EOT & hoist of suitable capacity (Min. 2T cap.) shall be provided for lowering and lifting & handling of pump sets.

Note:

- 1) All the interconnecting piping for all the units, bypass and final disposal piping including fittings and valves for treatment plant, water supply & service water lines shall be provided.
- 2) All necessary electrical (power & control) and instrumentation (signal, communication, control & power) cabling for LT power distribution, & instrumentation system as specified shall be provided.

The other units / work requirement are:

- a) Site Filling / Grading upto specified FGL.
- b) All Internal/Plant Roads including approach and surrounding roads for entire proposed WTP facility & Plant Pathways to approach various units, valve chambers, etc. form nearby roads. Roads shall be generally 5.0 mt. wide or suitable width as per space availability in approved plant layout with 1.5m or required shoulder width on both sides and with kerb stones. Pathways shall be minimum 1m wide with kerb stones and interlocking tiles (and 80 mm thick rubber molded paver blocks) arrangement. Approach shall be provided for each unit / building
- c) Plinth Protection for all buildings / pump house (units constructed over plinth).
- d) Storm water drain as required.
- e) Water distribution network for drinking purpose/service water within the plant premises and suitable sewage disposal facility.
- f) Earth filling, leveling and dressing around the treatment unit including cutting of trees, removal of debris, shrubs, etc. within the premises of treatment plant & filling, to bring the site up to formation level, landscape, tree plantation, shall be included in the scope of work of this contract.

The scope of work shall also include:

- All interconnecting pipes, channels, valves, fixtures, appurtenances.
- Demolition and disposal of existing structures, shifting of existing pipe lines and electrical lines, material / debris, etc. if any and as required and directed by engineer-in-charge within the proposed WTP sites for smooth execution.
- Supply, erection, testing, commissioning of various mechanical, piping, electrical & instrumentation equipment required for the smooth working of the water treatment plant, including the one year O&M of entire treatment facility.
- Any other item not indicated above but necessary, essential or incidental to the completion of the above works and making them operational / All other accessories, whether specified or not, but required for complete shall form part of contractors scope.
- Preparation of plant layout; process design/unit sizing calculations; hydraulic calculations and flow diagram including pump head calculations; P&I Diagram; civil, mechanical, piping, electrical & instrumentation design, drawings, data sheets, sizing calculations, etc. as applicable including architectural drawings for construction after review and approval and as built drawings.
- Applying on behalf of client and required technical or other documents submission and obtaining approvals and liaisoning for obtaining power connection / additional power in existing substation for designed power load (proposed load + existing load of present plant) for running and operation of entire treatment plant / treatment facility within the campus area (all work within scope of this tender as well as existing facilities) from the power supply company. Only the applicable statutory fees shall be borne by the employer.
- Obtaining statutory approvals for the entire treatment plant / treatment facility including electrical inspector for entire electrical installation, DG Set (as applicable), chlorine tonner storage & filling, etc.
- Preparation and submitting of operation and maintenance manual for plant and equipment in six copies.
- Operation and maintenance of all components of project for the defined period of operation and maintenance after successful trial run for defined period and commissioning.
- Providing necessary training to Client's Staff after successful commissioning of plant.
- Providing inspection and testing of equipments(s) and material(s) required for execution of the work as specified in tender for inspection requirements at his own cost

2.3 Overall & Construction Completion Period:

The overall completion period for the project is 18 months from the date of issue of Work Order or written order to commence work, whichever is earlier including monsoon period and 3 months trial run and commissioning period i.e construction period of 15 months + 3 months trial run and commissioning period and monsoon period is included within the same.

2.4 Trial Run Period:

Trial and run period for water treatment plant shall be Three (3) months after the date of completion of construction of entire WTP in all respect. The trial run and acceptance of the plant after stipulated guarantee run shall be carried out based on the quantity of water made available by employer at the time of trial and run and commissioning including guarantee run of the plant.

2.5 General Principles

The bidder shall carryout all works wholly in accordance with the terms and conditions of the contract to fulfill the requirement of the project. All the material used, and the equipment installed shall be as per the specifications defined in the contract and the work shall be executed with good engineering practices.

Generally, the following activities shall be carried out for each component of this contract but shall not be limited to.

- (i) Submission of all documents required according to the Contract (security money/guarantee, insurance policies, if any etc.)
- (ii) **Preparatory Work:** The Contractor shall use the land earmarked to accommodate for siting of all the units of the final capacity of proposed works. The Contractor shall construct approach roads connecting to all treatment units, and ancillary civil structures to be constructed within the campus from the main road upto Plant site. The contractor will have to use the same for transporting the materials to the site. The Contractor shall construct a bench mark at a suitable location within the campus to establish a GTS bench mark at a suitable location within the site and transfer level from the existing bench mark, as approved by the Engineer-in-charge. All levels shall be deemed to refer to that benchmark. The Contractor may establish other secondary benchmarks on the site, where required.
- (iii) **Soil Investigation** The Contractor in co-ordination with the Engineer in Charge has to determine at each location of a building or a water retaining structure the soil characteristics (safe bearing capacity, angle of friction, cohesion etc.) in order to design the dimensions of the foundations. It is also important to assess the potential of changes in water table, erosion and exposure of foundations and the stability of the soil with view to the lateral resistance to be taken into account. The soil conditions have to be analysed for all important structure of the water treatment plant. The required soil analyses are:
 - a) Penetration tests
 - Standard penetration test to a depth corresponding to at least 1.5 times the width of the building/foundation.
 - b) Plate load tests:
 - To assess soil bearing capacity at the foundation level (Plate test)
 - To take samples for laboratory analyses
 - c) Laboratory analyses for

- Granulometry
- Cohesion
- Angle of friction
- Proctor density
- Soil resistivity

d) **Water Table:** Ground water table as per soil investigation data obtained by the contractor.

In addition, to the above, the following soil data shall be obtained from the test pits:

Composition and classification of the soil (sand, clay, silt, organic matter etc, soft, medium, hard, decomposed rock, rock etc.) with view to:

- Excavation
- Need to support walls of trenches
- Compacting
- Permanent or temporary groundwater (waterlogging)
- Hard pans below the sand (depth, thickness, type of layer)
- Clay lenses

The results of the survey, the sampling, the laboratory analyses and the calculations shall be presented in a report in three copies to the Engineer in Charge. The execution of the foundations shall be started only after approval of the Engineer in Charge. The contractor however will be responsible for design of the structures based on the results of these investigations.

Note: Bidders may carry out the soil investigation/analysis at their own cost to ascertain the type of foundation before bidding. If required bidders may consider soil stabilization/ or any other type of foundation in their cost while quoting job. The successful contractor shall carry out detailed soil investigation at sufficient number of places as per design requirement at his own cost and the structural design of all the units shall invariably be based upon the most critical conditions of soil investigation. For any increase in foundation depth or type of foundation etc., or for any reasons during execution, no extra claim by the contractor shall be considered.

(iv) Along with the excavation for the buildings and underground sump etc., the Contractor shall assess all the necessary parameters such as type of soil, the strata, the level of groundwater and other indicators important for structure. He has to establish soil profiles and submit these to the Engineer in Charge for approval of the following.

- (a) Carrying out necessary Topographical Survey for all the units, pipeline etc. road works and campus development within the limits of the contract in consultation with the Engineer in Charge.
- (b) Preparation and submission of the layout plans of entire treatment system with ancillary structures, cross sections and conceptual drawings etc. of all components of the project. The drawings must be on scales as appropriate subject to the prior approval of the Engineer in Charge.
- (c) Additionally he has to assess the type of soil, the strata, the level of ground water and other indicators if any and establish soil profiles and submit these to the Engineer in Charge.
- (d) Submission of the process design, hydraulic calculations for the design of the water treatment plant, inter connecting pipe, channels etc., layout and P&I diagram.
- (e) The Contractors will have a choice to make use of the data/information/reports etc. placed in this volume but the department does not stand guarantee to the data / information / reports / designs / drawings included in this volume. The Contractors will be solely responsible for preparing and submitting required drawing after carrying out appropriate field surveys, data collection, designs etc. for approval of Engineer-in-Charge.

- (f) Approval of all design and drawings, material to be used, equipment specifications and the samples, shall be obtained from engineer-in-charge prior to commissioning of work on site. Unless mentioned otherwise, if for any specific provision / references have been made in more than one specifications, the provision which is more stringent of the lot shall be applicable and shall be binding upon contractor.
- (g) Submission of the design, specifications, catalogues and the technical data sheets of all the equipment, electrical system, design of the electrical components and the switchyard, shall be made taking into account the interfaces to the other project components /packages.
- (h) Preparation and submission of all detailed working drawings on the basis of conceptual designs and plans approved by the Engineer in Charge.
- (i) Providing adequately planned plinth protection works for all buildings / pump house to be constructed.

2.6 Design / Drawing / Document Submission

a) Along with Bid for Evaluation Purpose

- All drawings/documents/design submitted along with the offer shall be for preliminary review and shall be retained for information only. These shall be subject to modification/approval at the time of detailed engineering in line with tender specifications / process requirement. Such changes will not have any techno-commercial implications.
- The documents as specified else where for submission with bid as shall be submitted in two sets in hard copy as well as in soft copy along with on-line submission

b) Design / Detailed Engineering / Construction Drawings for Review & Approval

All the drawings enclosed with this tender like- layout plan, Hydraulic flow diagram etc. are given for general guidance only.

After award of work but before starting of any construction activities including excavation etc., process / unit size calculations, unit layout plan, hydraulic design calculations & hydraulic flow diagram, P&I diagram & G.A. drawings of all the units of the plant shall have to be prepared based on the scope of work & datasheet given in this tender and submitted by the contractor for approval of Client (Employer) / Consultant. **Hence, it is to be very clearly understood by the contractor that concept, specifications, shape / minimum volume, minimum size, capacity etc. given for any unit, item, etc. given in this tender shall have to be followed strictly in submission of all drawings by the contractor.** After getting the approval for the same from client, the contractor shall submit structural (RCC/steel) drawings with design calculations for approval of Client / Consultant. The piping, electro-mechanical and instrumentation design shall also required to be approved from the Client / Consultant .

Similarly the successful contractor shall submit data sheets / drawings for all piping, mechanical, electrical, and instrumentation/automation works conforming to tender specifications for approval from Client / Consultants prior to going ahead with manufacturing / procuring these material at site.

All Designs, Drawings and calculations shall be reviewed and approved by the Client / Consultant of Client. Any drawing can be released for construction / manufacturing only after getting final approval in writing from Client. Contractor shall be responsible to thoroughly study the tender scope of work, specifications, etc. and provide / submit the design / drawings / data sheets / documents in accordance with tender specifications and equipment offered as per makes specified in tender and contractor to further note that any review or approval granted by client / consultant for design / drawings / data sheets /

documents or make of equipment proposed by contractor does not absolve contractor from any responsibilities for their accuracy of the design, performance and safety of the plant / works or adherence to tender specifications or equipment make or for any other obligations under the contract and Indian Statutory Laws nor does it limit the employer's right under the contract.

- Contractor shall carry out basic design and detail engineering work for WTP and submit various drawings and documents for approval of client / consultant before these are released for construction or manufacturing.
- On award of the work the contractor shall hold a design conference with client / consultant to discuss and finalize various parameters before the start of actual basic engineering at no extra cost to owner. As this is a lumpsum contract, any changes suggested due to sound engineering practice shall be incorporated at no extra cost to the client. The contractor shall also submit the detailed work plan including resource plan to client / consultants for approval & records for tracking the progress of project.
- Contractor shall initially submit six/seven sets (two set for client, two sets for consultants and two sets (office & site copy) for contractor, one for independent TPI appointed by client if applicable) of each of the design, detailed engineering drawings & documents in hard copy for review and approval of client / consultants. In addition, contractor shall also submit these drawings & documents in two sets in soft copy to client / consultants in suitable format for review of client / consultants. Client / consultants shall review and approve or else furnish their comments / observations, if any. Only the approved drawings can be released for construction / manufacturing, subject to compliance of comments, if any, furnished with the drawings or documents approved by client / consultants.
Contractor shall also submit soft copy of drawings of all civil works (Civil / Mechanical G.A. Drawings), piping layout and piping drawings/isometrics, electrical SLD, electrical and instrument cable layouts, earthing layout, etc. shall drawings in autocad format (suitable revision to be conveyed later during detailed engineering). Drawings for bought-out items / equipment, etc. shall also be submitted in PDF for records and in autocad also where required (especially the equipment / equipment foundation related details to be incorporated in civil / process / mechanical GA Drawings shall be submitted in autocad).
- In the event of comments or non-approval of drawings or documents submitted by contractor, the contractor shall re-submit the concerned drawing or documents within 15 days from the date of issue of comments by e-mail or letter, as applicable & whichever is earlier, in number of sets and type as mentioned above for initial submission for review and approval of client / consultants. All revision number of the drawing / documents shall be revised for each re-submission (i.e. initial submission shall be considered as Revision 0 and subsequent submission shall be treated as Revision 1, 2, 3 and so on till the subject drawing or document is approved for construction) and all the revisions shall be marked in the revised drawings.
- Contractor shall retain a set of original as well as a copy of all drawings and documents at site duly approved for construction / manufacturing. All construction and manufacturing shall be as approved drawings only and shall be subject to compliance of comments.
- However reviewing of design / drawings / documents is not obligatory on the part of client / consultants and complete correctness / soundness of the design / drawings and their execution at site shall be the sole responsibility of the contractor irrespective of the fact whether the same has been reviewed / approved by client/consultants or not. Any defect observed during commissioning and / or operating the plant shall be rectified by the contractor by carrying out the necessary modification or rectifications, as applicable.
- All hard copies shall be submitted to client & consultant office (under intimation to client) along with required covering letter by courier or in person and soft copies to be submitted either in person or by courier (in CD / Pen Drive) or by e-mail to client as well as consultants.

Important Note: Bidders to note that all drawings / documents shall be submitted within time limit as per below schedule without fail or earlier as required to ensure timely completion of work:

Sr. No.	Nature of Drawings / Documents	Time Limit for submission from the date of WO/ LOI
1.	- Basic Engineering Package - BEP (including plot survey, soil report, process / unit size calculations. plant layout, hydraulic calculations and HFD).	Within 1 month
2.	- BEP – P&I Diagram. - All Process G.A, Drawings.	Within 15% of time limit
3	- All Civil / Structure Drawings.	Within 25-30% of time limit
4	- All drawings pertaining to mechanical and piping works.	Within 35-40% of time limit
5	- All drawings pertaining to electrical works. - For instrumentation works of PLC/SCADA if applicable in scope of work.	Within 40-45% of time limit
6	- All drawings pertaining to instrumentation works except PLC/SCADA.	Within 45% of time limit
7	- Any other drawings / documents as applicable to complete the work	Within 45% of time limit

c) As-Built Drawings

- Contractor shall submit Six sets (two sets for client, two sets for consultants, one set for PMC/TPI and one set for contractor for records) and two sets in soft copy (one set each for client and consultants) of each of as-built design and detailed engineering drawings & documents in hard copy duly incorporating the changes, if any, during the construction phase and duly approved by client with respect to the approved drawings for records of client / consultants. The contractor shall get the as-built drawings / documents reviewed and certified by client's engineer and project management consultants or Third Party Inspection Agency (if applicable) representative at site prior to submitting these documents for records.
- Contractor shall submit as-built drawings of all civil works (Civil / Mechanical G.A. Drawings), piping layout and piping drawings/isometrics, electrical SLD, electrical and instrument cable layouts, earthing layout in two sets in AutoCAD format (suitable revision to be conveyed later during detailed engineering) for records and future use of client. All As-Built process / mechanical GA drawings & Civil / Structure drawings for various civil unis; piping layouts; electrical SLD & electrical & instrument layouts, P&ID; etc. such documents shall be submitted in AutoCAD in desired version also in addition to PDF or such soft copy submissions

d) O&M Manual / Commissioning Related Documents

Following Documents shall be submitted as a minimum:

- **Plant Operating Manual**
It shall include:
 - Plant Units operation philosophy
 - Instrumentation philosophy
 - Operational-Control Logic
 - Initial start-up
 - Abnormal operating conditions
 - Shutdown and emergency procedures
 - Precautions and hazards
 - Routine checks & operations
 - Process Upsets & Recommended corrective action
 - **Recommended spare list for two years smooth, trouble free operation**
- **Equipment Operation & Maintenance Manuals**

- Operation / maintenance manuals supplied by respective vendors for all equipment / units in consolidated form (Preferably in volumes covering each treatment section).
- **Any specific requirement.**

2.7 TENDERING INFORMATION

- (i) **Details of Land:** Adequate land is available within the existing Nyari Water Works / Filter Plant facility as indicated in enclosed layout and explained above.
- (ii) **The Finished Ground Level (FGL) shall be RL 136.50 Mtr for Plot A area and shall be RL 135.80 Mtr for Plot B area** (Refer tender drawings).

