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DELHI METRO RAIL CORPORATION LTD.

CONTRACT NO.: OCM-2249

**Operation and Maintenance of 01 No. STP and 01 No. ETP & 02
Nos. R.O. plants of Yamuna Bank Depot in Line-3 of DMRC**

Employer's Requirements with Specifications

TENDER DOCUMENTS

**DELHI METRO RAIL CORPORATION LTD.
5th FLOOR, C-WING, METRO BHAWAN,
FIRE BRIGADE LANE, BARAKHAMBA ROAD,
NEW DELHI 110001**

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EMPLOYER'S REQUIREMENTS

1. Objective

The objective of the contract is the maintenance of DMRC structures to keep restore or improve facilities and services to current acceptable standards and sustain utilities and value of the facility by the contractor (including without limitation, the maintenance and removal of the Temporary Works) and the rectification of defects appearing in Permanent structures in the manner and to the standards and within the time stipulated by the Contract. In full recognition of this objective and with full acceptance of the obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of the Works.

2. GENERAL

2.1 The maintenance of the Permanent Works shall be done in accordance with Employer's Requirements and the other requirements of the Contract to keep buildings and services fully functional and utilizable.

2.2 The Maintenance Works shall be executed to the highest standards available using proven up-to-date good Engineering practices. The Specifications shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Technical/Maintenance Specifications contained in the Tender Documents, approved list of manufacturer and Specifications provided by CPWD or BOQ of Contract.

3. SCOPE OF WORKS

3.1 Brief Scope:

The contractor will execute the work i.e. **“Name of work: OCM-2249: Operation and Maintenance of 01 No. STP and 01 No. ETP & 02 Nos. R.O. plants of Yamuna Bank Depot in Line-3 of DMRC.**

The operation and maintenance of 1 no. Effluent Treatment Plant , 1 no. Sewage treatment Plant & 2 Nos. of RO Plant at Yamuna Bank staff quarter for 3 years. The capacity of Effluent Treatment Plant is 60 KLD and the capacity of Sewage Treatment Plant is 60 KLD, 250 LPH capacity of each 2 Nos. RO. Contractor shall prepare the drawing/work method/bar chart for the approval of the DMRC as per requirement.

Manpower deployment at the plants are 2 Nos. operators for operation of plants 16 Hours and 1 Nos. of cleaner for cleaning of plants machine and area including surroundings.

The above-mentioned work shall be carried out with contractors' own material, tools, machinery & labour etc. as per the specification & BOQ. The Brief scope of work is mentioned in BOQ and as per site requirement. The work under this contract shall

consist of, but not limited to, all materials, labour, equipment's, tools, plants and necessary machinery as required for Contract: OCM-XXX Operation and Maintenance of 01 No. STP and 01 No. ETP & 02 Nos. R.O. plants of Yamuna Bank Depot in Line-3 of DMRC for 3 Years. The contractor shall plan & execute the work in such a way that the STP runs smoothly to the satisfaction of the engineer

The work is to be carried out as per relevant DMRC standards, Safety Circulars, Approved methodology, Standards Codes, CPWD Specifications, Material manufacture's specifications or as directed by the Engineer. The above-mentioned work shall be carried out with contractors' own material, T&P & labour at all height and lifts as per the specification & drawings if any.

3.2.1 Methodology of Execution of Work:

- (i) The agency should inspect the site and submit methodology for execution of work for approval to engineer-in-charge. Agency should also submit details of material to be used along with data sheet of materials.
- (ii) The work under this contract shall consist of, but not limited to all materials, labour, equipment's, tools, plants and necessary machinery as required to completely execute any or/and following works within DMRC scope.
- (iii) The contractor will execute the work i.e. "OCM-XXX: Operation and Maintenance of 01 No. STP and 01 No. ETP & 02 Nos. R.O. plants of Yamuna Bank Depot in Line-3 of DMRC". Work enlisted in BOQ mainly contains the works of Operation and Maintenance of 01 No. STP and 01 No. ETP & 02 Nos. R.O. plants of Yamuna Bank Depot. The work is to be carried out as per relevant DMRC standards, Safety Circulars, Approved methodology, Standards Codes, CPWD Specifications, Material manufacture's specifications or as directed by the Engineer. The above-mentioned work shall be carried out with contractors' own material, T&P & labour at all height and lifts as per the specification & drawings if any.
- (iv) Tool Box Talks (mandatory safety briefings in Depot/OHE areas) shall be conducted without exception at the entrance gate of YB Depot prior to commencement of any activity. Non-compliance shall result in stoppage of work.
- (v) The Safety Engineer of the contractor shall be held **personally responsible** to ensure safety awareness and training of all workers before execution of work.
- (vi) Entry of workers shall be permitted only upon production of valid original ID cards (Aadhaar Card/Driving License/Voter ID). Workers without valid IDs shall be denied entry.
- (vii) Machinery, plants, trucks, cranes, and lifters shall be permitted entry only upon submission of Valid fitness certificate, Current third-party inspection report, Operator training certificate with valid license. Absence of any of the above shall result in immediate denial of entry.
- (viii) Verification of workers and machines shall be carried out daily at the time of entry into the depot area. Permission shall be granted solely on production of original valid IDs and certificates.
- (ix) The Quality Engineer, Supervisor, Site Engineer, or Project Manager of the Contractor shall be held fully responsible for execution of work strictly in accordance with the applicable Standard Codes of Practice.
- (x) No worker shall be permitted to execute any activity within the Depot area in the absence of the designated Supervisor/Engineer of the Contractor.

- (xi) Shall include, but not be limited to, all associated preparatory, cleaning, repair, inspection, and finishing activities as directed by the Engineer-in-Charge.
- (xii) Contractor should deploy necessary experienced personnel in capacity of Site Engineer and Supervisors for inspection and supervision purpose. The minimum number of such personnel are mentioned in annexure of ITT along with requisite qualification and experience. CV/resumes of these should be submitted to engineer for his approval before deploying/replacing them at site, however, contractor may be asked to suitably augment these numbers and type of experience required, based on work required to be executed during currency of the contract.
- (xiii) Based on performance, Engineer may ask contractor to replace these Engineer and supervisory staff, contractor should comply to it.
- (xiv) Failure to achieve work as per mutually agreed timeline (delay on the part of contractor), will entitle employer for getting the work done through other contractor/agency on risk and cost of contractor.
- (xv) The Contractor shall attend regular coordination/review meetings convened by the employer/engineer for interface and adhere to the decisions taken in the meeting. Joint visit at site may also be taken up by engineer and his representative with contractor based on requirement.
- (xvi) The Provision of all necessary labours, maintenance equipment, instruments and appliances in connection with all above mentioned work are required to be provided by contractor as specified or as directed by Engineer-in-Charge or the representative of Engineer.
- (xvii) All necessary safety precautions shall be taken by agency during execution of work.
- (xviii) The contractor shall plan & execute the work in such a way that the work proceeds smoothly to the satisfaction of engineer-in-charge.
- (xix) Contractor should erect all temporary structure as required for safety of permanent works beings executed by agency and necessary signage and protection should be fixed to protect DMRC's commuters and staff from injury.
- (xx) Contractor shall also be responsible for clearing site after completion of work and handing over of all the works, as specified and directed by Engineer in charge.
- (xxi) Damage caused to properties of DMRC or other department or entity, if any, during execution of above work shall be rectified by the contractor at his cost failing which the cost of rectification shall be recovered at market cost of such items from the bills or performance security of the contract.
- (xxii) The work shall be carried out with all safety precautions. The contractor shall ensure all his workers shall have Personal Protective Equipment's (PPE"s) at his cost (not to be charged to the worker) and ensure safety of site by providing Barricades for restricting movement of public to work area. The barricade arrangement shall be approved by Engineer in charge keeping in view the overall circulating pattern of the staff/visitors.

- (xxiii) The Contractor shall take all necessary precautions to ensure safety of the staff, adjoining structures, materials & equipment and the work in progress as per the directions of engineer-in-charge.
- (xxiv) Before taking up execution of work in restricted areas/stations, permissions may be required from site staff of DMRC; contractor shall deploy necessary manpower for obtaining such permission at his own cost.
- (xxv) **In case of failure to compliance of above conditions, penalty up to Rs. 10000/- per instance may be imposed as deemed suitable by Engineer.**

3.2.2: The monthly joint inspection will be carried out by DMRC officials and items identified should be informed to the contractor along with the specified time during which it can be attended. This will be an item of the regular check during the next monthly inspection. These items shall be recorded in Site Order Book / Complaint and Progress Monitoring Register maintained at field office.

The capacity/ rating of pumps and equipment, parts etc. shall hold good for the capacity of STP/RO/ETP (in cubic meter / day or litre per day as applicable) and shall be good for meeting the treated parameters requirement as follows:

- a. Permissible limit as prescribed in IS: 2490 (Part-I) – 1974.
- b. Water (Prevention and Control of Pollution) Act, 1977 & 1978.
- c. Environment (Protection) Act, 1986.
- d. Environment (Protection) Rules, 1986.
- e. Hazardous Wastes (Management & Handling) Rules, 1989.
- f. Manufacturer, Storage and Import of Hazardous Chemicals Rules, 1989.
- g. Manufacturer, use import and storage and hazardous Micro-Organizers, Genetically Engineered organizations or Cell Rules, 1989.
- h. Manual on Sewage & Sewage Treatment /STP/ETP &RO
- i. All standards as laid down by Central Pollution Control Board and any other relevant statutory authority.

3.2.3: DMRC has implemented ISO-14001 & OHSAS 18001 for Environment, Health & Safety. The Comprehensive Maintenance works are to be carried out as per international norms/standards and in such a manner that all premises always look neat & clean. Eco friendly chemicals/Reagents to the extent possible shall be used. Similarly, the waste disposal is also carried out in totally sealed manner without affecting the Environment. The Personnel Protective Equipment as per the requirements are to be used & All Safety norms are to be followed.

- a. The STP/RO/ETP plant shall be made fully operational.
- b. Under Comprehensive Maintenance Contract, following works of STP/RO/ETP are covered for which firm/ agency/ contractor has to be replaced/ rectified the whole component to bring into the original condition:

1. Cleaning of all tanks of STP/ETP.
2. Supply and installation of new pumps in place of damaged/unserviceable pumps as and when required.
3. Repairing and Servicing of pumps including winding of motor and replacing any electrical and mechanical parts etc complete.
4. Air blowers service and repair for containing oil leakages, replacing worn out blower parts and necessary electrical repairs.