The proposed water treatment plant will have to be designed & constructed considering the given hydraulic flow levels in enclosed hydraulic flow diagram (HFD) for the raw water at first unit of WTP (Stilling Chamber) on one side and FSL of existing clear (treated) water reservoir (GSR-1) on the other side i.e. The head loss of WTP (inlet chamber to outlet of WTP / FSL of CWR) shall not exceed 4.5m. **The FSL of existing CWR/GSR-1 shall be considered as per attached tender drawings i.e. RL 136.10m and accordingly the max. permissible FSL at inlet chamber of WTP shall be RL 140.6m.** The hydraulic design of WTP shall be planned accordingly.

(iii) **Technical / Design Criteria :**

a) Plant Capacity:

The treatment plant to be designed and constructed shall be of 25 MLD net output excluding 4% treatment losses at outlet of the plant considered / evaluated on monthly average basis @ 22 Hours operation. Design capacity of all connecting pipes/ channels like inlet pipes, clarified water launder/pipes, outlet channels/outlet pipes, etc. shall be for 25 MLD + losses / recycle flow + 20% overload @ 22 Hours operation. All Civil and Mechanical / Electrical / Instrumentation works are to be checked for above requirement and considering losses due to sludge withdrawal from clarifiers and backwash water for filter beds. All the losses must be clearly indicated. The 4% loss specified will be considered / evaluated on monthly average basis. Wherever recycle flow mentioned, the raw water intake shall be proportionately adjusted to help conserve water and to achieve net output at WTP outlet as specified above. Bidder shall provide mass / water balance chart for entire WTP / treatment facility proposed under this work

b) Overloading of units of Treatment Plant

The complete water treatment plant shall be designed for 20% hydraulic overload. However, filter under drainage system shall be designed for 100% hydraulic overload condition.

c) Source of Raw Water

The major source of raw water for the treatment plant is Nyari Dam / Narmada Canal based Water.

d) Quality of Raw Water

Raw water characteristics vary considerably. Turbidity of raw water may go upto 100NTU or occasionally sometimes as high as up to 500-1000 NTU in rainy season. But except monsoon season, it is expected to be less than 25 NTU.

The quality of raw water considered for the design shall be as given below:

Sr. No.	Parameters	Value	Unit
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1.	pH	7.0 – 8.5	
2.	Turbidity	25 < 1000	NTU (non Monsoon) NTU (Monsoon)

Though the turbidity of water is expected to remain within 25 NTU throughout the year; in rainy season turbidity is expected to shoot up to 100-200 NTU & above for two to three weeks. Turbidity may remain above 500 NTU for very shorter period. Hence the plant should be able to take shock load of 500 NTU for one month and 1000 NTU for few days in a year.

The above parameters are for guidance only and client assumes no responsibility for the correctness of the same and it is the responsibility of bidder to carry out the sampling tests of raw water by themselves to ascertain the raw water quality for treatment process at no extra cost to design the plant for worst conditions. The Employer will not be responsible for the above and no relaxation will be given to the guarantee conditions of desired treated water quality. For design purposes the lower parameters than the above mentioned parameter shall not be allowed.

e) Settled Water quality:

The settled water quality at clari-flocculator outlet will normally be up to the following standard.

Sr. No.	Parameters	Value	Unit
1.	Turbidity	<=10	NTU
2.	Free Chlorine	>=0.5	mg/L (PPM)

In extreme conditions during monsoon, when the raw water turbidity changes, the operator should make changes in PAC/alum dosage by Jar Test; so the filters should receive above quality of settled water.

f) Treatment Plant Process

It should be ensured by intending tenderers that the scheme of treatment is designed to give adequate operational flexibility, reliability and minimum reliance on manual operations. During the works performance test and trials, the contractor will be required to demonstrate and optimize performance abilities of the works.

g) Treated Water Quality

- 1) In general, the treated water leaving the plant / fed to existing UGSR/CWR inlet shall be consistently as per the following standards:-

Sr. No.	Parameters	Value	Unit
1.	pH	7.0 – 8.5	
2.	Colour	<= 5.0 Units	On Pt-Co Scale
3.	Turbidity	<= 1.0 Upto 2.0 NTU occasionally	NTU
4.	Taste	Unobjectionable	
5.	Odour	Unobjectionable	
6.	E-coli organisms	Absent per 100 ml sample	
7.	Free chlorine	0.5-1.0 mg/L, Not Less Than 0.5 mg/L	mg/L (PPM)

The tenderer shall give guarantee for the degree of purification as specified. To establish the quality of filtrate and performance of other units as specified above, the tenderer shall have to arrange for taking samples and send them to recognized laboratory and get the raw, clarified, and filtered water samples analyzed for physical, chemical and bacteriological qualities of all the three raw, clarified, and filtered water. The tests are to be taken by the tenderer at his cost during the period of trial run of the plant.

- 2) During trial runs, however, the turbidity to be achieved, should be preferably less than 1.0 NTU and under no circumstances shall be less than 2.0 NTU since the plant designed for this requirement will be able to produce water of acceptable standard even if adequate operating conditions cannot be guaranteed continuously. The contractor shall at his own cost undertake the necessary sampling and testing to prove that the treated water conforms to the foregoing standards. If the tests show that the water quality has not been reached to specified levels, the contractor shall submit his proposals for meeting guaranteed requirements to the Engineer. The contractor shall have to carry out at his cost whatever measures; such as improvements, additions, alternative or additions to the plant and equipment (Civil, electrical, mechanical, instrumentation works) that are required to be taken to achieve specified water quality. No charge will be levied to the contractor for water & power used during trial run & testing. However, if the trial run is not completed successfully within the stipulated 3 months period after completion of construction and if extended beyond the stipulated period, the energy charges will be charged as per actual during the extended period of trial run.

h) All water retaining structures shall be in M-30. All water retaining structures shall undergo hydraulic test prior to applying plaster.

i) Plant Layout Considerations:

The reference water levels / top of existing old UGSR slab level at the outlet / treated water disposal end shall be as indicated in enclosed hydraulic flow diagram and FSL of inlet chamber / raw water receiving chamber of WTP will be governed by the loss of head across the treatment plant considering this outlet level. The principal considerations for a good layout of the plant shall be –

- Smooth flow of water from inlet to outlet
- Foundations and floors firmly resting on naturally consolidated soil
- Working space between structures
- Isolation of hazardous areas
- Easy vehicular approach to all equipment/material handling areas / units
- Well connected drainage system up to disposal point
- Stair access to high level outdoor operation areas with hard standing at the foot
- Security of the main operation areas
- Economic area lighting
- Architecture and aesthetics
- Adequate earth cover to buried pipes and ducts

Bidders shall note that plot plan or any such other data / report and tender drawings provided along with tender are for bidder's guidance only and not final and binding to Client. Bidder shall be responsible to collect all necessary data and carry out all necessary test / analysis / survey on their own prior to bidding.

(iv) Contractor to adopt/adhere to the general engineering specifications and practice given below while designing the treatment plant which shall form as part of specific

requirements and shall supersede general requirements specified else where in tender when observed to be in conflict to below requirements:

- Monorail with Electrically operated chain hoist & EOT shall be provided at all pump houses / pump locations (both underground and above ground except for locations for which EOT crane with electrically operated chain hoist is specified) for handling of various pumps like backwash pumps, Chlorine booster/service water pumps, sludge / dirty water recycle pumps, GSR-2 tank filling pumps installed in existing GSR-1, etc.; at blower room for handling backwash air blowers; at chemical house for handling alum, etc. EOT crane with electrically operated chain hoist shall be provided at Chlorine Tonner Room for handling chlorine tonners, etc. Each shall be of adequate capacity (minimum 1.25 times the weight of the equipment / single heaviest component). Monorail / Rail shall be extended to outside pump house / building to facilitate loading / unloading of equipment directly on vehicle, for which otta / ramp approach shall be given. The lift of the hoist shall be upto the bottom of sump or upto the level of road / FGL or such platform to where the pump/equipment is to be lowered or lifted, whichever lift/ height is higher.
- Adequate measure shall be taken to prevent dry running of the pump in all modes of operation i.e. manual as well as auto mode. Low level to trip the pump shall be above the top of pump casing. The sump floor shall slope towards suction pit / channel. Care must be taken especially for underground sludge sumps to provide suction pit of adequate size for emptying the sump for ease of maintenance.

All pumps shall be provided with flooded suction. Effective liquid depth of units shall be considered between levels corresponding to lowest liquid level and highest liquid level as per design. Accordingly, all sumps/tanks shall be provided with required suction pit. Displacer / Float type Level switches (in addition to level transmitter where specified for auto operation / alarms) shall be provided for dry run protection of pumps to trip the pumps irrespective of auto or manual mode of operation of the pumps. However for pumps to be installed in existing sump / reservoir, the installation shall be as per site condition / existing provision in sump / reservoir and will be installed in joint consultation with / approval from client's engineer.

However, for positive displacement pumps like screw pumps, suction lift of up to 3-4m can be permitted subject to meeting NPSHr requirements and vendor's approval / confirmation for satisfactory operation of pumps for considered suction lift.

- Operating platforms shall be provided for operation of any equipment and to take care of valves causing inconvenience to operate from ground/floor level.
- All pump areas / pedestals shall be provided with kerb walls and suitable arrangement for collection of leakage and connection to the nearest piping/unit, keeping in mind the process requirement. In dry wells, necessary drain collection pit and dewatering pump of sufficient capacity and head requirement with level switches for auto start & stop operation shall be provided in all pump houses, especially underground pump house for this purpose.
- Vehicular approaches shall be provided to the units for operation and wherever required maintenance.
- Flushing connections shall be provided for all sludge handling units and sludge lines.
- Access to all units / walkways / platforms shall be by RCC stairways (with 1m high handrail) except for valve and such operating platforms requiring occasional use where access with ladders shall be accepted.

- Handrails shall be of 40NB medium duty MS pipes with epoxy paint except for alum store / dosing area and for administration cum chemical building.. Handrails for alum store / dosing room shall be in FRP / GRP. Handrails for administration cum chemical building shall be in SS-304 (Sch. 10) pipes. Horizontal handrails shall be 1000mm high with an intermediate rail at mid height, vertical post spaced max. 1.5m C-C and with 100mm x 3mm thk toe guard at bottom.
- The clear distance between adjacent pumps (>7.5KW) / blowers (>7.5KW) pedestal or any other equipment (dewatering unit, etc.) shall be minimum 1000mm or higher as recommended by manufacturer to ensure smooth operation and maintenance including opening clearances for acoustic / equipment hood or covers, etc.

The clear distance from pedestal to internal face of end walls shall not be less than 1000mm for pumps upto 22KW capacity & for blower or such other equipment and for pumps >22KW capacity the clear distance from pedestal to internal face of end walls shall not be less than 1500mm. The clear distance from pedestal to internal face of walls shall not be less than 1500 mm on suction side and 2000 mm on motor side / delivery side of the pump set.

However for pump / blower with motor rating 7.5KW and below, the clear distance between adjacent pump foundation can be up to 750mm, clear distance from pedestal to internal face of end (side) walls as well as clear distance from pedestal to internal face of walls (suction & delivery side) shall not be less than 1000mm.

- Motors of all outdoor equipment shall be covered with canopy.
- Safety shower and eyewash facility, and service water connection shall be provided near chemical handling areas, especially at chlorination area.
- All instrument indication facility shall be readable from grade.
- All below grade / below ground valves shall be operable from grade by providing extended spindle and hand wheel arrangement.
- Epoxy lining in alum tanks and any other units as required, shall be provided. Complete wetted surface including free board and top of walls shall be lined. Alternately, acid proof tiling can also be accepted. In case of client requiring to use only PAC during execution phase, bidder can also consider to provide tanks in non-corrosive MOC (uPVC / HDPE or suitable) in required numbers for total volume / HRT as per tender specifications with required piping as specified and in mutual consultation with client.
- All pre-treatment / overhead units, underground tanks where specified shall be able to be segregated for manual desludging / draining, whenever required, along with drain piping and valve. The purpose is to have possibility to drain all the tanks and other applicable units to make empty for cleaning / maintenance purpose. The drain pipe / drain valve (sluice / knife gate valve) shall be of minimum 100mm size. The drain shall be led to dirty water sump or to nearby nallah / drain for disposal.
- Common delivery header and suction header of pumps (and blowers) shall be provided with a blind flange on one end.
- Exhaust fans with bird screen / net shall be provided for all LT rooms, chemical handling/storage area, laboratory, filter house, etc. Min 2nos. or higher quantity shall be provided as per requirement for sufficient air changes per hour. However, for filter house min. 2 Nos. or 1 no. of exhaust fan per two beds whichever is higher, for alum store room/area min. 4 Nos. of exhaust fans, for alum dosing area min. 2 Nos. or 1 no. of exhaust fan per dosing tanks whichever is

higher, for tonner room/area min. 2 Nos. or 1 no. of exhaust fan per two tonners whichever is higher, of exhaust fans shall be considered.

- All motors shall have running (on/off) & fault indication at MCC as well as at SCADA terminal. All starters shall be provided with auto / manual selector switch (with auto mode selection status input to PLC/SCADA) as well as with Local/Remote selector switch. The motors shall operate through PLC in auto mode and in manual mode it shall operate through push buttons at LCS when selected in remote mode and from push button at MCC when selected for local mode. All stop push buttons shall be mushroom head stay put type with padlocking facility.

Present Plant shall be designed to operate in manual mode as well as for specified process in auto mode.

- Backwash air blowers shall be located inside the blower room with necessary acoustic hoods complying with statutory and safety norms.
- All variable frequency drives and soft starters shall be selected to provide current after suitable de-rating for 50°C continuous operating temperature of at least 10% above the rated current of driven motor.
- PCC/PMCC shall be of single front type only. Similarly soft starter cubicles and VFD starter cubicles shall be in single front execution only.
- Clear Distance between two civil units should generally not be less than 5 m.
- Sluice Valves / Knife Gate valves shall be provided for sludge application.
- TMT Fe-500 reinforcement steel shall be as per IS1786-1985 REAFFIRMED-2005 or latest as applicable like Sail, Tata, Vizag, Sulekhram, Vinayak, Electrotherm, Vibrant limited, Nilkanth, Kamdhenu, etc. manufactured from prime manufacturing unit and as per instructions of Engineer in charge.
- The cement shall be of OPC 53 Grade complying with BIS 12269. The approved makes shall be ACC / Ambuja / Ultratech / Shree Cement / Saurashtra Cement (Hathi / Sidhee Brands) / Dalmia Cement / Sanghi / Ramco Cements / JK Cement / Wonder or as approved by engineer-in-charge. Design of liquid retaining structures shall be carried out as per IS3370:2009 latest revision.
- Doors, Windows and Ventilators shall be of aluminum glazed type with EZ section or of uPVC. Aluminium Section shall be of Jindal / Hindalco / Gujarat / Maan / National / Royal / as approved by Engineer-in-charge.
- Carting of existing / surplus excavated earth shall be within 10Km radius.
- All sludge lines shall be of minimum 100mm dia. or higher as specified elsewhere & all unit drain lines shall be of minimum 100mm dia. or higher as specified elsewhere. All drain lines shall be provided with isolation valves (sluice / knife gate valve).
- All RCC pipes shall be min. NP3 (or better as specified in tender requirement) socket spigot type as per IS with rubber ring.
- The plinth level of all the building shall be min. 600 mm above formation level (FGL). The roof of the building (bottom of slab) shall be min. 3.6 m above plinth level or higher as required.

- All the buildings shall be provided with 1000mm wide plinth protection of 75 mm thick CC 1:2:4 laid over 150 mm consolidated rubble soling.
- **Plaster, Bottom Screeding and paint requirement:**

The inside surface of all water retaining structures shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. Inside surfaces of rest civil units including buildings, pump house, etc. shall be plastered with 12-15 mm thick cement mortar 1:3.

Outside surface of all civil units (water retaining, buildings, pump house, etc.) shall be provided with 20 mm thick double coat sand face plaster in cement mortar (first coat 12mm thk in cement mortar 1:3 and second coat 8mm thk in cement mortar 1:2) up to FGL and 15 mm thick sand faced plaster in C.M. 1:3 below ground level up to footing.

The bottom of all water retaining structures (includes all tank / sump / reservoir, channels, launders, etc.) shall be provided with 50 mm thick screeding

The top of all covered water retaining structures (sump / tank / reservoir, etc.) provided with RCC cover slab, all RCC walkways / platforms / staircase, etc., shall be provided with 50 mm thick IPS unless specified to provide with kota stone or chequered tile or such other flooring elsewhere in tender specifications.

The outside surface of all civil structures including columns, etc. shall be painted with a minimum of two coats of Apex paint (up to 200-300mm below FGL) and all inner surfaces of various pump house and buildings shall be painted with a minimum of two coats of Plastic paint as per civil specifications. The paint shall be of Asian / Berger / ICI / Shalimar make only. The color shade shall meet approval of client.

- Parapet walls of 900mm height shall be provided above administration building & chemical house and 600mm high for rest all buildings and pump houses.
- All cables within building shall be laid on cable trays (on wall or within cable trenches or both) and for cables on walls / platforms of various buildings or civil units shall be laid on cable trays and rest all cables to be laid outside the building / outdoors shall be laid on overhead pipe / tray racks (bottom / lowest tray to be min. 4m height from FGL and min. 5m height or more as required at road crossing). All cables trays shall be of medium duty GI / FRP / GRP and cable trenches shall be in constructed in RCC. However all cable trays within alum store and alum dosing room shall in FRP / GRP only.
- Except for pipes / channels for which minimum sizes are specified in tender specifications and in this specific requirement and subject to these sizes being of higher size then pipe sizes calculated as per below given velocity criteria, fluid velocity to be considered in the design of balance pipes / channels and all valves / gates shall be sized as under:

For gravity flow	:	1.2 m/sec except for filter backwash clear water pipe header and valve.
For pump discharge & for Filter B/W Inlet only	:	2.5 m/sec max
For Pump Suction	:	1.5 m/sec max
For Air line	:	20 m/sec max

- All indoor & outdoor lighting fixtures shall be power saving long life LED type only. Surge protection device shall be provided at feeder pillar or as applicable for protection of LED lamps.

- Lighting poles shall be GI octagonal type. The street light poles shall have min. 7.5m height above FGL, flood light pole shall be min. 9m above FGL / at suitable height when mounted on any unit / building, lighting poles on top of various civil units / walkway platforms shall be min. 2.5m height. Area lighting shall be through High Mast Poles / Flood Lights. The street/flood light poles shall be mounted over RCC pedestal / foundation at least 300mm above FGL. Floodlights mounted on top of building / at elevation on civil units can also be accepted.
- All buildings, pump houses, super structures, etc. shall be provided with required internal electric wiring with light & fan fixtures, fitting with light/power points etc, as per requirement and specifications.
- All rainwater downtake pipes shall be of min. 100mm dia. uPVC in required numbers up to 300mm above FGL / Plinth Protection.
- Freeboard for all water retaining structures shall be min. 500mm or higher (Freeboard upto min. 300mm above FGL for below/under ground structures). The top of unit of below ground water retaining structures shall be provided atleast 300mm above FGL with 1m high surrounding handrail.
- SS-304 ball valves shall be provided of required / min. specified sizes for all service/ booster water, for pressure gauge isolation (in addition to manifold valves), etc. applications. SS-304 / PP ball valves shall be provided of required / min. specified sizes for chemical dosing line (alum/PAC/DWPE).
- The blower air header shall be taken above the higher water level and Vacuum breaker shall be provided to prevent siphoning action.
- CI foot rests provided for access in to various units shall be of size 35 mm x 35 mm, min. weight 4.5 kg/no.
- **All Sluice Valves, Non-Return Valves and Butterfly Valves shall be of DI Body only for entire plant.**
- All valve and flow meter chambers shall be in RCC construction only. The bottom of flow meter chamber shall be provided with adequate slope and a dewatering pit of min. 750mm x 750mm x 750mm depth to house a dewatering pump with low and high level switches for automatic pump operation to pump out accumulated water in chamber and prevent submergence of meter in water.
- For staircase height exceeding 2.5m shall be provided with multiple flights such that height of each flight does not exceed 2.5m.
- Industrial grade / duty FRP (Molded Fibreglass) grating and manhole covers can be accepted instead of MS Gratings and CI manhole covers. Similarly slip resistant molded fiberglass floor cover (flooring product that combines slip resistant floor plate and molded FRP grating) can be accepted for covering the submersible pump or such opening (esp for treated water application) instead of MS chequer plate covers.
- For overhead service water tanks of up to 5000 litres capacity, Plastic (uPVC / HDPE) water storage tanks suitable for outdoor application (UV treated) can be accepted in lieu of RCC tanks.

**03- CHAPTER
PROCESS DESIGN CRITERIA & SPECIFICATIONS**

- 3.0.** The guide lines for process design criteria for Water Treatment Plant, unless otherwise specified shall be as under. The specified sizing and quantities mentioned are minimum and not limited to and contractor shall provide adequately higher sizing / quantities if required and any additional items for satisfactory fulfillment of the specified tender conditions and final treated water quality.

The raw water generally will be treated by chemical coagulation, precipitation followed by filtration to meet the desirable limits of drinking water standards.

INLET CHAMBER (1 No.):

INLET CHAMBER (1 No.):

➤ **Design & details:**

- Inlet chamber of proposed plant shall be designed and constructed to receive raw water for 25 MLD output capacity + 4% Losses capacity with minimum 60 seconds retention time.
- Material of construction shall be minimum RCC M-30.
- Free board shall be minimum 500 mm, but it should be sufficient to contain the water splashing within the inlet chamber.
- One or Two RCC baffle wall shall be provided at proper level and across the width of stilling chamber for effective pre-chlorination.
- Minimum 50NB or sufficient higher size perforated uPVC pipeline grid shall be provided at the bottom of inlet chamber with fixing in pre-cast concrete blocks with inlet pipe from chlorination room located in chemical house.
- The raw water from stilling chamber shall be led to flash mixer distribution chamber / flash mixer.
- CI rungs shall be provided to access the bottom of chamber.
- Arrangement shall be done to feed the PAC / alum solution in the inlet chamber outlet / upstream of flash mixer from coagulant chemical tanks by at least 50NB or sufficient higher size uPVC / HDPE pipeline.
- The outlet of inlet chamber shall be provided with CI isolation gates for isolation of flow leading to each flash mixer / clariflocculator unit

➤ **Approach:**

- Approach to stilling chamber shall be provided with min. 1.2 wide RCC staircase in no. of flights as required with chequered tiles flooring and 1.20 m. wide RCC platform with chequered tiles flooring shall be provided on at least two sides of inlet chamber, at top level with 1.00 m. high Hand Railing. The RCC platform shall extend further to cover entire length to approach upto flash mixer unit and provided with chequered tiles flooring.

➤ **Finishing:**

Inside & outside plaster, bottom screeding for water retaining structures, painting, etc. shall be provided as per specifications.

➤ **Drain arrangement:**

- 100mm dia CI drain pipe with isolation sluice / knife gate valve and with 100 mm dia. C.I. drain pipe connected to nearby RCC drain chamber with necessary specials shall be provided at bottom of inlet chamber for draining /cleaning the unit. Onwards conveyance / disposal from drain chamber for all unit drains shall be by min. 100mm dia. RCC NP3 (socket & spigot type) piping leading to dirty water sump.
- **Connection of inlet raw water lines to inlet chamber:**
The incoming raw water rising main line of size and MOC as specified above shall be laid up to and received at inlet unit for which flanged puddle pipe shall be provided at bottom side of inlet chamber and required jointing with incoming pipe. It shall include receiving raw water line and connecting the same with flanged puddle pipe at side/bottom below FSL of inlet chamber. For inlet unit with bottom above FGL, the incoming pipe shall be connected at bottom with raw water pipe extending vertically up upto 100mm above FSL.
- **Clariflocculator Bypass (CLF Bypass) channel & Isolation Gate:**
 - A suitably arranged bypass channel with CI isolation gate/s shall be provided at inlet chamber for bypassing the clariflocculation units suitable for 100% design flow including losses and overload i.e. 25 MLD + Losses + 20% overload flow capacity & connecting to clari-flocculator outlet channel / min. 800mm dia MS pipe line with isolation sluice valve alongwith metallic expansion bellows connected to clarified water outlet pipe line leading upto inlet of filter house.

FLASH MIXER (1 No.):

- **Design & details:**
 - One No. Flash mixers shall be provided leading to clariflocculator. Flash mixer inlet & outlet arrangement shall be designed to avoid short circuiting of the flow by providing a baffle wall from top to bottom (forming duct of suitable width and length as per flash mixer length) and with suitable size of opening at bottom. The water entering flash mixer shall be led to bottom of unit from inlet baffle arrangement and from bottom of unit it shall rise above in the flash mixer unit with required mixing and shall overflow into outlet chamber over the outlet weir. Alternately a downward opening weir gate for flow control can be provided at inlet of each flash mixer with water entering flash mixer at top which after required mixing shall be led to bottom of unit for onwards conveyance to clari-flocculator.
 - Capacity of each flash mixer shall be for 25 MLD + Losses with minimum 60 seconds retention time (Total capacity 25 MLD + Losses). Free board shall be minimum 500 mm.
 - CI isolation gates (suitable for 25 MLD + Losses + 20% Overload) shall be provided at inlet of flash mixer for flow control and isolation of an individual stream of flash mixer unit & it's associated clariflocculator unit for O&M purpose.
 - Material of construction shall be RCC M-30
 - Retention time shall be minimum 60 seconds.
 - CI rungs shall be provided to access the bottom of chamber.
 - The flash mixer shall be mounted over RCC platform of min. 1200mm width of higher with required opening/cut-out and required foundation with pockets to mount mixers or shall be mounted over MS girders (Three numbers or required numbers of M.S. girders (I - sections) for supporting agitator motor for mixer shall be provided of sufficient size (min ISMB:200) with 8 mm thick chequered plate top over each flash mixing tank. These M.S. girders shall be grouted in RCC wall of flash mixer. All M.S. sections, plate etc. shall be provided epoxy paint.

- Adequate and proper arrangement of operating platforms (min. 1.2m wide) with chequered tiles and 1m high handrail shall be provided for accessing flash mixer unit/equipment and for accessing weir plates at flash mixer outlet and operation of gates provided at distribution chamber / flash mixer inlet.
- Arrangement shall be done to feed the alum solution / coagulant at the inlet of each flash mixer (prior to inlet baffle) through an independent separate pipe line from alum / chemical tanks for each flash mixer by at least 50NB uPVC pipeline with provided from dosing pump header to each flash mixer. An isolation full bore ball valve (min. 50NB or higher as per pipe size) shall be provided on discharge side of dosing line to each flash mixer suitably mounted for ease of O&M.
- The raw water from overflow chamber / outlet of flash mixer shall be shall be led to inlet of each clariflocculator through min. 700mm dia DI K-9 pipe line.
- **Finishing:**
Inside & outside plaster, bottom screeding for water retaining structures, painting, etc. shall be provided as per specifications.
- **Drain arrangement:**
100mm dia CI drain pipe with isolation sluice / knife gate valve and with 100 mm dia. C.I. drain pipe in each flash mixer unit at bottom and connected to nearby RCC drain chamber with necessary specials for draining /cleaning the unit. Onwards conveyance / disposal from drain chamber for all unit drains shall be by min. 150mm dia. RCC NP3 (socket & spigot type) piping leading to dirty water sump.
- **Approach:**
Minimum 1.2m wide RCC platform with chequered tiles and 1.0 m. high hand railing shall be provided to approach each flash mixer unit, for operating flash mixer gates & valves on dosing lines to each flash mixer and up to outlet overflow chamber suitable to operate / adjust overflow weir plates & access each overflow chamber and connecting to distribution chamber platform / walkway on one side and leading to clari-floccualtor walkway on either side.

CLARI-FLOCCULATOR (1 No.):

There will be min. One (01) Nos. of circular RCC clariflocculator, which shall have a central area for coagulation and flocculation with flocculators and outer area for clarification settling. The flocculation zone and settling zone shall be separated by circular isolation RCC wall. All inlets, outlets passages of water shall be designed and arranged for a steady and uniform flow without undue turbulence to avoid disintegration.

It will have a peripheral weir with vertically adjustable (min. 100mm adjustment must be possible) 8 mm thk. and min. 350mm Ht. FRP V notch weir plates for uniform surface withdrawal of clarified water. The weir plates shall be fixed with stainless steel anchors, nuts and washers. A baffle arrangement of min. 450mm height (min. 300-350mm submergence) in FRP (min. 8mm thk) with suitable supporting arrangement shall be provided in front of weir to stop floating material to escape in effluent. Alternately perforated pipe launders with ports (orifice) submerged about 50 to 100mm below FSL can be provided instead of weir.

Design capacity of each clariflocculator shall be 25 MLD + Losses.

Design capacity of all connecting pipes or channels like inlet pipe, central shaft, clarified water launder, outlet channel, etc. shall be 25 MLD + Losses + 20% overload.

Material of construction shall be minimum RCC M-30. Free board shall be minimum 500 mm for unit, launders, etc.

Sludge withdrawal pipe lines provided for each clari-floccualtor shall be in DI-K9 MOC (min. 200mm dia.) for sludge withdrawal and conveyance up to sludge (dirty water) sump and such that the top of sludge conveyance DI pipe line which leads to dirty water sump shall be atleast 100mm below the bottom of clari-floccualtor.

A bridge with peripheral on-board drive with suitable diameter CS wheels traveling on the steel billets supported (welded) over insert plates (refer mechanical specifications of clari-flocculator for specific requirements / rail requirement) on the top of peripheral wall will be provided with:

- Central platform for the installation of the stirrers and their drives and for the local control panel;
- Paddle stirrers / agitators for slow mixing of the incoming raw water in the central unit;
- A radial scraper system with bottom scraper blades, suspended on the bridge.

The hydraulic equipment is:

- The inlet pipe from the flash mixer feeding into the central flocculation part;
- Sludge withdrawal lines, of min. size & MOC as specified above with electric actuator operated knife gate valve for intermittent operation according to an adjustable timer;
- Sludge pipe from clariflocculator to dirty water sludge sump.
- A constant bleeding arrangement for sludge withdrawal pipe shall be provided (to be provided on upstream of sludge withdrawal valve) to enable observation of the sludge quality. Necessary telescopic sludge withdrawal valve arrangement shall be provided. The telescopic sludge withdrawal line shall be provided with isolation valve, normally open.
- 50mm dia. Flushing line with isolation ball valve in SS-304 and with flanged end with blind flange with connection to sludge withdrawal pipe on upstream and downstream side of sludge withdrawal valve for pressurized flushing and chokage removal on either side.
- A discharge channel from the peripheral collecting channel to the main channel leading to filters.