5. Replacing the following with providing new one including removing the old etc and making connection with existing line/system complete.
 - a. Fresh media supply & change activated carbon filter
 - b. Supply and change dual media filter
 - c. Anthracites, Filtration sand, Silex, Gravel and pebbles
 - d. Supply and replacement of filter cloth for filter press
 - e. Reconditioning of filter press
 - f. DWPE dosing equipment's of STP/RO/ETP.
 - g. Butter fly valves, Pressure Gauge, Cable trays etc.
6. Providing and fixing of multiport valve for dual media filter for STP/RO/ETP plants.
7. Repairing of electric panels accessories/fittings (like cable wire of required gauge, switch set, MCB set, cable tie, thimble and other operating panels accessories etc. complete) for STP/RO/ETP.
8. Repairing and replacing damaged internal pipes, fittings, cable tray, valves and pressure gauges for suction and delivery pipe for making the system complete.
9. Repairing and replacing pump impellers, body, bearings shafts column pipe etc.

3.2.4: Sampling and Analysis: Sampling and analysis of the effluent of STP/WTP should be done to check the quality of waste and performance of each unit. Samples should be taken and analysed at the following points

Effluent at the inlet of FAB reactor
At the outlet of Tube Settler.
At the outlet of Chlorine contact Tank
At the outlet of Dual Media Filter
At the outlet of Activated Carbon Filter

SEWAGE TREATMENT PLANT

Sampling points should be selected where waste water is homogenous in nature. Composite samples are required to see the performance of the units. The samples thus collected shall be then mixed together for making a composite sample.

SAMPLE VOLUME

About one to two litres of sample are adequate for testing the parameters required of outlet/waste water of STP for process control. Samples should be immediately transported to laboratory for analysis. In case there is some delay, proper preservation like keeping the samples in ice box should be kept.

Analysis

The Samples shall be analysed for various parameters on quarterly basis. The samples can be analysed/tested from nearest NABL accredited laboratory or in-house laboratory if available. Testing charges will be borne by the contractor.

Outlet Sewage/Effluent are considered as below:

Ph value: 5.5 -9.0

BOD: <10 mg/l

COD: <50 mg/l

TSS: < 20 mg/l

O & G: < 10 ppm

Nitrogen<10 mg/l

Above technical parameters of outlet sewage/waste water should be maintained. If the above parameters are not fulfilled by the contractor then suitable penalty as mentioned below.

3.2.5: LIQUIDATED DAMAGES AND PENALTIES FOR O&M WORKS:

The basis for applying penalties is to restrict Contractor from deviating from disposing all raw/treated waste water efficiently from the service area – as per fixed schedule and as per stipulations prescribed in the tender. The Contractor is also expected to carry out the instructions of the Engineer or its representative from time to time, maintain the System in accordance with good Operating Practices attend to Customer complaints, refrain from offering operations without due authorization where so required and follow other requirements under this Contract.

The Contractor shall be subject to the following liquidated damages and penalties for its failure to carry out its operations as indicated below

Basis of Penalty	Penalty Benchmark	Penalty Value
Failure to maintain BOD/COD/TSS/Oil & grease/pH levels within prescribed limits. Detected as per reports of quarterly samples sent to approved lab and outlet quality to be achieved as per tender provisions	BOD > 10 mg/L	Rs.1000/- per occurrence
	COD > 50 mg/L	Rs.1000/- per occurrence
	TSS > 20 mg/L	Rs.1000/- per occurrence
	Oil & grease < 10 mg/L	Rs.1000/- per occurrence
	pH>9 and pH<5.5	Rs.1000/- per occurrence

3.2.6: Penalties for faulty of Air blower, pumps (feed pump, dosing pump etc) should be as following:

Equipment	Time	Penalty (INR)
Dosing pump	More than 48 hours	5000 /-
	More than one week	10000/-
Feed pump & motor	More than 48 hours	5000/-
	More than one week	10000/-
Filter press pump/Motor	More than 48 hours	5000/-
	More than one week	10000/-
Supply pump & motor	More than 48 hours	5000/-
	More than one week	10000/-
ETP/STP/RO raw water /High pressure pump & Motor	More than 48 hours	5000/-
	More than one week	10000/-

3.2.7: Emergency Inspection

In case of any serious problem with any unit, feeding should be stopped immediately to that unit. Drain all the wastewater from the unit and inspect carefully the structure, unusual deposition, each and every part of mechanical equipment, etc. All the mechanical equipment should be maintained in good working condition. Unit should be cleaned properly before making the same operational again.

3.2.8 Plant Shutdown

In case plant needs to be shut down for a considerable period of time, following points should be observed.

- i) Close inlet valve to plant and open bye-pass valve if any.
- ii) Thus, effluent will not be received in the plant.
- iii) Pump out effluent from intermediate sump. Open drain valves of tank and drain out the contents.
- iv) The equipment then should be flushed with clear water.