The electrical equipment shall comprise of:

- Incoming cable (power and control) laid separately in 2 nos. heavy duty uPVC Sch. 80 / GI (Hvy Duty) pipe lines of min. 100mm dia. (with dual draw wires or suitable arrangement for pulling cables to top of center column) with sufficient slip ring contacts (Min. 12 nos.) for the on-board power supply and the supply of all motors & other remote control & monitoring requirements;
- On-board local control panel in SS housing suitable of outdoor installation for all operations of the unit with connections to the main control room for common common drive status indication of the unit components;
- Drives for the flocculator stirrers;
- Drives for the bridges;
- Emergency mushroom type stop buttons with padlocking at the control panel and at LCS the outer side of the bridge;
- Lighting.

Design Parameters of Clari-flocculators shall be as given below:

A. Clariflocculator

Sr. No.	Description	:	Parameters
i)	Nos.	:	2 Nos.
ii)	Flow through each Clariflocculator	:	25 MLD (Normal) + losses
iii)	Surface loading in Clariflocculator zone.	:	1.667 M ³ /M ² /hr Max. (40 M ³ /M ² /day

Sr. No.	Description	: Parameters
		Max.)
iv)	Detention time in clarification zone.	: 2.5 hrs.
v)	Liquid depth	: 4.0m SWD
vi)	Free board	: 500 mm min.
vii)	Floor slope	: 1:12
viii)	Inside dia of clarifier	: 50m dia max.
ix)	Location of launder	: Outside or as required to suit the weir loading criteria
x)	Weir loading	: 12.50 M ³ /M/hr. Max. (300 M ³ /M/day Max.)
xi)	Outlet arrangement of the clarified water	: 90° 8 mm thk FRP adjustable V notch weir plate, min. 350mm Ht. and min. 100mm slot for weir height adjustment, to be fixed along the periphery of the clarifier tank as per hydraulic design calculations. A baffle, min. 450mm height (min. 300-350mm submergence) in FRP (min. 8mm thk), shall be provided in front of weir to stop floating material to escape in effluent. Alternately, perforated pipe launders with ports (orifice) submerged about 50 to 100mm below FSL can be provided instead of weir.
xii)	Clarifier Bridge with wheel assembly	: Min. 1200 mm clear in to in width
xiii)	Peripheral speed of Scrapper Arm	: 1 - 3 cm / sec
xiv)	Thickness of scrapper Blade	: 6 mm (Min.)
xv)	MOC of Bridge and Scrapper	: MS, IS 2062, epoxy painted. All hardware, nuts and Bolts (wetted / submerged and non-wetted) shall be of SS- 304 Material.
xvi)	Painting	: Epoxy paint as per specifications.
xvii)	Telescopic Bleed valve	: Required, inlet sludge line with isolation valve, normally open. Overflow / return line from chamber to sludge withdrawal line be provided, connection on downstream of sludge withdrawal valve.
xviii)	Water flushing connection	: 2 nos., 50mm dia with isolation ball valve and flanged entry with blind flange, for each sludge withdrawal pipe / chamber with dual connection each on upstream and downstream side of sludge withdrawal valve.

Sr. No.	Description	:	Parameters
xix)	Railing	:	MS pipe railing with epoxy paint.
xx)	Clarifier by- pass	:	Yes
xxi)	Sludge Drain	:	Required, with electric actuator operated knife gate valve with extended spindle, minimum size and MOC as specified above for sludge withdrawal pipe line, straight to dirty water sump. The actuator shall be above ground level connected with extended spindle.

B. Flocculator

i)	Type.	:	Set of counter rotating flocculator blades
ii)	Flow	:	37.5 MLD (Normal) + losses
iii)	Detention Time	:	30 min. (Minimum)
iv)	GT Value	:	10,000 – 1,00,000
v)	MOC of Flocculator	:	MSEP
vi)	Service factor for gear box	:	2.0 (Minimum).

Note:

- For the purpose of clari-flocculator sizing, flocculator area shall be considered after deducting the area of RCC central shaft / centre feed well and clarifier area shall be considered after deducting the total area within flocculation zone (i.e. flocculator + centre shaft/centre feed well area) and also after deducting the launder area in case if provision of inside launder.
- **The RCC central shaft / centre feed well shall have min. 250mm wall thickness.**

Clarified Water Collection

The collection of clarified water shall be in a peripheral launder constructed inside / outside the tank wall as required to satisfy the weir loading rate requirement. The launder shall receive clarified water through 90 deg, 8 mm thk FRP V notches of adjustable (min. 100m ht. slot for adjustment) weir plate, min. 350mm Ht., fitted along the tank perimeter. The clarified water from peripheral launder shall be led to clariflocculator outlet channel (inlet channel to filter house).

Clarifier De-sludging

The clari-flocculator sludge withdrawal line shall be min. size and MOC and arrangement as specified above. It shall be possible to drain the entire clari-flocculator with this sludge pipes. Actuator of this valve must be above ground level and connected to valve with extended spindle.

For clarifier De-sludging the sludge shall be discharged at least once in 120 minutes or as per design through electric actuator operated knife gate valves with manual over ride facility. In addition, there shall be a continuous bleed arrangement with telescopic trumpet, placed near the outlet launder and discharging into the wet pit.

The actuator shall be provided with position transmitter (4-20mA output to PLC) for valve position feedback to stop the valve at intermediate position as programmed and with timer based auto operation (0-24 hrs range) through PLC at control room.

The valve chamber shall be dry and wet pit type with an operation platform above chamber for ease of operation. The discharges shall be let directly into dirty water sludge sump by gravity through pipe line, for further disposal. Suitable flushing arrangement shall be provided. Inside & outside plaster, painting, etc. shall be provided as per tender

➤ **Approach:**

RCC platform all around the clari-flocculator units with chequered tiles and 1.0 m. high hand railing shall be provided of min. 1.2m width or higher to provide min. 0.75m clearance from the rotating bridge projection and with 1.2m wide staircase for each clari-flocculator unit (such that top of clari-flocculator can be accessed from the adjacent road / pathways around clari-flocculators) and 1.0 m. high hand railing to approach the walkway from ground level with chequered tiles flooring shall be provided. Further the clariflocculator shall be accessible / connected with flash mixer unit on one side with min. 1.2m wide platform with chequered tiles flooring and 1m high handrail.

➤ **Finishing:**

Inside & outside plaster, bottom screeding for water retaining structures, painting, etc. shall be provided as per specifications.

CLARIFLOCCULATOR OUTLET PIPELINE / FILTER INLET:

Design & details:

The outlet launder of clariflocculator shall be connected to inlet of filter house. Clarifier outlet pipe line suitable for 25 MLD + Losses + 20% overload capacity shall be designed and provided as required with minimum size and MOC as specified above in tender.

FILTER HOUSE / RAPID GRAVITY SAND FILTER

➤ **Design & details:**

Filter bed shall be provided of declining rate type with loss of head and rate of flow measuring device. Each filter bed shall be self contained and capable of working under full or part load independently of other. Arrangements shall be made for incoming water to be uniformly distributed between the various filter beds and individual on each filter bed. The filter runs should be normally not less than 24 hours with a designed loss of head between 1.6 to 1.8 mts. The minimum depth of water on the filter bed shall be 2m above the sand (top of filter media) with min. clear 500 mm free board. Further the top of filter media shall be min. 100 mm below the weir crest at the outlet of filter.

The filter bed washing will be done by air and water. The total time of backwash for each bed must be specified (i.e. from closure of inlet valve to reopening of inlet valve after complete backwash). The plant should be so designed that there should no loss of sand with the wash water and sand bed should settle down fairly and without any undulation. There should be no mud balls after washing. Also, there should be no air binding during filtration or during washing. Maximum expansion of sand during back wash may be specified and should be within standard given in CPHEEO manual. Normally the wash water consumption should not exceed 2-3% of the total quantity of water filtered (evaluated on monthly average basis, water/mass balance for clarifier sludge and filter dirty wash water losses to be submitted).

For the provision of wash water gutter and trough design, sizes, spacing, minimum height above top of sand bed, level of top edge, slope of the same shall be as per criteria given in design manual on "water supply and treatment" issued by CPHEEO. For this, various factors such as expansion of sand bed, disposal of dirty backwash water of filter, backwash water rate, etc. should be taken into account. At the commencement of the filter run after a back wash the initial loss of head should not exceed within specified limit.

1m high hand railing should be provided all around for all filters to safeguard against accident.

Proposed filter house for 25 MLD + Design Losses capacity shall contain 3 Nos. (3W @22 operating hours per day) equal capacity twin section and declining rate type rapid gravity sand filter beds to be constructed in single row. For filter beds constructed in single row shall be with **filter pipe gallery of minimum 3.5 m. width + treated water channel** with provision of header for backwash water line in pipe gallery.

Rate of filtrations shall be 6.00 Cu. m./ Sq. m./ hour.

The total depth of filter house shall be min. 3.5m. All piping within filter house shall be CI Double Flanged piping.

Material of Construction up to the top of Filter House shall be minimum RCC M-30.

Inside and outside plaster, bottom screeding for water retaining structures and painting shall be provided as per specifications for entrie filter house.

Other design requirements are as under:

- In filter backwash air scouring rate shall be 36 cum/Sq.mt./hr for 5-10 minutes for each filter bed. The rate of backwash shall be 24 cum/Sqm/hr for 10 minutes for each filter bed.
 -
 - Backwash shall be through overhead backwash tank to be located above filter house. For this purpose, 2 Nos. (1W + 1S) Submersible Centrifugal type pump sets each of min. 150 m³/hr capacity (or higher capacity as required as per design) shall be provided for backwash tank filling. Each delivery line shall be min. 150mm dia. DI K-9 with isolation valve, metallic expansion bellows & NRV on each delivery line and the header line of min. 150mm dia. DI K-9 pipe. The pumps shall be located in Chlorination Chamber / Chlorine Contact Tank.
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 - 2 Nos. (1W + 1S) of air blowers of min. 2400 Cum./hr. & 4000mmWC capacity shall be provided for air backwash of filter bed.
 -
 - The under-drain system shall be consisting of heavy duty virgin food grade PP nozzles, 50 Nos. per sq.mt with cast –in –situ false flooring shall be provided
- **Filter inlet channel:**
- Filter inlet channels shall be of 25 MLD + losses + 20% overload capacity. The incoming pipe from clari-floccualtor outlet shall be connected to the inlet channel of filter house.
 - On side of filter house filter inlet channel shall be provided. The depth of the channel shall be desinged to ensure that the filter inlet gates are fully submerged and that liquid depth shall be atleast 200mm above the top of gate and accorodngly the width of channel shall be designed and in no case the inside width of channel shall be less than 0.9m considering the fixing of gate and O&M requirements and that minimum clear free board of 500 mm shall be provided.
 - 1.2 meter wide RCC walkway with chequered tiles and 1.00 meter high hand railing shall be provided on the total length of channel. If covered channels are provided then over filter inlet gates/valves cut-outs of min. 1.2m length and min. 0.9m width or higher as required for removal of valve/gate and cut-outs to be provided with FRP (GRP)/MSEP grating and head stock supporting arrangement.
 - CI rungs / ladder shall be provided at minimum one location for accessing the channel for cleaning / maintenance. If covered channels are provided then cut-outs of min. 1m x 0.9m size with FRP (GRP)/MSEP grating shall be provided over cut-outs for access of channel.

- The approach from filter house inside to filter inlet channel shall be provided with door for approach / entry to filter house at min. one location.
- **Drain arrangement:** For draining out total clarified water of the channel up to the bottom level during the plant shut-down period, 100mm dia CI drain pipe with isolation sluice / knife gate valve and with 100 mm dia. C.I. drain pipe shall be provided at bottom of filter inlet channels (in the slab) at minimum one location and the same shall be extended up to the backwash outlet channel / dirty water sump.

➤ **Filter Valves / Gates:**

Each filter shall have total 5 Nos. electric actuator operated Butterfly Valves / Thimble Mounted Gates operated in auto mode from PLC based filter consoles (Local control panel) at filter gallery as well as from main control room HMI or manually with manual over ride facility having minimum size as under or higher as per design requirement:

Filter Inlet Gate	350mm x 350mm / equi area sluice gate
Filter Outlet Valve	400 mm dia. butterfly valve
B/W Inlet Valve	500 mm dia. butterfly valve
B/W Outlet Gate	600mm x 600mm / equi area sluice gate
Blower Air Inlet valve	250 mm dia. butterfly valve

In addition to above, each filter bed shall be provided with min. 2 nos. manually operated sluice valves of min. 150mm size for drain purpose. The outlet shall be provided with blind flange.

All the filter valves / gates (except drain valves) shall be possible to operate from filter house / filter bed top gallery level and accordingly shall be provided with extended spindle (with required coupling as per specifications) and headstock and with electric actuator at top of bed floor level. The dirty backwash gate shall be provided on inside wall of filter and the filter inlet gate shall be provided on outside wall and necessary operating platforms shall be provided at filter bed top level with suitable approach to all valve operators / headstock at top level for operation & maintenance.

Cutout with MS / FRP (GRP) grating shall be provided in filter bed floor level above pipe gallery valves (filter outlet and backwash inlet) for ease of lowering & lifting of valves / gates and for natural light & ventilation in pipe gallery.

All the filter bed valves in pipe gallery (except drain valve) and air scour valves at filter top gallery shall be provided with metallic expansion bellows.

Also the backwash header line in pipe gallery shall be provided with one metallic expansion bellows between two filter beds on backwash pipe header in each pipe gallery for ease of dismantling / O&M of header line.

➤ **Filter bed & Filter media details:**

Filter Media: In every typical twin-section filter bed, total depth of filter media shall be min. 1150 mm with minimum 900 mm depth of filter sand media, and rest thickness of gravel for packing of filter nozzles top portion. Filtration media and gravel shall be as per latest edition of IS:8419 (Part D). The depth of filter material should be adequate commensurate with safe bacteriological removal.

In 900 mm depth of filter sand media, filter sand shall be of hard and resistant quartz or quartzite free of clay, fine particles, soft grains and dirt of every description and as under:

- ✓ effective size shall be between 0.45 to 0.70mm
- ✓ uniformity co-efficient of sand between 1.3 to 1.7
- ✓ ignition loss shall not exceed 0.7% by weight

- ✓ soluble fraction in HCl acid shall not exceed 5% by weight
- ✓ silica content shall not be less than 90%
- ✓ specific gravity shall be between 2.55 to 2.65
- ✓ wearing loss shall not exceed 3%
- ✓ impurities must be less than 5% by volume

The filter gravel shall be preferably rounded stones (as spherical as possible), hard, clean (free of clay, fine particles, soft grains and dirt of every description) and uniform in quality and to be provided in 2-3 graded layers of different size of gravels with finer/small size gravel layer at top and coarse/big size gravel layer at bottom. Specific gravity shall be between 2.55 to 2.65. Soluble fraction in hydrochloric acid shall not exceed 10% by weight for 10mm or large gravels (to be provided in lower level) whereas it shall not exceed 5% by weight for sizes smaller than 10mm gravels (to be provided in upper level of gravel bed i.e. below filter sand media). The top most layer of gravel shall be generally 2-5mm size.

Filter media and charging :

Prior to packing, all filter sand shall be washed, heat dried and sieved to conform the specified grading and be tested. **Separate test certificates shall be provided to the Engineer for each 20 cubic meters of media so supplied.**

Packing shall be in suitable approved double or triple bags to protect the media from spillage or contamination. Any sand media delivered loose or found to be split or open bags shall be rejected out rightly.

Storage on site shall be only in an approved pre-defined area, well drained and free of mud and silt.

Following installation and satisfactory testing of all the filter floors and when the Engineer is satisfied that the installations are complete, the contractor will be given written permission to commence filling the filters.

Filter media shall be carefully placed and not charged by dropping, dumping, machine handling or any other method which in the opinion of the Engineer will be detrimental to the floor media, nozzles/drains or sealants. In each filter, two adjacent halves shall be charged simultaneously.

Following the initial charging the filters shall be washed by the contractor. The filter media and supporting media shall be of the best quality and shall have to be got approved by the Client. The tenderer shall have to make his own arrangements to get the filter media tested through a recognized laboratory and shall have to get it finally approved by the Client before use, as per standard testing procedure.

Filter Beds:

Both sections of every filter bed shall be provided with required numbers of RCC launders / wash water troughs (min. 300 mm clear width, 300mm to max. 350 mm deep) such that C-C distance between launders does not exceed 2.5m (distance between two troughs not to exceed 2m), to drain out the back wash water into back wash channel. The height (top) of wash water trough from top of filter media / sand shall be about 600mm and in no case exceeding 700-750mm.

The backwash wash gutter / drain channel of required width (min. 0.9m width in any case) shall be provided between the two twins of each filter bed with bottom of drain channel matching top of underdrain system / false floor (nozzle) slab.

The under drainage system shall be of standard pattern so as to ensure required filtration rate. The strainer should be designed so as not to dislodge the filtering media when water independently introduced for washing under drainage system and materials to be used shall be of non- corrodible

materials. The false floor nozzle slab shall be of cast-in-situ RCC. The design of cast-in-situ RCC should be such that the same can withstand against pressure during backwashing. The contractor shall have to take proper care in construction of the same in filter bed with necessary RCC supports. The heavy duty nozzles shall be placed at equal and uniform distance so that even distribution of air/water pressure occurs. The bottom of slab shall be plastered or given the epoxy lining treatment to avoid the corrosion.

There shall be minimum 1.00 m. clear gap between bottom of false floor slab with nozzles and bottom raft of filter bed. Below filter sand media, virgin PP Nozzles shall be casted in cast-in-situ RCC slab for under-drain system. Number of nozzle to be provided/casted in cast-in-situ RCC false floor slab shall be minimum 50 nos. per Sq.mt. Nozzles shall be made in two parts connected by screwing action. Bottom part shall be totally casted in the slab. They shall be maintained in vertical position at the time of casting of slab, by fixing them to the steel reinforcement specifically provided for this purpose in the slab. For removing centering & shuttering material, after casting the slab, one 1.00 x 1.00 m size cutout shall be left in each section while casting, which shall then be covered by precast slab of the same size, with nozzles bottom portion casted in the same. At the time of casting of concrete to prevent the concrete from entering into the nozzle bottom portions, they shall be covered by false caps screwed into all nozzles. After casting of slab is over and before filling of filter sand, these false caps shall be removed and after total cleaning of inside of bottom portion of the casted nozzles, top portion of nozzle with fine slits shall be screwed in with applying non toxic adhesive on sides or as recommend by nozzle manufacturer/supplier, to the bottom portion of nozzles already casted. Arrangement of nozzles shall be such that effective & uniform backwashing takes place in total area of filter bed.

Before placing concrete in false floor slab with nozzle base, sides of filter beds below false floor slab shall be plastered with 20 mm thick water proof plaster in C.M. 1:3 and 50 mm IPS / screeding shall be provided on top of filter bed bottom raft. Inside filter-beds, all internal walls above false floor slab shall be plastered with 20 mm thick water proof smooth cement plaster (1:3). Sufficient nos. of 100 mm dia uPVC pipe puddles shall be provided in the middle filter wall in that portion, so that filtered water can be passed to the filter outlet valve as well as backwash water can be passed to filter media bottom, via central channel (portion below the dirty backwash drain channel between the two twin section of each filter bed) . CI air scour line of min. specified size (matching to air scour valve size) or higher shall be provided upto bottom of filter bed with elbow/bend and with onwards header pipe of matching size in uPVC Sch. 80 or better pipe MOC header line shall be provided in the central channel below false floor slab level / backwash drain channel for the entire length of the central channel with required perforations and/or if required further air distribution for each of the both twins shall be carried out providing tapping from this header line and perforated lateral pipe of required size of uPVC Sch. 80 pipe or better MOC and in required numbers under each twin section on both sides for distribution such that blower air spreads evenly throughout the space below the false floor slab.

The nozzle slab / false floor slab shall be flat slab type without any beams providing clear 1m clearance for air distribution without any obstruction or else the air distribution piping shall be provided with perforated lateral piping (uPVC Sch 80) of required size throughout the length of bed spreading on both sides under each twin bed to ensure uniform distribution of air. If the nozzle slab is rested over beams then the required min. clearance of 1m for underdrain system shall be provided from bottom of beam to top of filter bed bottom raft.

SPECIFICATIONS FOR PP NOZZLE: PP nozzles shall be manufactured of virgin PP material with nozzle strainer cap of min. 45mm dia x 25mm height and having min. 36 slots with slot width of 0.4mm and in any case not exceeding 0.5mm and slot height of about min. 18-20mm with min. 2.85-3.00 cm² clear area of slot opening and shall be suitable for design flow and head loss requirement for backwash. The nozzle pipe shall be min. 14mm dia with stem length of about 250mm or as per requirement of nozzle slab thickness and the projection of nozzle stem below the slab. The nozzle stem at bottom shall have about 2-3 slots of 1-2mm opening with required height

of opening or as required. Variation in nozzle construction as per manufacturer design can be accepted subject to meeting the min. slot opening area requirement and suitability for design flow and head loss requirement for backwash.

- ✓ *The details of pre-cast nozzle slab with arrangement of nozzle shall be submitted for review and approval after finalizing the false floor structure / support beam design with nozzle to be adjusted as per clear opening available in structure drawing.*
- ✓ *Air Distribution piping arrangement shall be submitted for review. Trial in one bed complete with nozzles and filled with water shall be carried out and demonstrated to client before carrying out air wash piping distribution work in other beds.*
- ✓ *Nozzles shall be offered for inspection at manufacturer works. About 1% quantity shall be randomly selected from the total lot / quantity for this plant for nozzle slot and other dimensional check. Test certificates for the material, etc. shall be provided for review.*

➤ **Treated Water Channel:**

Treated water (Filter Water) channel, box type closed channel covered with RCC top slab, shall be constructed throughout the length of filter house (in between the filter gallery in case of two rows of filter beds and on one side of filter gallery on opposite side of filters in case of single row of filter beds) in which treated (filtered) water from all the filter beds shall be received via treated water open chamber at outlet of each filter and onwards conveyance.

Throughout the treated water channel, on sides including free board and on bottom, white glazed tiles shall be fixed. On top slab of filter water channel, which shall also be used as walkway for filter gallery, CI manhole cover with frames (min. 0.75m x 0.75m) shall be provided at sufficient distance (min. 2 nos. and at least one for every 15m channel length). Both sides 1.00 m. high hand railing throughout the length of treated water channel shall be provided. On channel top chequered tiles flooring shall be provided.

The width of channel shall be designed by the contractor such that adequate clearance below channel shall be available for crossing of backwash inlet water pipe with adequate margin above and below the pipe for ease of maintenance. However in any case the inside width of treated water channel shall be min. 1.0m wide / out to out width of channel shall be min. 1.2m wide.

➤ **Backwash outlet channel:**

On side of filter house, backwash outlet channel of suitable width and depth (the channel shall be min. 1m wide in any case) shall be provided throughout the length of filter house to receive dirty wash water from each filter bed. This dirty wash water channel shall be further connected by suitable dia. RCC NP3 pipes and which shall be ultimately connected to dirty water sump & pump house. The FSL of backwash outlet channel shall be atleast 50-100mm below the top of false floor slab / nozzle slab.

The outer wall of backwash channel in front of dirty backwash valve/gate shall be at least 500mm above the top of dirty backwash valve / gate and min. 1.8-2.0m wide and further if required, on top of every opening of backwash outlet valve / gate, MS plate cover hood shall be provided such that at the time of opening of backwash valve, water shall not come out of channel due to splashing.

Typical brick masonry chamber of required size with top slab & manhole cover at every 30m. interval and every bend shall be provided on the RCC drain line conveying dirty wash water from backwash outlet channel to dirty water sump.

▪ **Filter house gallery details below first floor level (Pipe Gallery):**

- From every filter bed, treated water shall be discharged to treated water channel via treated water open chamber with weir type sectional wall for rate of flow & loss of head measurement as per

manufacturer's requirement. Transparent acrylic fiber sheet of sufficient thickness (min. 6-8mm thick) with suitable aluminium framing and having sliding / openable desing shall be provided on top of all filter water open chambers to cover the chamber and prevent any ingress of dirt / foreign material in treated water with necessary cut-outs as required for instrument mounting.

- On both ends of filter house, from the level of treated water channel top to filter house intermediate (operating gallery) slab level, min. 1.2m wide RCC stair case with hand railing in suitable no. of flights, with polished kota stone on risers/steps shall be provided. Similarly On both ends of filter house & on each side of pipe gallery, from the level of treated water channel top to filter house pipe gallery bottom level, min. 1.2m wide RCC stair case with hand railing, with polished kota stone on risers/steps shall be provided. For intermediate beds / beds between first and last bed of filter house, MS/GI ladder (min. 600mm wide) to access from top of treated water channel to bottom of bed / pipe gallery between each filter outlet chamber shall be provided and portion of ladder shall be provided with openable handrail or safety chain.
- On side of treated water box channel i.e. in pipe gallery, throughout the length of filter house in filter pipe gallery, where filter outlet pipes, valves, backwash inlet common header pipes, valves are provided and including below the treated water box channel, total RCC M-30 raft floor with 50 mm IPS on top shall be provided with sufficient gradient and average 300 mm deep & 300 mm wide open gutter leading to min. 500m x 500mm x 750mm deep drain pit at end of filter house on each side of pipe gallery, so as to drain out any excess/leakage water. 1 No. dewatering pump of adequate capacity with required piping upto drain point shall be provided in each pipe gallery. Additionally, drain pipe from both the ends shall be connected suitably to nearest drain chamber / dirty backwash channel leading to dirty water sump.
- **Filter house details at first floor level (Operating Gallery):**
 - At the top of filter bed level, filter house intermediate floor shall be provided with RCC slab throughout the filter house length covering the entire pipe gallery and treated water channel portion and this slab shall have cut-outs covered with MS/FRP grating above the valves of pipe gallery as explained elsewhere in the specifications. Also minimum 1200mm wide RCC platform in between the two filter beds in a row and continuous 1200mm wide RCC platform on the outer faces of all filter beds for full length of filter house shall be provided. All the filter beds shall have 1.00 m. high hand railing all around them on RCC slab/platform.
 - Electronic type LOH/ROF meters shall be provided with local indication at their respective filter consoles provided at opeating gallery and remote indication at HMI in control room. The system offered shall be such as to provide two separate alarm contact each for “High Loss of Head” level and for “Low Rate of Flow” through instrument or through PLC which shall provide necessary local audio-visual alarm & remote audio-visual alarm at HMI at control room for filter bed clogging initiating auto backwash operation through PLC in auto mode or prompting operator to carry out backwash in manual mode. Alarm set points shall be user adjustable.
 - Total floor covering RCC slab/platform shall be provided with minimum 22 mm thick polished kota stone flooring with kota stone size of min. 22” x 11” or higher as approved by Engineer-in-charge and with mirror polish finishing.
 - The passage of slab above the pipe gallery and treated water channel, at filter bed top level, shall be provided with cut-outs in about 25% area of total floor area at that level, with removable MS grating (50 x 50 mm grill size from MS flates min. 5mm thk and or suitable size, gratings to be in no. of pieces as required and placed in MS frame of suitable size and min. 5mm thk) with anti-corrosive paint / heavy duty FRP grating in suitable frame, in alternate bay method, in such a way that every set of backwash inlet valve & filter outlet valve is covered with one set of grating on top of it for ease in erection / lifting of valves and sufficient natural ventilation is provided in the gallery below the slab. MS channel / beam supports shall be provided as required in these cut-outs

for supporting the headstock of valves to be mounted on operating gallery in case for filter outlet and backwash inlet where required/specified iwht extended spindle upto operating gallery level.

- All the outer sides of filter house, above filter house intermediate slab level, shall be covered by 230 mm thick brick work up to terrace slab level in C.M. 1:6 as per tender specifications. These brick walls shall be plastered from inside with 15 mm the smooth cement plaster in C.M. 1:3 and underneath of roof slab shall be finished with 10 mm to cement plaster in C.M. 1:3.
- The air pipe line at platform level shall be projecting toward the bed side such that entire central operating platform is without the obstruction of the air pipe i.e. separate air headers shall be provided on each side of filter beds. Necessary RCC platform for maintenance of the air valve shall be provided at this level. The necessary pipe support shall also be provided for the entire length of the pipe. Alternatly air pipe can also be provided overhead about min. 2.5m above floor level with required pipe supports to keep operating area clear.
- **Filter house details at roof level:**
 - Total filter house shall be covered by RCC roof with 3.60 m. clear height from the top of finished floor level of filter house intermediate slab (Top of filter bed level). Access to terrace slab shall be provided by RCC stair-case with hand railing.
 - On filter bed and central gallery of filter beds, flat RCC roof shall be provided at terrace level with Indian type brick bat koba water proofing. Parapet wall of min. 900mm shall be provided.
- **Entrance Gates, Windows & Ventilations:**
 - All windows of filter house shall be provided with aluminum powder coated frame & sliding glass type shutters. About 20% of floor area of slab at filter bed top level shall be considered as area for providing windows / ventilations with grill to prevent entry of birds, etc. inside the filter house. Doors shall be of aluminum part glazed type.
 - Minimum size of window shall be 1.50 meter X 1.20 meter. with sill level at 0.90 meter from floor level. All windows & doors shall be provided with standard fixtures & fittings for aluminum windows & doors. Glazing shall be with minimum 5 mm thk. clear sheet glass. Continuous RCC lintel with 600 mm wide chhajja shall be provided over windows, on sides and for full length of filter house. Window & vent shall be with polished kota stone sill and Jams.
 - Below RCC slab level, fixed glass (5 mm thick), steel section framed ventilations shall be provided on both sides of filter house for improved natural lighting.
 - On both ends of filter house, from ground level to treated water channel top level, Entrance with M.S. collapsible or suitable gate or as directed by engineer-in-charge and RCC stair with hand railing shall be provided. Polished kota stones shall be provided on steps/risers. Precast CC ventilation blocks shall be provided on both sides of collapsible gate at both ends.
- **Finishing:**
 - Inside of filter house, every wall (RCC / brick) & ceiling, at all levels shall be painted with oil bound synthetic washable plastic of approved color shade in 2 coats.
 - Outside the filter house, at every level on RCC /brick wall from 300 mm below ground level to parapet top level, 20 mm thick double coat sand face plaster in C.M. 1:3 shall be provided as per tender specifications. Above this total sand face plaster, 2 coats of Apex paint shall be applied as per tender specification.
 - Inside filter-beds, all internal walls above false floor slab shall be plastered with 20 mm thick water proof smooth cement plaster in C.M. 1:3

- Inside of filter house, on every wall at all levels, oil bound synthetic washable plastic shall be painted in 2 coats
- **Interconnecting approach with other units:**
Filter house shall also be preferably connected with Chlorination sump & pump house through suitable passage.
- **Filter Bypass arrangement:**
For filter bypass arrangement shall be provided for 100% of design flow + losses + 20% overload flow capacity for which sluice gates suitable for total 25 MLD + losses + 20% overload capacity flow handling shall be provided at the bypass point leading into chlorination sump through suitable size pipe line or other such suitable arrangement.

The treated water after passing through chlorination chamber provided at end of filter water channel shall be led to old UGSR of existing WTP (GSR-1) by 800mm dia. MS Pipe line.

- **Backwash Overhead Tank above Filter House**
For the backwashing of filter beds, backwash tank of min. 290 cu.mt. capacity RCC M-30 overhead tank shall be provided on the top of filter house at sufficient elevation for effective backwashing by gravity. Sufficient numbers & size of overflow pipes shall be provided in the backwash tank with minimum clear free board of 500 mm. Backwash tank shall be covered on top by RCC slab with IPS. Sufficient numbers of C.I manhole covers with frames shall also be provided on top of tank and C.I. rungs shall be casted in RCC walls of tank to facilitate entry inside the tank for maintenance. Inside the back wash tank, 50 mm thick water proof IPS shall be provided on bottom and 20 mm thick water proof cement plaster in CM 1:3 on walls.