3.2.9 Comprehensive Maintenance Chart

Sr. No.	EQUIPMENT	COMPREHENSIVE MAINTENANCE INSTRUCTIONS
1	Bar Screen Chamber	Remove material arrested at screen – Once in 2/3 days.
2	Oil & Grease Trap	Remove oil floating at surface – Once in 2/3 days.
3	Equalisation Tank	Verify uniform Air Bubbling in the tank.
4	Air grid in Equalisation Tank	Adjust the inlet valve for medium air bubbling in the Equalisation tank while commissioning
5	Feed Pump	Changeover from one pump to another daily. Provide lubrication regularly.
6	Air Blower	Changeover from one blower to another daily. Maintain the lubricating oil level in the Air blowers properly. Clean the Air Filter regularly. The dead weights provided on the air blowers should be kept free by applying grease periodically.
7	FAB Reactor & Tube Settler Unit	Drain the Sludge from FAB Reactor once in a month for 5 minutes by keeping air blowers off. This will avoid choking of air grid. Pressure at Blower discharge should be checked while starting the system fresh. Any increase in the pressure over a period of time would indicate choking of air grid and would need to be cleaned. The screenings from Screen Box at 2 nd FAB reactor inlet shall be removed periodically to avoid the foreign material, solids etc. entering the FAB Reactor so as to avoid choking of Air Grid of the reactor.
8	Air Grid for FAB	Adjust the inlet valve for proper air bubbling in the FAB

	Reactors	reactor while commissioning. Verify uniform Air Bubbling in the FAB regularly. The Air Grid of the reactor shall be cleaned once in 15 days. For cleaning the grid allow full air to flow for 5 minutes through the grid to be cleaned by stopping the air to the other reactor. This will also provide the higher fluidization velocity resulting in higher friction between FAB media, which in turn removes the excessive Biological growth over media.
9	Tube Settler Sludge Drain Valve	The Sludge from the Tube Settler shall be drained once in 2-3 hours for 2 minutes. However this frequency depends upon the actual plant load. Adjust the timer-while commissioning. Verify the sludge withdrawal regularly. The Tube Media can be washed with low-pressure jet of raw water if required. The media shall not be removed from tube settler tank while washing it.
10	Sludge Digester	Remove digested sludge bed every half yearly or yearly.
11	Sodium Hypochlorite Dosing Tank with Constant Head Box	Adjust the dosage – while commissioning Normally 5 to 7 mg/l Chlorine dose is required.
12	Filter Feed Pump	Changeover from one pump to another daily, Provide lubrication regularly.
13	Dual Media Filter	Backwash the Filter twice a day-every 12 hrs. for about 15 minutes.
14	Activated Carbon Filter	Backwash the filter twice a day-every 12 hrs. For about 15 minutes.
15	RO Spun filter20 inch	Quarterly and as per requirement.
16	Membrane – 80 GD	Every 4 th month and as per requirement.
17	Post carbon	Half yearly and as per requirement.
For 250 LPH RO		
18	RO Spun filter20 inch	Quarterly and as per requirement.
19	40*4 inch Membrane make : burton	Half yearly and as per requirement.
Tank cleaning Schedule		

20	Equalization Tank cleaning	Half yearly and as per requirement.
21	Tube shelter tank cleaning	Half yearly and as per requirement.
22	Chlorine contact tank cleaning	Half yearly and as per requirement.
23	Chlorine dosing tank cleaning	Half yearly and as per requirement.
24	Sludge holding tank cleaning	Half yearly and as per requirement.

3.2.10: TECHNICAL SPECIFICATION OF RO PLANT

a. REVERSE OSMOSIS PROCESS DESCRIPTION

Reverse osmosis, distillation and electrodialysis are the major processes used in industries. Reverse osmosis is in general the most economical process for desalination of brackish water and sea water. As a widely accepted technology reverse osmosis became more and more competitive and is superior to the traditional thermal process when a comparison is made of capital investment and energy consumption.

In reverse osmosis, the R.O. membrane acts as a barrier to all dissolved salts, inorganic molecules, along with organic molecules with a molecular weight greater than approximately 100. Water molecules, on the other hand, pass freely through the membrane creating a purified product stream. Rejection of dissolved salts varies between 95% to 99%.

The applications for R.O. are numerous and varied, and include desalination and purification of sea water and brackish water for drinking purposes, waste water recycling, food and beverage processing, biomedical separations, purification of drinking water, cooling tower make up water, boiler feed make up water and industrial process water. RO is often used for the production of ultra pure water for use in the semiconductor industry, power industry and pharmaceutical/medical/laboratory applications. Utilizing R.O. prior to D.M/EDI plant dramatically reduces the operating cost.

b. PRODUCT WATER QUALITY:-

S.NO	PARAMETER	UNIT	AFTER RO
1.	pH	-	6.5-8.5
2.	TDS	Mg/L	< 300
3.	Flow Rate	m ³ /hr	as per O&M manual

c. PROCESS & PLANT OPERATION

- A. System of Treatment
- B. Significance of equipment provided
- C. Instrumentation
- D. Operation philosophy
- E. Running of Plant
- F. Backwashing of DMF
- G. Cleaning of RO Module
- H. Shutdown of the plant

d. System of Treatment

Raw water is pumped by feed pump to the DMF where coarse suspended solids are removed and after that it is stored in the ground water storage tank.

This water is, then taken from storage tank with the help of raw water pump it is passed through cartridge filter to get water free from small suspended particles. It is then pumped with the help of high pressure pump to reverse osmosis module so as to get final low TDS water from it.

There are two type of dosing in the whole process:

- 1) Alkali Dosing:** It is provided as a safeguard for membrane scaling.

e. Significance of the equipment provided

Raw Water/ CIP pump	To pump raw water from raw water storage tank and also for membrane cleaning and backwashing of D.M.F
Dual Media Filter	To filter suspended solids from water more effectively.
Cartridge Filter	For fine filtration of the feed water
High Pressure Pump	To feed water at high pressure to RO module to give treated water.
Reverse Osmosis	To give final process water by reducing TDS of the reject water.
Antiscalant Dosing	To protect reverse osmosis module scaling.
RO Membrane	A semi permeable membrane system for the separation of fluid components includes a laminated composition
RO Pressure Vessel	Pressure vessels are storage tanks that are designed to operate At pressures above 500 PSI.

f. INSTRUMENTATION

Considered adequate level of instrumentation like flow meter, pressure switches and pressure gauge which will enable easy operation of the plant. The plant will switch off when the raw water tank is empty.

g. OPERATION PHILOSOPHY

Automatic Tripping of the Plant

The low-level switch shall trip the high-pressure pump if the suction pressures is below the 1 to 2 KG/CM². Similarly, the high-pressure switch at the discharge of the H.P. Pump shall trip it, whenever the discharge pressure rises above the designed valve.