On the top slab of backwash tank, 50 mm thick IPS shall be provided with 1.00 meter high parapet wall all around. Access to top of backwash tank shall be provided by 1.2 mt. wide RCC staircase from above filter house terrace level. The backwash tank filling pump rising main flanged C.I./DI K-9 pipeline shall be provided from backwash tank filling pumps common header to inlet of tank. One backwash outlet flanged C.I./DI K-9 pipeline shall be provided from the bottom of tank and then pipe line shall be extended up to filter beds, as applicable. A manually operated butterfly valve along with metallic expansion bellows for isolation shall be provided on the backwash tank outlet common header line.

Backwash tank filling pumps shall be including CI /DI K-9 delivery piping of required size and complete with metallic expansion bellows, non-return valve & sluice valve at delivery pipe of min. 150mm dia. The common header shall be of min. 150 mm dia. flanged C.I./D.I. K-9 pipeline provided from backwash tank filling pumps to inlet of overhead backwash tank.

POST CHLORINATION (CHLORINE CONTACT) TANK & PUMP HOUSE

The tank in RCC M-30 shall be designed to receive 25 MLD treated water from treated water channel of filter house having minimum 15 minutes of residence time. Min. 500mm freeboard shall be provided. 1.5 mm thick FRP lining shall be provided in the bottom of top slab. The outlet from CCT to the existing CWR (Clear Water Reservoir / GSR-1) shall be through suitable weir overflow.

The chlorine solution shall be injected in post chlorination tank. The chlorine solution-feeding unit must be detachable for easy maintenance without interrupting the flow of filtered water to the clear water reservoir. The normal dose of chlorine shall be 3.0 mg/L. The diffuser system and baffle walls installed in the chamber shall be designed to guide the incoming water and to ensure a complete diffusion of the chlorine solution before it leaves the chamber.

Dosage of chlorine shall be adjusted such that min. 0.5 PPM FRC shall be maintained at the outlet of CCT / at CWR.

Total inside surface of the sump (wall & floor) shall be provided with white glazed tiles dado & flooring. For walls, glazed tiles shall be fixed on roughened 12 mm thk. waterproof cement plaster backing coat and for floor glazed tiles shall be fixed on roughened 50 mm thk. waterproof IPS.

The tank / sump shall also be used for drawing filtered water for filling backwash tank [2 Nos. (1W + 1S) backwash tank filling pumps of minimum capacity as specified] and providing service water for 2 Nos. (1W + 1S) of min. 25 m³/hr capacity and required head for providing service water for alum solution preparation and at other locations where service water supply by gravity not possible from overhead backwash tank as well as the pre-chlorination and post-chlorination booster pumps. All the pumps shall be installed within suction pit below floor level and meeting the recommended submergence requirement.

A pump house having minimum floor area as specified or higher as required, covered with RCC roof slab at minimum 3.6 meter height shall be constructed over CCT. The super structure shall be in RCC framework consisting of RCC columns, RCC roof beams with brick panels.

The floor of the dry well / superstructure shall be provided with 50 mm thick cement concrete 1:2:4 with 12 mm thick ironite finish. A 1.0 m RCC staircase shall be provided on one side to have access to the floor of dry well from plinth level. The pump house shall be preferably accessible from the filter house through min. 1.5m wide covered passage (covered with RCC slab) provided on top of filtered water channel outside the filter house or such suitable arrangement.

Total outside brickwork of pump house at all levels, shall be 230 mm thick. Brickwork parapet of minimum 600 mm height shall be provided on roof top. The roof shall have six courses of water proofing treatment as per specification and uPVC rainwater down take pipes.

The plinth level of the building shall be 600 mm above formation level. The roof of the building / pump house shall be min. 3.6m above plinth level. Ramp of suitable size and slope duly chequered at top for entrance shall be provided.

The LT panels for plant load of Plot-B (WTP units in plot adjacent to existing GSR-1) can be provided with pump house and suitable area / space shall be provided within pump house for the same. Alternately bidder can also consider these LT panel/s above air blower room or such suitable location / room within Plot-B.

A steel collapsible gate / rolling shutter / MS double door of full height as well as a door shall be provided at entrance. Adequate nos. of aluminum powder coated sliding windows & louvered ventilations shall be provided. Clear 5 mm thk sheet glass shall be provided for windows and wired glass for louvered ventilations.

Monorail with electric hoist shall be provided shall be provided for handling the pumps. Required cut-out in floor of pump house shall be provided separately for each pump for lowering and lifting of pumps and cut-out shall be fully covered in normal course except for removal or lowering of pump to prevent any dirt / foreign particle entering sump /treat water. CI Manhole cover (min. 750mm x 750mm) with CI rungs shall be provided for approaching the bottom of sump / tank.

Plaster, screeding / finishing, painting, etc. shall be as per specifications.

The backwash tank filling pumps of minimum capacity as specified above shall be drawing filtered water from post chlorination / CCT.

Provide service water for 2 Nos. (1W + 1S) each of pre- and post-chlorine booster pumps of recommended capacity as per chlorinator manufacturer. All the pumps shall be installed within suction pit below floor level and meeting the recommended submergence requirement.

The overflow from CCT shall be received in outlet chamber and outlet from chlorination tank shall be through gravity main pipe line of size and MOC as specified above leading to existing clear water reservoir (GSR-1).

DIRTY WATER COLLECTION SUMP & PUMP HOUSE:

The arrangement for discharging dirty back wash water of filter and sludge from clarifiers etc. and including plant drain should be provided up to proposed dirty water sump. All RCC chambers for RCC pipes shall have to be constructed with the C.I. steps and C.I. frame and cover of suitable size as directed by the Engineer-in-charge.

The sump shall be constructed in RCC M-30 with inside and outside plaster and bottom flooring / screeding, painting, etc. as per specifications of min. 300m³ capacity. The sump shall be preferably constructed in rectangular / square area configuration only adjoining to filter house due to space constrain at site. Baffle wall arrangement shall be provided in front of dirty wash water pipe entering the sump to break velocity and minimize turbulence in the sump. The floor of the sump shall be provided with gentle slope towards suction pit and suction pit of required depth to provide backwash recycling pumps with required minimum submergence shall be provided. The FSL of sump shall be below the BOP of dirty backwash pipe / dirty backwash channel to ensure that the channel / pipes are completely drained after each backwash.

The wastewater generated from WTP is also proposed to be recycled back into the inlet chamber through a controlled pumping arrangement. 3 Nos. (2W + 1S) dirty water recycling pumps of submersible non-clog type of suitable capacity (min. 70 m³/hr & suitable head) with required isolation sluice valve, NRV at each delivery line and pump header / rising main piping in size and MOC as specified above up to inlet chamber of WTP shall be provided. Additionally a tapping shall be provided from this header line with an isolation sluice valve along with metallic expansion bellows on tapping to divert the dirty water into existing dirty water disposal open drain of existing plant for onwards disposal to storm water drain and also an isolation sluice valve along with metallic expansion bellows shall be provided on header line after tapping point to control the flow as required for recycling and disposal to existing drain.

Suitable lifting arrangement consisting monorail and electric hoist with required operating platforms shall be provided. Handrail shall be provided all around the sump and for all operating platforms.

ADMINISTRATION BUILDING CUM CHEMICAL HOUSE / CHLORINATION ROOM AIR BLOWER ROOM (TWO STOREY, MIN. 160 SQM AREA EACH FLOOR)

➤ **Planning, Elevation & Details:**

The administration building cum chemical house fulfilling the following requirement and comprising of ground floor and first floor shall be constructed with following minimum area requirement. Plan & Elevation of this building shall be got approved from Client. Internal plan area may be changed as per suitability of Client within the given total plan area and if required higher area of building shall be provided by bidder to meet the specified requirements.

The building fulfilling the following requirement shall be constructed with following minimum area requirement (the room arrangement and area of GF & FF can be varied fulfilling requirement to provide min. specified area together for both floors as a minimum or higher as per requirement shall be provided):

Ground Floor (160 Sq. mt.) Min. Height 4.20m	<ul style="list-style-type: none"> ➤ Chlorinator Room & Chlorine Tonner Room ➤ LT / MCC room ➤ Chemical (Alum/PAC) Store Room (if required) ➤ Toilet (Separate for Men & Women), Pantry Area & other utilities, Passage & reception & other as per client requirement
First Floor (160 Sq. mt.) Height min. 4.0 m for rooms and min. 5.0 m for dosing area	<ul style="list-style-type: none"> ➤ Chemical (PAC) Dosing tanks ➤ Laboratory ➤ Control Room (PLC /SCADA)

Note: Chlorine scrubber otta / platform area shall be provided separate (i.e. not included in above) as required by scrubber vendor.

- All RCC work of foundations & super-structure of Chemical House shall be of minimum M-30 grade, including PAC tanks.
- The clear height of ground floor and first floor shall be minimum as specified in above table.
- Total outside brickwork of admin cum chemical house at all levels, shall be 230 mm thick, as per tender specifications. Internal brick walls shall be 230/115 mm thick brick walls as per tender conditions at ground floor, first floor level & for toilet block at first floor level. At first floor level, internal partition of all rooms shall be made with 1.0 mt. high brick wall & remaining height up to false ceiling of rooms with powder coated aluminum section framed fixed / sliding glass panels / windows as approved by Engineer-in-charge.

➤ **Ground Floor level:**

- Chemical / PAC/ Alum store and dosing room shall be so arranged for ease of alum handling so as to preferably permit lifting of dry Chemical by electric hoist (min. 1T cap.) from storage room to each of the dosing tanks. Suitable cutout shall be provided in the common wall for the same. Chemical / Alum dosing facility with electrically operated lifting arrangement of 1T capacity with monorail & lifting basket shall be provided.
- If required by client if alum is planned for use, one at least 1.0m x 1.0m size through duct opening shall be provided in plan from Chemical store at ground floor level to Chemical dosing tanks at first floor for lifting of dry Chemical by electric chain hoist. This duct opening shall be closed from all sides by at least 230 mm th. Brick walls or by handrail of min. 750mm height.
- In men's toilet block, two numbers long & flat back type urinals, one number oval shaped wash-basins with granite stone platform, & one European Type W.C. where as in women's toilet block one number oval shaped wash-basins with granite stone platform, one European Type W.C. are to be provided of approved size, colour and make. Inside both W.C. and in passage area of toilet block, dado upto ceiling height with glazed tiles of approved size, make & colour shall be fixed. All uPVC piping of toilet block shall be concealed. All waste pipes shall be of uPVC with sufficient size. Sufficient numbers of nahn trap, G.T., inspection chambers shall be provided for drainage up to soak-pit, by providing & laying stoneware pipeline. Doors of W.C. shall be of PVC section with door shutter fitted in granite stone framing. Sufficient louvered glass ventilation of aluminum section shall be provided in toilet block. Total toilet area shall be planned / designed as per modern concept

➤ **First Floor level:**

- In laboratory, 1.0 meter wide platform shall be provided at 800 mm height from floor, on full two sides of room at right angle, with 2 Nos. S.S. sinks. Polished kota stone platform of minimum 25

mm thickness shall be provided on top of kota stone slab and vertical sandwich type supports at sufficient distance. Glazed tiles dado of 1.0m height above the platform shall be provided for total length of platform. Below the platform, in total length Aluminium section cupboard shutters with framing shall be provided in approved make & colour. Polished vitrified tiles (granamite) flooring of approved size (min. 24" x 24"), make & colour shall be provided in laboratory. Sufficient numbers of plug points with switches of 5/15 Amp. Shall be provided at sill level on the platform for laboratory testing instruments.

Required testing shall be carried out in proposed plant laboratory and all required Equipment, Instruments, Chemicals, Reagents, Glassware, etc. shall be provided by bidder. The other testing shall be carried out in central laboratory of RMC as required.

Laboratory instrument shall be provided as per below table as a minimum:

Sr. No.	Instrument	Qty.
1.	Table Top Turbidity Meter	01
2.	Table Top TDS Meter	01
3.	Hand Held TDS Meter	01
4.	Table Top pH Meter	01
5.	Hand Held pH Meter	01
6.	Autoclave (300 X 625 mm)	01
7.	Incubator	01
8.	300 liter double door refrigerator	01
9.	5 liter Distillation unit (MOC-SS)	01

- False ceiling with Plaster of Paris shall be provided in Laboratory & Control Room at first floor of chemical house. Design of false ceiling with cornices all around the ceiling shall be got approved from Client. False ceiling shall be supported by G.I. angle frames. Necessary cut-outs for electrical/ lighting fittings shall also be provided as per the given number of lighting fittings. All the internal wiring and fittings shall be concealed. Lighting switchboard shall be decorative PVC type. Given numbers of twin tube light fixtures complete in all respect shall be provided & fixed in false ceiling.
- Three numbers (2W (1 Wkg & 1 preparation) + 1S) of Alum / PAC dosing tanks shall be provided of suitable capacity, each having 8 hours HRT and to dose 10% alum solution at a maximum rate of 50 mg/L PAC/ alum dosing with min. 500mm free board to treat raw water of 25 MLD + 4% losses (each tank shall be min. 4.75m³ capacity). To dose the solution, 3 numbers (2W+1S) of pumps of required capacity (with min. 20% spare capacity) shall be provided along with bypass piping for gravity dosing. The average dose rate shall be 30 mg/l @ 10% w/v solution strength (each pump shall be min. 800LPH capacity). The alum dose shall be manually adjusted based on dose rate required as per jar test.

Overflow and drain arrangement shall be provided in each dosing tank with suitable disposal. The tank floor shall have conical hopper shape or shall have drain pit with adequate slope in floor for complete draining of the tank. Dissolving basket / suitable arrangement shall be provided in each tank.

The dilution and homogenation of the chemical/ PAC shall be effected by means of Stirrer type agitator with gear box having stainless steel (SS-304) shaft and blades.

- Chemical/ PAC tanks shall be provided with continuous RCC platform, at operating level. The level of platform shall be such that the unloading of chemical from platform to dosing tank is operation friendly and 600 mm ht. shall be between top of platform and top of dosing tank. 1.0 meter high handrailing shall be provided on side of platform and RCC stair to platform. Inside the

total surface of PAC solution preparation tanks as well as dosing tanks, 3 mm thk. Epoxy lining shall be applied on one coat of 20 mm thk. Cement plaster on walls / 50 mm thk. IPS on floor, after successful hydraulic testing of tanks.

- Further, the chemical/PAC dosing pipelines are to be fed by 3 Nos. (2W + 1S) PAC/Alum dosing pumps with gravity bypass arrangement (from gravity header to each dosing line with isolation valve) in stilling chamber & flash mixer with minimum bends/specials to avoid problem of chocking of pipeline and shall be without “U” bends laid on pipe rack from first floor dosing room to flash mixer unit. The suction header shall be provided with isolation valves at outlet of each tank, suction header pipe, isolation valve & strainer at suction of each dosing pump and interconnecting valves between each pump suction. Similarly, the discharge of dosing pump shall be provided with non-return valve and isolation valves at delivery of each pump and the delivery header shall be with interconnecting valves between two pumps with two separate / independent delivery piping up to flash mixer. Moreover, the provision for nipples/valves etc. for air scour & water pressure jet must be made in the pipelines. The contractor may provide pressure water line for removal of chocking in chemical / PAC line with arrangement of pipe line/water tapings etc.
- It is must to provide sufficient height of bottom of dosing tank to get minimum required head for chemical / PAC dosing liquid at minimum level to fed gravity in stilling chamber & flash mixer during the failure of the dosing pump.