Interlocking is provided between high pressure & Raw water pump. Raw water pump get tripped followed by the automatic tripping of HP pump by the tripping logic of pressure switches.

h. RUNNING OF THE PLANT

START UP OF RO PLANT SERVICE

DMF are thoroughly washed in forward after back washing mode by taking water from bore well and R/W storage tank respectively. Backwashing is carried out for 10 – 15 minutes (As described later in backwashing procedure).

Ensure cartridge filter is loaded with the element & properly tightened.

Check & Adjust the valves positions such that:

- Open suction valve to R/W pump.
- After start of Raw water pump gradually open discharge valve of Raw water pump.
- Open, service inlet valve of DMF.
- Open, service outlet valve of DMF.
- Keep close the CIP by pass valve of DMF
- Keep close the backwash inlet & outlet valve of DMF.
- Keep close the rinse valve to drain of DMF.
- Open the micron filter suction valve.
- Open the discharge valve of micron filter.
- Open the HP Pump suction valve.
- Keep close the CIP valves from CIP tank to Raw water pump.
- Open the HP pump discharge valve gradually after starting the pump.
- Open the membrane reject recirculation line valve to suction of high pressure pump.
- Keep close the CIP recirculation valve at RO reject line

Throttle the reject valve in such a position so that treated water of sufficient rate is available.

Check the interlocking of the Raw water & HP pump provided & Ensure that all on line instruments are working properly. Now adjust the raw water discharge valve to get a flow rate of 22 m³/hr, by watching the movement of the pointer.

Start the anti-scalant dosing & alkali dosing pumps at their respective rate provided & ensure that the chemical liquid is being pumped into the system.

Now the plant is ready for starting the R>O. Process.

Before starting the HP Pump, close the HP pump discharge valve completely.

Watch the reading of pressure gauge at the HP pump suction, it will increase slowly. When the pointer is in the range 2 to 3 KG/CM², push the HP pump start button.

Then slowly open the HP pump discharge valve (Sudden opening the HP switch in the discharge line will trip the pump); make sure that the reject valve is open fully.

After, opening the discharge valve finely through, throttle the RO reject valve gradually to get the permeate flow ready in the product water Rotameter & at the same time, the RO module inlet pressure to 9 to 10 KG/CM² approx.

Pressure switches are provided on suction & discharge sides of the HP Pump so as to trip the pump with low pressure in suction & high pressure in discharge.

High pressure pump is interlocked with raw water pumps to trip each other.

Product water is stored in the product water storage tank PH dosing shall be carried out at the inlet of the product water tank.

i. BACKWASHING OF THE DMF

Whenever the pressure drop across the filter increases beyond certain limits (0.5 Bar) the backwashing of the filter is to be carried normally it is being carried once on daily basis to keep the filter vessel & media clean.

Before start up the R.O. plant, go for the backwashing of the PSF & DMF followed by rinsing operation.

As a normal consequence of the filtering process, the filters gradually entrap increasing amounts of agglomerated particulate matter. Hence to ensure that they are able to provided the required filtration flow rate, these are backwashed this, the valves are rotated in such a way that it closes the feed inlet and feed outlet and at the same time it opens the backwash inlet and backwash outlet.

BACKWASHING INITIATION

Backwash of the filter should be taken once in a day without fail. However it can be undertaken in case of any emergency wherever the pressure drop across the filter increases beyond 0.5 BAR.

BACKWASHING SEQUENCE & RINSE

Take care of other valves such as suction valve to R/W, / CIP/ Pump Inlet, air vent. Valves should be opened but close the rinse valve.

Run the R./W, B/W pump with full discharge throttle, to get the maximum flow out of it.

Take care of the R/W tank water level & the water supply to it by pressure sand filter.

Observe the rotameter reading at R/W pump discharge such that the sufficient water head is available on the overhead tank is available. (If you can see that air bubbles are coming with water, with its ready pointer, moving up & down continuously, that means water level on the over head tank is low & at any point of time the low level switch can trip the pump.

Continue this backwashing process for 15 to 20 Minutes.

RINSE

The filter vessels that just have been back washed must be rinsed thoroughly, before they are brought back to service line.

The can achieved by closing backwash inlet & outlet valves and opening service inlet but closing service outlet. Open the rinse valve to drain. Open the air vent valve Wait for some times (2-3 minutes) when water without air bubbles coming out from it then close it completely. Now the feed water will rinse the media bed to drain. Do it for 5 – 6 minutes. Then stop the Raw water after rinse.

CLEANING OF THE RO MODULE

Whenever high pressure drop across the RO module is achieved to above 10% or the flow drops down to below 10% the RO module is to be taken out for cleaning. In order to carry out this operation one separate CIP tank is provided but the use of Raw Water pump and cartridge filter is made.

In this process particular chemical solution is prepared in CIP tank depending upon type of fouling which is pumped to RO module and recalculated back to CIP tank for at least half an hour. Allow solution to be kept in contact with RO module for at least two to four hours before draining it. Then the RO module is thoroughly flushed and washed by Treated water.

SHUTDOWN OF THE PLANT

Whenever plant is shutdown never allow water to be drained out from RO module. It has always to be kept in the moist condition. Immediately the plant is to be flushed with the water so as to keep the membranes clean. In case it is to be kept out for more than 8 hours it is better to keep RO module under 0.5% sodium meta BI sulfite (SMBS) solution and maintain the pH above 3.5. in case it falls below this value after draining old solution fresh solution of sodium sulfite solution is taken.

In case plant is shut down for very long time it shall be better to keep the membrane in formaldehyde solution to avoid any kind of deterioration.

3.2.11: Minimum Level of inventory maintained at site office

Inventory List

Minimum Quantity of following to be kept as need required in stored of contractors: -

S. No.	Items	Details	Quantity
1	Hypo Chlorine	As per Specification CPWD	150 Ltr
2	Anti scaling agent	As per Specification CPWD	150 Ltr
3	Sodium carbonate bi-	As per Specification CPWD	240 Kg
4	Resin		100 Liter
5	Activated carbon	As per Specification CPWD	1 Lot
6	Filter media	As per Specification CPWD	1 Lot

ELECTRICALS AND CONTROL SYSTEM

We have provided a control panel made of CRCA sheet steel of appropriate size the panel mainly consists of:

- 1) Incomer
- 2) Pump controls
- 3) Interlocks

1. INCOMER

Input supply requirement is three phase 415v.

2. PUMP CONTROLS

Pump controls are provided in the system with on/off push buttons for the following pumps.

- i. Raw water pumps
- ii. CIP pump
- iii. High pressure pumps
- iv. Dosing pumps

3. INTERLOCKS

- 1) Low level in Raw water tank: The level switch of the tank get activated an trips Raw water pump.
- 2) Pressure switch low and H.P. Pump.
In case the Liquid pressure at the suction of H.P. Pump falls below the setting level, the pump switches off.
- 3) Pressure switch high and H.P. Pump:
In case the liquid pressure at the discharge of H.P. Pump goes above the setting level, the pump switches off.
- 4) Interlocking provided in between Raw water & HP pump I.E. tripping of HP pump automatically trips the Raw water pump.

BASIC PLANT MAINTENANCE

ROUTINE CHECK UP

1. Water leakage from all joints.
2. Base plate fasteners of all pumps.
3. Pressure drop across Sediment Filter, ACF, Micros Filter & RO Membrane.
4. Water testing/ checks:
5. Feed water salinity & Clarity
6. Permeate water TDS
7. Rotation, Vibration & noise level of all pumps.
8. Testing of electrical items as Fuses, Indicating lights, Buzzer etc.
9. Tightening of electrical/ wiring connections.
10. Checking of all 3 phase for correct supply.

SCHEDULED MAINTENANCE

- | | |
|--|-------------|
| 1. Testing of Pressure & Level switches | Every month |
| 2. Cleaning of Dosing pump's NRVs | Every month |
| 3. Proper earthing of all Electrical equipments & skid | Every month |
| 4. Electrical connections/ joints – Intact & Carbon fee | Every month |
| 5. Cleaning & sanitization of all Storage & Chemical tanks | Every month |
| 6. Replacement of Filter Cartridges: | |

A. Pre-treatment (Prior to HPP)	Every month
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Replacement of DMF media	As per Requirement
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- **Spare parts:**
The Contractor shall keep a reasonable stock of spare parts so that the down time of equipment can be kept within the limits specified. The contents of the stock and the reorder level of the inventory have to be approved by the Employer's representative.
- **Transportation:**
All necessary transportation shall be arranged and made by the Contractor at his own expense.
- **Consumables and Chemicals:**
The Contractor has to ensure that there is always sufficient stock of 15 days of consumables and Chemical (if mentioned in BOQ) etc.

3.3 Measurement and Payment

- i) Items required be executed under this contract are provided in BOQ of the contract.

- ii) Under this contract, the maximum quantum of work may be executed on the daily basis during both day and night; no additional payment shall be made for the work specified in the BOQ.
- iii) Agency should maintain detailed register at site (Daily progress register) to maintain details of work, such as quantity of items executed, manpower deployed etc. for verification by engineer.
- iv) Agency should monitor and keep records of all items of BOQ being executed and in case of required quantity exceeding the BOQ quantity contractor should submit prior intimation and take approval of engineer before execution of work. Agency also needs to submit Variation statement accordingly for approval of engineer.
- v) Similarly, in case of requirement of any execution of Non – scheduled item (Item not available in BOQ of Contract), contractor should intimate and take approval of Engineer before taking up work.
- vi) The contractor shall take the measurements at site and prepare and submit the bill to the Engineer. Bill shall be raised both in Hard copy and through online mode that is through Vendor Payment Portal DMRC. For verification of measurements, contractor will require to deploy his Engineer. Delay due to non – providing of site staff for joint verification will be considered on part of contractor.
- vii) While raising the bill, contractor shall provide requisite documents such as Abstract, Insurance, Performance security, Invoices, Standard certificates, ESI & PF chalans and receipts etc. Any delay occurring while processing of payment by DMRC due to shortcomings in submissions of aforementioned documents shall be the considered on the part of contractor.
- viii) Contractor should deploy necessary experienced personnel in capacity of Bill Engineer for above purpose. The minimum number of such personnel is mentioned in annexure of ITT along with requisite qualification and experience. CV/resumes of these should be submitted to engineer for his approval before deploying/replacing them at site, however contract may be asked to suitably augment these numbers during tenure of the contract. Based on performance, Engineer may ask contractor to replace these personnel, contractor should comply to it.