➤ **Staircase cabin:**

- RCC staircase of at least 1.20 meter width shall be provided from first floor to terrace of chemical house with cabin having RCC roof. On all steps of stair, polished granite stone flooring of good quality & pattern shall be provided on risers & treads. 1.00 meter high Stainless-Steel railing shall be provided on stair-case. In stair-case portion, sufficient size and numbers of fixed glass ventilation with aluminum framing shall be provided

➤ **Flooring, Finishing, & roof slab water proofing:**

- Rough Kota stone flooring shall be provided in alum store area (if alum store provided) and for air blower room. Polished vitrified tiles (granamite) flooring (approved make, colour& size (min. 24” x 24”) in laboratory, control room and all passage. Toilet block shall be provided with ceramic tiles flooring. All staircases shall be provided with polished kotastone flooring of good quality and size as approved by engineer-in-charge. IPS flooring shall be provided for rest all rooms / area. All ground floor flooring shall be provided on 100 mm th. RCC (1:2:4) with nominal reinforcement.

- Inside & Outside Plaster and Paint shall be as per tender specifications.

- On terrace Indian type brickbat coba / china mosaic waterproofing shall be provided by giving proper slopes and 150 mm dia. uPVC rain water pipes shall be provided in sufficient numbers to drain out the rain water.

➤ **Doors, Windows & ventilations:**

- All windows of Chemical house shall be provided with powder coated good quality section made aluminum sliding / fixed windows as approved by Engineer-in-charge.
- Powder coated aluminum section louvered glass ventilations shall be provided in Chemical store area at ground floor and Chemical dosing tank platform area at first floor such that at least 20% of floor area is provided for ventilation openings.
- Plain glass shall be 5 mm thick for glazing of all windows & wired glass for all ventilations. All windows shall be provided with standard fixtures & fittings for aluminum windows, and exterior windows with sun control film.

- All windows & ventilations at all levels shall be provided with RCC lintel & 600 mm wide chhajja.
- **Water pipelines: (uPVC)**
- Arrangement of water supply for drinking, toilet block, etc. and solution making purpose within chemical house shall be provided by tapping from back wash over head tank pipe line. Suitable valve arrangement shall be provided. The arrangement of water supply connection should be such that the water filling time of chemical tank should not be more than 15-20 minutes. Additionally the provision to fill over head tanks and dosing tanks from service water pumps (provided as chlorination sump) shall also be provided as well as for locations / tanks or such service water requirement where backwash water cannot reach by gravity.
- PLC / SCADA system including control panel shall be provided in control room to monitor and control the entire proposed WTP as per process operation and instrumentation philosophy provided in the tender specifications. SCADA furniture including console units, operator tables (min. 2 nos.) and operator chairs (min. 2-3 nos.) shall be provided. Control room shall be provided with min. 2nos. of 1.5 T capacity split type air conditioners of 5-Star rating. Control room shall be provided with false ceiling with recess mounted decorative mirror optic light fittings. PLC based control panel shall be installed over cable trenches (min. 1-1.2m deep and min. 1m wide) in required arrangement with cable trays, etc. False floor shall be provided if required. Venetian blinds shall be provided for all windows of control room.
- Adequate furniture including minimum one table & three chairs shall be provided at chemical house. Adequate nos. of ceiling fans shall be provided for various rooms of the building (LT room ,control room, laboratory, store room ,etc. as applicable).
- Drainage disposal facility shall be provided as per site requirement.
- **Chlorination room & chlorine tonner room**

The chlorinators and chlorine tonners shall be installed in chlorination cum tonner room at ground floor.

Chlorinators in required numbers and of minimum capacity or higher as required as per design shall be provided along with specified number of chlorine tonner as mentioned specified. The Pre- & Post-Chlorinators shall be capable of dosing minimum 3-5 mg/l Chlorine at the maximum design flow. 2 Nos. (1W + 1S) each of Pre- & Post-Chlorine booster pumps shall be provided of capacity & head as per the design standard of chlorinator supplier. Chlorinator along with booster pumps (with required provision for booster water from backwash tank or suitable location, alternately as specified above, the booster pumps shall be provided in chlorination sump) shall be arranged in chlorinator room. One no. of Neutralization tank shall be provided adjacent to chlorinator room for treatment of leaked chlorine tonner. Automatic chlorine leak absorption system (Chlorine scrubber) shall be provided as per specifications. Suitable safety equipment shall be installed in the chlorinator room as per mechanical specifications. Rolling shutter with ramp / otta shall be provided for chlorine room.

Chlorination System

Dose of chlorine	:	Pre-Chlorination: upto 5 ppm Post-Chlorination: 3-5 ppm to maintain min. 0.5ppm FRC at CCT outlet / disposal point at existing UGSR inlet
No. of chlorinator	:	Pre: 2 nos. (1W + 1S) Post: 2 nos. (1W + 1S)
Type of chlorinator	:	Vacuum type, wall mounted
Capacity of chlorinator	:	Pre: Min. 10.0 Kg/hr capacity

		Post: Min. 10.0 Kg/Hr capacity
Chlorine Leak Detection System	:	Required, min. 3 nos., 2 each at chlorine tonner room and 1 no. at chlorinator room with alarm
Chlrine Scrubber	:	Required, for all working / installed tonners in tonner room
Auto-shut-off valve	:	2 Nos., 1 each for pre-chlrination and post-chlorination working header or as directed by enginer-in-charge

Chlorine Tonners

No. of tonners (Common for Pre- & Post-chlorinators)	Only filled tonners shall be Free Supply by RMC (4 Nos. to be placed on roller support in tonner room and additional as per RMC requirement as store outside if required or as per requirement). To be installed/operated & maintained by bidder as per norms.
Capacity of each tonners	App. 900 Kg.

The dosing line of each chlorinator (pre- & post) shall be interconnected with isolation valves (one between each of two chlorinators) for interchangeability of dosing as required. The pre-chlorination header line shall be provided upto inlet chamber and post-chlorination line upto chlorination chamber.

Tonner room shall be suitable to accommodate chlorine tonners with required connection to pre- & post-chlorinators. EOT crane with electric hoist with tonner handling clamp and min. 3T capacity suspended weighing scale shall be provided for tonner handling.

Existing EOT crane / hoist in existing chlorinator room shall be utilized for tonner handling.

The contractor shall have to make total 4 Nos. tonner foundation (250-300mm high) with roller supports in chlorine tonner room, by keeping the minimum clear distance as 0.9-1.0 m between two tonners to place online duty and standby drums. Suitable ramp shall be provided for drum loading and unloading for direct handling by the crane.

Moreover the contractor shall have to provide and erect 2 Nos. each of pressure feed vacuum type wall mounted chlorinators for pre- & post-chlorination system in the chlorinator room adjoining to tonner room aloing with specified no. of pre- and post-chlorine booster pumps. The required civil work and other allied arrangement including necessary RCC structure for mounting the chlorinator shall be provided by bidder.

Chlorine leak detectors shall be provided in tonner room (min. 2 nos.) and at chlorinator room (min. 1 no.). Adequate nos. of Exhaust fans at floor level shall be provided.

Chlorine scrubber with required cover hood for each of the tonners installed within chlorine tonner room, all required pumps & blowers (1W + 1S configuration), piping, valves, accessories, etc. complete in all respects with leakage sensing, and fully automatic operation shall be provided. The PLC based control panel for scrubbing system shall be provided and hooked up to plant SCADA for remote monitoring and alarms

One Neutralization tank of reinforced concrete shall be provided near chlorination facility for emergency use in case of chlorine scrubber failure. The capacity should be adequate to neutralize two nos. of full chlorine tonners. The tank should be suitably projected above the floor to prevent the entry of floor washings. It should be filled with suitable neutralizing agent such as caustic soda

(NaOH). The opening of the tank should permit to place the chlorine tonner into it in any position. It's top should be covered with some thin plywood type cover which can be broken up easily in the emergency by the tonner itself. The tank should be lined from inside with suitable material so that the chemicals may not have any aggressive effect. The position of the tank should be such that the tonner can be dumped into the tank easily by using the EOT crane provided for tonner handling.

The chlorination system, layout and arrangement shall meet all statutory approvals.

AIR BLOWER ROOM (MIN. 50 AQM. AREA)

Air Blower room of required size & min. 4.5m clear height shall be provided at Plot-B near filter house on ground floor to install 2 Nos. (1W + 1S) No. of Air Scour Blowers in RCC frame structure as per the Civil Specifications. Total outside brickwork of admin cum chemical house at all levels, shall be 230 mm thick, as per tender specifications. The room / approach staircase shall be provided with rough kota stone flooring and with aluminium section doors, windows, ventilators, exhaust fans (Min. 2 Nos.), etc. Inside & outside plaster, painting, roof slab water proofing, etc. shall be as per specifications. Monorail with electric hoist shall be provided for loading and unloading of blowers. Rest all other requirements shall be generally as per administration building / tender specifications. Min. 1m clearance shall be provide all around and between two blowers or higher as recommended by blower manufacturer. Rolling shutter / Double Door full height shutter with ramp / otta shall be provided for blower room.

HT SUBSTATION (SWITCHYARD, HT ROOM, MAIN LT ROOM & TRANSFORMER YARD)

The Electrical HT Substation shall be provided as per the requirements specified in electrical section / specifications / design & statutory requirements.

HT room (if applicable) shall be provided with necessary cable trenches (min. 1.2m deep and min. 1.5m wide), cable trays, etc. RMU foundation shall be provided near the existing substation (near pump house of GSR-1) at locaton as directed by engineer-in-charge. Main LT Panels and it's associated power factor correction panels shall be placed in exisintg building / room of GSR-2 or at locaton as directed by engineer-in-charge.

Switch yard(s) for transformers & two/four pole structure with gate and fencing or at locaton as directed by engineer-in-charge.

A transformer yard shall be provided adjacent to the HT sub-station for receiving H.T. power along with transformers, transformer foundations, necessary soil/gravel filling, fencing, gates, etc. as per electrical requirements / specifications.

RCC foundation of suitable size and min. 600mm above FGL shall be provided for DG set near the existing substation / main LT room.

MECHANICAL WORKS:

Following are the major items shall be included in the scope of work as a minimum and shall be as per the minimum capacity specified in tender and as per detailed specifications for mechanical works:

- One No. Flash Mixer
- One No. Clari-Flocculaotr
- Filter Media & Nozzles – 1 Lot (min. 10% media and 5% nozzles shall be supplied as spare)
- Two Nos. (1W + 1S) Air Scour Blowers
- Two Nos. (1W + 1S) submersible centrifugal type backwash tank filling pumps
- Two Nos. (1W + 1S) submersible centrifugal type GSR-1 tank/reservoir filling pumps (installed in existing reservoir GSR-1)

- Two Nos. (1W + 1S) submersible centrifugal / monoblock type service water pumps (for chemical solution preparation and other application where water from overhead backwash tank cannot be supplied)
- Two Nos. (1W + 1S) submersible non-clog type dirty water recycle pumps (Recycle to inlet unit / disposal to existing drain channel)
- Two Nos. (1W + 1S) PAC/Alum Dosing Pumps
- Two Nos. PAC/Alum Dosing Tank Agitators
- Dewatering Pumps: 1 no. for filter house (submersible monoblock or end suction centrifugal type)
- Two Sets (1W + 1S) of vacuum type wall mounted chlorinators for Pre-chlorination system including 2 Nos. (1W + 1S) of chlorine booster pumps
- Two Sets (1W + 1S) of vacuum type wall mounted chlorinators for Post-chlorination system including 2 Nos. (1W + 1S) of chlorine booster pumps
- Chlorine Scrubber System to handle chlorine tonner leakage
- Material Handling (EOT/HOT Crane, Ele. Hoist, CPB, etc.) systems as specified
- Gates / Valves / Piping as specified and as per process requirement.
- 2 Nos. Platform Type Digital Weighing Scales, 1 No. for filled chlorine tonner weighing (min. 3.0T capacity) at chlorination room & 1 No. for other general use (0.5T Capacity)

ELECTRICAL SCOPE OF WORKS FOR WTP :

- Scope of electrical work includes, existing 11KV HT power to be utilized obtained from existing 11KV substation near Plot-A housing the power supply company and client GOD structures. Bidder shall be responsible for required upgradation / modification in this existing substation including required liaisoning with power supply company for enhanced demand (existing demand plus the additional demand as required for proposed plan load) and obtaining required approval from electrical inspector and any such other statutory approval for entire electrical installation.
- Replacement of existing 11KV HT cable laid between the existing substation GOD structure or such near Plot-A to the 11KV existing substation near Pump House-1 GOD structure (approx. 150RM or as required as per site condition). The scope shall also include providing single breaker RMU with required foundation at 11KV substation near Plot-A, if required as per electrical inspector requirement, including required indoor/outdoor HT termination kit and HT Cable (in this case the HT cable shall be provided between RMC GOD structure to RMU and from replacement of existing HT cable to be considered from RMU to the existing 11KV GOD structure near pump house-1).
- SITC of 3way RMU HT VCB Panel (1 no Incoming & 2 nos. Outgoing,) shall be provided at existing substation near pump house-1 or location as directed by engineer-in-charge in nearby vicinity as per site requirement to distribute power for existing HT panel @ pump house-1 and the proposed substation (incomer of four pole of structure) from existing GOD structure. .
- SITC of HT cable as under as a minimum:
 - ✓ from existing two pole structure located at existing working Pump House (PH)-I to incomer of proposed outdoor 3way RMU HT VCB Panel
 - ✓ from one outgoing and shall be connected to incomer of existing HT Panel located at PH-1
 - ✓ from another outgoing shall be feeding power to proposed plant substation / four pole structure)
 - ✓ from GOD/Four pole structure to HT side of each of the two distribution transformers of proposed plant.
- The client HT substation (GOD Structure, HT Breaker Panel, etc. as applicable) shall be provided adjacent to / in proximity of electrical inspector / statutory requirements. In case if the substation is located away from the point of supply by power supply company and if breaker panel / RMU is required to be provided as per statutory norms near client GOD structure, the same shall be provided by bidder at no extra cost (this breaker / RMU shall be in addition to scope of work for electrical works mentioned elsewhere in tender).

- The Electrical HT Substation of client shall be provided as per the requirements specified in electrical section / specifications / design & as per electrical inspector / statutory requirements.
- Accordingly, the scope of electrical work includes required HT cables up-to proposed WTP sub-station and termination to proposed 11KV Sub-station (Switch yard, Transformer Yard, HT Room with 11KV Three Breaker Panel (if required as per Electrical Inspector / Statutory norms or such to feed downstream load / transformers of proposed plant), LT Panels (PCC/PMCC, MCCs, APFCs, PDBs, LDBs etc.), Push Buttons, Cable and Cables Trays, Earthing, Motors, Indoor & Outdoor lighting system within specified area of WTP campus and others electrical accessories to complete the Plant. Obtaining required statutory approvals, Liasoning for obtaining power, etc.
- PMCC panel of proposed plant along with APFC panels shall be at located at room near / adjacent to existing new Pump House-2. PMCC shall be also with one no. min. 200A MCCB feeder for MCC-1 Panel located at CCT cum panel Room / LT panel catwring to for Plot-B load , one no. min. 32/63A MCCB for MCC-2 Panel located at Admin building to cater to Plot-A load, 2nos. min. 45kW Star-delta starter for Sub. Pump set to be provided in existing GSR-1 to lift clear water from GSR-1 to existing GSR-2 (GSR-2 tank filling pump), two no. min. 250A MCCB Spare feeders (one on each side of bus coupler), etc. complete.
- Switch yard(s) for four pole structure/s (1 Set of Four Pole Structure with 1No. Incoming & 2Nos. Outgoing,) and transformers yard with gate and fencing. Switchyard and transformer yard for proposed plant shall be provided near to exisintg DG Shed / GSR-1 or at location at directed by engineer-in-charge along with GOD structure (Four Pole), transformers, transformer, required GOD structure and transformer foundations, necessary soil/gravel filling, fencing, gates etc.
- It shall be the Contractor's responsibility to assist client to strengthen the existing / obtain adequate HT power from Power Supply Co. based on the total maximum demand load and obtain statutory approval / NOC from electrical Inspector / Statutory Authority for entire electrical installation (including for DG Set). The Employer will pay the charges & fees for obtaining the above connection whereas necessary Liasoning work for the same shall be done by the Contractor in consultation with Client's Engineer.
- Two nos. of Transformers (1W + 1S), each to cater to entire proposed WTP with suitable overload capacity as specified elsewhere shall be provided. Suitable cable boxes for H.T. and cable boxes / bus ducting for L.T. side be provided.