3.4 Material

The minimum inventory of material shall be maintained by the contractor as per requirement for timely replacement of items mentioned in BOQ. In case of

premature termination, no extra compensation shall be payable. Payment of remuneration in that case will be made to the extent the services rendered till that time can be made use of by DMRC officials/Engineer or his representative limited to the period for which the agency had actually rendered the service and subject to the intermediate targets being adhered to as per the work schedule mutually agreed to. No notice of termination or remuneration thereof will be necessary and continuance shall be solely at the discretion of DMRC.

3.5 Quality

All materials used in the works shall be of the quality of their respective kinds as specified in BOQ items, CPWD specifications, Specifications obtained from sources and suppliers approved by DMRC and shall comply strictly with the tests prescribed in the Technical Specifications/Codes of Practice/ITP, if any. Approved list of vendors by DMRC for materials/ products is enclosed as per appendix-4 of Employers requirement.

In case of non-availability of specified materials, the alternative material should be used with the prior approval of Engineer in charge. The approval should be obtained in writing. Any unapproved or substandard material shall be deemed as rejected.

3.6 Rejection

Any materials that have been found not to conform to the specifications will be rejected forthwith and shall be removed from the site by the contractor at his own cost immediately. **In case of failure to remove such material within reasonable time, token penalty up to Rs. 10000/- may be imposed as deemed suitable by engineer. Engineer can further get the rejected material removed from the site through other agency at risk and cost of contractor in case of failure by contractor in removing the rejected material in reasonable time. The rejected material will be considered as scrap and no value shall be payable to contractor, when material is disposed through other agency.**

3.7 Workmanship

All works shall be true to level, plumb and square and the corner, edges and arises in all cases shall be unbroken and neat and shall be as per provisions in the relevant Technical Specifications/ Standard Codes of Practices. Contractor shall also submit Quality Assurance Programme and Methods Statements for the

major works to be done in the contract within 07 days of assigning of such work by the engineer before the start of work for approval of Engineer-in-Charge.

3.8 Specifications:

DMRC approved list of Manufacturer (as enclosed with tender documents), IS (Indian Standards) Codes as per latest addition with all correction slips and CPWD (Central Public Works Department) Specifications 2019 Vol-I & Vol-II with up-to-date correction slips issued up to date of submission of tender are applicable in this contract. General Specifications for NDSR items have been provided in BOQ.

Whenever these codes are silent the same shall be governed by Other Standard codes, manufactures specifications/ Sound Engineering practice and the decision of the Engineer in Charge shall be final and binding on the contractor.

4 INTERFACE WORK

In addition, the Contractor shall be required to accommodate requirements of miscellaneous works as per interfacing requirements. The Contractor shall carry out necessary co-ordinations with Facility Manager, E&M Contractor and various system contractors pertaining to traction power supply, Housekeeping etc.

5 STRUCTURES

The maintenance of structures will have to be planned in such a manner that they do not obstruct or interfere with existing utilities. Where work is required to be carried out at locations adjacent to such utilities suitable safety and protection arrangements will have to be ensured for which nothing extra will be payable. It should be ensured that no damage is caused to any such element and Engineer/ Employer shall be indemnified against such damage at no extra cost.

6 REFERENCE TO THE STANDARD CODES OF PRACTICE

All Standards, Technical Specifications and Codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian standards of practice and IRSC & TRC Codes as applicable as per requirement.

Wherever Indian Standards do not cover some particular aspects of maintenance, relevant British, German Standards will be referred to. The Contractor shall make available at site such standard codes of practice.

In case of discrepancy among Standard codes of practice, technical specifications and provisions in sub clauses in this NIT, the order of precedence will be as below:

- i) Provision in NIT
- ii) Technical Specifications,
- iii) CPWD specifications
- iv) Standard Codes of Practice.

In case of discrepancy among Standard Codes of Practice, wherever these codes are silent same shall be governed by the manufacturers' specifications/ sound engineering practice and the decision of the Engineer in charge shall be final and binding on the Contractor.

7 DIMENSIONS

- 7.1 As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Special Conditions of Contract will apply.
- 7.2 The Contract shall utilise the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.
- 7.3 Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.
- 7.4 The levels, measurements and other information concerning the existing site as shown on the conceptual/ layout drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on the drawings.

8 SPACE FOR TEMPORARY OFFICE & STORAGE

- 8.3 A suitable space for store shall be provided on temporary basis by DMRC/Engineer or his representative free of cost on as is where basis for

execution of work, subject to availability. This space shall not be used for accommodation of labours or Contractors' staff.

- 8.4 The contractor shall handover the space provided for store to them and final bill shall be released to the contractor after vacation of stores to the DMRC.

9 SITE INFORMATION

9.3 Work Site

- 9.3. The work site is located in National Capital Territory of Delhi (NCTD)/ NCR.

9.4 Climatic Conditions

Delhi (NCTD)/ NCR experience extreme climatic conditions and tenderers must acquaint themselves about the same before submitting the tender. The Employer shall in no way be responsible on this account.

10 CONTRACTOR'S SUPERINTENDENCE

- 10.3 The Contractor shall submit a Staff Organisation Plan in accordance with the relevant clauses of DMRC. This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities and authority of each staff member.