The entire Plant shall be operated on 415 V, 3-Phase, 50 Hz, 4-Wire system. The Contractor's Scope of Work shall include the following as a minimum:

- Strengthening of existing 11KV HT power to be utilized for proposed plant work requirement & rectification, if required for client existing two pole structure located near PSC two pole structure, including SITC of RMU HT VCB Panel, if required.
- Outdoor type, 11kV motorized Three way (1 Incoming + 2 Outgoing) Ring Main Unit (RMU) complete with 3VCB and FPI as per IS.
- HT Cable with Indoor / Outdoor Termination Kits, as applicable including HT Cable termination Kit for "Source" & as required for proposed scheme.
- HT Substation including Outdoor 3way RMU (One Incoming & 2 Outgoing) or higher as per statutory requirement, 4-Pole Structure/s (1Set-1no Incoming & 2 Outgoing), Transformers, Power Control Centre / Power cum Motor Control center, etc. complete.
- Distribution Transformers with transformer yard. Transformer shall be with Off Circuit Tap Changer (OCTC) in 100% standby configuration.
- LT Panels (PCC / PMCC / MCCs / APFCs / LDBs / PDBs etc. as applicable). LT Panels shall be distributed at near pump house-2 room, at building @ Plot-A and at building @Plot-B as required.
- Automatic Power Factor Correction Panel. Min. 12 steps or higher as required as per detailed specification, 2 Sets (separate for each bus section as per connected load)

- MV / LT Motors as applicable
- LT Cabling (Power, Control. Etc.), Double Compression Ni-Plated Brass Cable Glands, Fittings & Accessories.
- GI / FRP Cable Trays & Fittings & Accessories
- Earthing System (Chemical Earthing) for Electrical equipment as well as Instruments
- Internal Lighting in Buildings (Energy Eff. LED Type) to maintain lux levels as per specifications
- External Lighting / Road & Pathway Lighting (Energy Eff. LED Type) to maintain lux levels as per specifications
- DG Set/s of required rating to cater to 100% of treatment plant working load @ 80% loading of DG Set along with AMF / AMF cum Synchronizing Panel to operate entire working load of WTP on DG Set in case of power failure. (Shall be Min. 320KVA rating or higher as required). DG Set foundation of suitable size and as recommended by DG Set vendor shall be provided near proposed substation or near room adjacent to pump house -2 housing PMCC panel or at location nearby as directed by engineer-in-charge.
- Internal & other Electrification works
 - 1200mm sweep ceiling fan at required locations.
 - 450mm dia. exhaust fans at required locations except for toilet blocks. 300mm dia. exhaust fans for toilet blocks.
 - Power points and other requirements at various locations.
- Local Push Button Stations near respective Drives & Junction Box etc. along with complete all required accessories and hardware, etc.
- Necessary Structure Steels as required.
- Safety Accessories as required (Fire extinguishers, sand filled fire bucket with stand, first aid box, first aid / safety charts & sign boards, battery operated emergency lamp, rubber mats as required, hand gloves as required, etc.)
- Electrical & instrumentation (Power, control, Signal & earthing cables) to be laid in cable tray for indoor area and to be laid on overhead cable trays (min. 3m clear height and for road crossing shall be min. 4.5m clear height) or in cable trench for outdoor area. For outdoor area, cables laid direct buried in ground are not permitted.
- Any other item / accessories required for successful completion of the project.

The Contractor shall design/execute the System as per standard specifications, I.E. Rules and Regulations, requirements of State Electricity Board and other local Authorities and actual site conditions.

Bidder shall refer electrical specifications for further requirements / detailed specifications.

INSTRUMENTATION & AUTOMATION WITH PLC/SCADA SCOPE OF WORK:

The WTP shall be designed for monitoring and for automatic operation where specified in tender through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI) as specified in tender specifications. The contractor shall provide necessary and adequate automation & instrumentation for the same. Provision shall also be made to operate each Unit of the Plant manually, if required by operator.

WTP Plant shall be designed for monitoring and for automatic operation including level based auto operation of pumps, automatic backwash operation of filter beds, etc. through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI).

Salient features of the proposed System shall be as follows:

- Dynamic display of all Units, Equipment's and Drives shall be available on SCADA / HMI Screen.

- Auto/Manual operation of each Drive shall be made by selecting a Soft Switch on SCADA / HMI Screen.
- In Auto mode, each Drive shall operate based on preset sequence and interlock.
- In Manual mode, each drive shall be operated in Local/Remote mode by selecting a selector switch at associated LT Panel. In Local mode, each Drive shall be operated from the Local Push Button Station (LPBS) located nearby and in remote mode shall operate through START PB at starter of associated LT Panel. In auto mode selection at starter, operation from LPBS & Starter PB shall be disabled and each drive shall be operated from PLC as per selection of a L/R Soft Switch on SCADA Screen. In Local mode, each Drive shall be operated manually by operator through soft PB at SCADA console from PLC. In remote mode at SCADA console, the drive shall operate as per programmed logic as finalized during detailed engineering. Also Working/Standby selection of Drives shall be done by selecting a Soft Switch on SCADA screen.

Similarly it shall be also possible to operate (open & close) motorized valves/ gates from HMI / SCADA as per electric drive operation philosophy.

- Run/Trip indication of all Drives shall be displayed on SCADA screen.
- Open/Close indication of all Auto Gates and Auto Valves shall be displayed on SCADA Screen.
- Selector switch status at starter / electric actuator (A/M or L/R as applicable) shall be displayed on SCADA screen.
- All pumps / equipment, electric actuator operated valves / gates, etc. shall be possible to operate and monitor from SCADA.
- Annunciation & Alarm facility shall be available in PLC/SCADA. In the event of a Fault, the symbol representing the Equipment/Drive shall continue flashing on SCADA Screen with Equipment/Drive description appearing at bottom of the SCADA Screen and electric Hooter shall continue blowing until the Fault Alarm is acknowledged.
- Process control, open or closed loop, for various process parameters, as specified or required as per process design
- Data logging of Running Hours of each Drive, Alarm and Historical Trends of monitored Parameters etc. shall be envisaged in SCADA. Drives shall be possible to operate on OH (operating hours) basis as well as on level or such process interlock basis in auto mode.

Working pumps shall be turned on & off based on operating hours (pump with lowest OH will start as per starting sequence and during turning off the pump will highest OH will turn off as per stopping sequence) or will run on a per operator selected pump at HMI/SCASDA in starting & stopping sequence.

- HT & LT Breaker status monitoring and power status monitoring through multifunction meters / ACB / VCB / Communication ports (RS-485 Modbus or such) of all applicable feeders & drives & starters with trend. Also it shall be possible to have remote operation of breakers (ACB / VCB).
- Power monitoring with daily total and per MLD power consumption details and other power parameter details (power factor, daily max. demand, etc.) for incomer power and power monitoring with per day power consumed by each equipment & total power consumed & total power consumed per MLD for set of working equipment for a given application for major plant / PS equipment like Air Blowers, Tr. Water pumps, etc. for starters of ratings where MFM are provided.
- Report generation on daily, weekly and monthly basis from SCADA for submission to client including all parameters and analysis data specified in tender
- SCADA software Runtime with min. 25 display screens / suitable tags at WTP control room

The following shall also form the scope of work of the bidder:

- The bidder shall select service provider for telemetry system after checking the feasibility and signal strength in the area of coverage of this contract and obtain prior approval from Client's Engineer for the selected service provider.
- All software license shall be registered in the name of Client.

- All equipment supplied with PLC as part of equipment control panel shall be suitable and provided with required communication port or if equipment supplied with control panel without PLC shall be provided with required potential free contacts or suitable to hook up with plant PLC to monitor all these equipment status at plant SCADA in STP control room.
- Working hours of all equipment like pumps, blowers, DG Set, etc. shall be displayed and logged in SCADA system and shall be part of reporting system to be submitted to client. Also all preventive maintenance based on working hours shall be scheduled in SCADA system as recommended by equipment manufacturer. The SCADA logic and screens and report formats shall be got approved by client's engineer and shall be modified as per client requirement as required.

Entire WTP as per proposed automation work shall be possible to be monitored and controlled from proposed WTP control Room. Further remote data transmission facility (over 4G/5G GPRS Modem) shall be provided to transmit data at central SCADA / Office of Client.

Water Treatment Plant (25MLD)

Bidder shall provide following instruments & automation at WTP as a minimum in addition to other as specified elsewhere in tender specifications (Refer instrumentation chapter for detailed specifications):

- pH analyzer at inlet / Stilling chamber and at CCT / Clear Water Reservoir / Final treated water outlet for monitoring incoming raw water and supply water quality.
- Free Chlorine analyzer at Clariflocculator outlet channel / Filter Inlet common channel & at CCT/Clear Water Reservoir / Final treated water outlet for monitoring free chlorine for pre-chlorination in raw water and post-chlorination in supply water (along with required pH sensor for pH compensation).
- Turbidity analyzer at inlet / stilling chamber for monitoring raw water quality, at clarifier outlet / Filter Inlet common channel to monitor clarifier performance, and at CCT / Clear Water Reservoir / Final treated water outlet for monitoring supply water quality.
- Electro-magnetic type flow meter at Plant incoming line (600 mm dia.) and at backwash tank filling pump common discharge header, for monitoring incoming water and backwash & service water consumption.
- Ultrasonic type level transmitter (sensor with min. 5m cables or higher as required and remote type transmitter) shall be provided for all tanks / sumps / reservoirs (including all chemical dosing tanks), Existing Sump/GSR for monitoring levels and level based auto operation / interlocking of pumps i.e. for overhead backwash tank, CCT / backwash sump, dirty water sump, PAC dosing tanks, any other tank/sump as per design, etc.
- Hydrostatic type level transmitters for level monitoring over each filter bed and associated filter outlet weir for Loss of Head & Rate of Flow measurement (calculated at PLC/SCADA) as per application requirement for monitoring the clogging condition with alarm and auto backwash operation of filter beds.
- Displacer/Float type Low Level Switches shall be provided for all tanks / sumps / reservoirs (including all chemical dosing tanks) for dry run protection of pumps / equipment, as applicable. Additionally all filter beds shall be provided with high-high level switch for alarm and all dewatering pumps shall be provided with low and high level switches for auto operation of dewatering pumps.
- Pressure Gauges shall be provided at delivery of each pump, blower, compressor, etc. All pressure gauges shall be glycerin filled type and for chemical / sludge / dirty water service shall be diaphragm type.
- Pressure Transmitters shall be provided at common header of air scouring blowers for equipment performance monitoring.
- Filter console panel with 10" color touch screen HMI– Min. 1 No. (One no. between three no. filter beds).
- PLC & SCADA system at main control room.

- Laboratory instruments as specified.
- Required cables (power, signal, control, communication, etc.), Double compression type cable glands of Ni-plated brass & accessories, GI perforated cable trays & accessories, electronic earthing and earth strips / wires, etc. as required to complete the work.
- Instrument Cables (Power / Control / Signal / Communication/RTD Cable) & Cable Trays, Instrument Earthing System, Cable Glands, Junction Boxes & Accessories, etc.
- Any other as required to complete the work in all respects.

Bidder may consider providing multi-channel controllers for various process analyzers to achieve ease of monitoring and optimizing cabling requirement subject to sensor cable length not exceeding 50m length from the controller. Bidder may also consider providing instruments with communication port (Ethernet / Modbus / other suitable) with necessary converters & communication modules for communication with PLC system providing benefit of cable optimization and enabling transfer of monitoring as well as diagnostic data to control room aiding for preventive maintenance measures during O&M.

The process logic shall be submitted by bidder for review and approval during detailed engineering and ensuring the application of above instruments for monitoring and control of various process parameters based on each application and to achieve the process control and desired quality at various stages of treatment.

INTERCONNECTING PIPING

All interconnecting Piping, Gates, Valves, Specials and other appurtenances, auxiliaries and accessories required as per Process Design and Scope of Work. In case of Rising Mains, thrust blocks shall be provided wherever required. The material of construction for major interconnecting Piping for general guide lines unless specified otherwise in specifications / scope of work / specific requirements shall be as follows:

Sr. No.	Material	Duty	Mfg.	Application Area
a	Mild Steel (with outer coating with epoxy paint & inner coating with food grade epoxy paint)	Fe 410 Spirally Welded	IS 3589	a) Raw water rising mains to Inlet Chamber b) All process piping >1000mm dia. c) Clear Water Transmission Lines by Gravity d) Dirty Water Pump Delivery & Rising Mains (To WTP Inlet / Disposla point)
B	Cast iron (coal tar coated)	Class LA S/S & Class B DF, as appli- cable & as per specs	IS 1536 IS 1538	a) All process water piping except raw water piping to inlet chamber, clear water to b) existing GSR & dirty water pump delivery & header/rising mains c) Sludge draw off from clarifiers below floor upto sludge chamber d) All Sludge pumping & disposal (as required) piping e) Filter air scour & filter back wash piping, all piping within filter house f) All unit drain piping up to disposal chamber / drain g) All process piping <=1000mm dia.
C	Ductile Iron	Class K-9	IS 8329	a) All applications of CI piping as specified in sr. no. b above.
D	Reinforced cement concrete	Class NP3 S/S	IS 458	a) Sludge/backwash drainage from desludging chamber or backwash channel to dirty water sump / sludge sump b) Encasement pipes for road crossings, if any

				c) Sludge / Dirty Water disposal or drain piping onwards of disposal chamber
E	uPVC	Class SCH 80	ASTM D-1785	a) Chlorine solution pipe work b) Alum solution pipework
F	uPVC	Class SCH 40 Or better as required	ASTM D-1785	a) Service water supply from ESR / backwash tank to various buildings incl. booster pumps b) Sampling pipe work c) Communication pipework to all service areas Rain water down take piping

Note: All piping shall be designed by considering the peak/max. flow including hydraulic overload.

OTHER MISCELLANEOUS WORKS:

- Inauguration and year of construction name plate including lettering with golden color on granite stone (maximum size 1.5 m x 0.9 m) should be provided and fixed at location as directed by Engineer-in-charge.
- One no. sign board of max. size 2.5m x 1.5m including the details / name of plant, name & logo of client, and other details as desired by RMC shall be provided and fixed at WTP plot at location as directed by Engineer-in-charge.
- The contractor shall be required to give test report and submit the same to Electrical Inspector for complete Electrical works done by the Contractor and including requisite approvals for proposed electrical installation. The approved drawing/test reports shall be handed over to CLIENT.
- Providing the following furniture in addition to requirements specified elsewhere:

(i)	➤ Steel Cupboard	1 No. , Godrej Store well Plain or equivalent model of approved make
(ii)	➤ Office Chair (Steel)	8 Nos. , Godrej Workspace chairs of suitable model or equivalent model of approved make.
(iii)	➤ Office Table (Steel)	3 Nos. , Godrej T-8 or equivalent model of approved make.
(v)	➤ Split Type Air Conditioner.(1.5 Ton Capacity with 5 Star Rating) for Office Room, Laboratory & Control Rooms	Office: 1 No. Lab. Room: 1 No. Control Room: 2 Nos. (above includes all other if specified elsewhere)
(vi)	➤ Computer System for Office	Latest Computer with 21” LED Screen along with A4 Laser Printer
(vii)	➤ Computer System for Laboratory	Latest Computer with 21” LED Screen along with A4 Laser Printer

The process selected is a well-established process for treatment of raw water. Bidders are to adopt the same nomenclature used for various Treatment Units in their design documents as used in the Tender documents.

MINIMUM UNIT SIZING

Bidder to note of minimum unit size requirement as specified in tender layout. The sizes of units specified are the minimum requirement and contractor shall provide the above mentioned minimum or higher sizes units as required during detailed engineering. However, for tanks & sumps contractor may revise the size as per process requirement / detailed engineering subject to maintaining the min. effective volume as worked out from above minimum sizes & similarly for buildings / pump house the geometry may be revised maintaining the minimum specified area from above minimum sizes.