- 10.4 The Site Engineer and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

11 THE SITE

11.1 1 Use of the Site

11.1.1 The Site or Contractor's Equipment shall not be used by the Contractor for any purpose other than for carrying out the Works in the scope of this contract, except that, with the consent in writing of the Engineer, the Site or Contractor's Equipment such as batching and mixing other contracts under the Employer.

11.1.2 The location and size of each stockpile of materials, including excavated materials if any, within the Site shall be as permitted by the Engineer. Stockpiles shall be maintained at all times in a stable condition.

11.1.3 Entry to and exit from the Site shall be controlled and shall be only available at the locations for which the Engineer has given his consent.

11.1.4 All Temporary Works which are not to remain on the Site after the completion of the Works shall be removed prior to completion of the Works or at other times instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

11.2 Access to the Site

11.2.1 The Contractor shall make its own arrangements, subject to the consent of the Engineer, for any further access required to the Site.

11.2.2 In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Employer and Engineer.

12 Liquidated Damages

- i) Liquidated Damages shall be applicable as per GCC Clause 8.5.

13 SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with in the conditions stipulated in the Conditions of contracts on Safety and Health, for civil works of O&M wing. And condition of contract on Environment for civil works of O&M for contract value above Rs.1.00 crore.

“Tractor Transmission type” Pick and Carry Hydra Crane – 1st Generation model is prohibited at DMRC works. Contractor shall mobilize “Truck Transmission type” Pick and Carry Hydra Crane – 2nd Generation model or higher version.

The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works and the public.

14. CARE OF THE WORKS

- i) Unless otherwise permitted by the Engineer all work shall be carried out in dry conditions.
- ii) The works, including materials for use in the works, shall be protected from damage due to water. Water on the Site and water entering the Site shall be promptly removed by temporary drainage or pumping systems or by other methods capable of keeping the Works free of water. Silt and debris shall be removed by traps before the water is discharged and shall be disposed of at a location or locations to which the Engineer has given his consent.
- iii) The discharge points of the temporary systems shall be as per the consent of the Engineer. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant authorities for discharging water to drains watercourses etc. The relevant work shall not be commenced until the approved arrangements for disposal of the water have been implemented.
- iv) The methods used for keeping the Works free of water shall be such that settlement of, or damage to, new and existing structures do not occur.
- v) Measures shall be taken to prevent flotation of new and existing structures.

15 PROTECTION OF THE WORKS FROM WEATHER

- i) Work shall not be carried out in weather conditions that may adversely affect the Works unless proper protection is provided to the satisfaction of the Engineer.
- ii) Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.
- iii) During maintenance of the Works storm restraint systems shall be provided where appropriate. These systems shall ensure the security of the partially completed and ongoing stages of maintenance and in all weather conditions.

Such storm restraint systems shall be installed as soon as practicable and shall be compatible with the right of way, or other access around or through- out the Site.

- iv) The Contractor shall at all times, make programme and order progress of the work and make all protective arrangements such that the Works can be made safe in the event of storms.
- v) The finished works shall be protected from any damage that could arise from any activities on the adjacent site/ works.

16. DAMAGE AND INTERFERENCE

- i) Work shall be carried out in such a manner that there is no damage to or interference with:
 - watercourses or drainage systems;
 - utilities;
 - Structures (including foundation)
 - Roads,
 - Public and Private Vehicular & pedestrian accessMonuments, trees, graves or burial grounds other than to the extent that is necessary for them to be removed or diverted to permit the execution of the Works. Heritage structures shall not be damaged or disfigured on any account. The Contractor shall inform the Engineer as soon as practicable of any items which are not stated in the Contract to be removed or diverted but which the Contractor considers need to be removed or diverted to enable the Works to be carried out. Such items shall not be removed or diverted until the consent of the Engineer to such removal or diversion has been obtained.
- ii) Items which are damaged or interfered with as a result of the Works and items which are removed to enable work to be carried out shall be reinstated to the satisfaction of the Engineer and to at least the same condition as existed before the work started. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor.
- iii) The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties.

- iv) The Contractor shall take all necessary precautions to protect the structures or works being carried out by others adjacent to and, for the time being, within the Site from the effects of vibrations, undermining and any other earth movements or the diversion of water flow arising from its work.

17. Defect Liability Period

The Defect liability period (DLP) shall be 12 (Twelve) Months from the date of Issue of the latest Taking over Certificate/ Completion Certificate for the whole of the works.

18. Payment- Interim and Final

18.1 Interim Payments (Running Account Bills)

18.1.1 The Contractor shall submit Interim (Running Account) Bills on a monthly or quarterly basis, or as directed by the Engineer-in-Charge, for the work executed during the relevant period.

18.1.2 Payments shall be made based on measured quantities of work executed at site and duly recorded and certified by the Field Engineers and the Engineer-in-Charge.

18.2 Completion of Work

18.2.1 The Engineer-in-Charge shall issue a written intimation regarding completion of the work.

18.3 Final Bill

18.3.1 The Contractor shall submit the Final Bill within three (3) months from the date of issuance of the work completion letter by the Engineer-in-Charge.

18.3.2 The Final Bill shall include all claims, measurements, variations, and adjustments pertaining to the completed work. No additional claims shall be entertained thereafter, except those specifically admissible under the contract.

18.3.3 In case the Contractor fails to submit the Final Bill within the stipulated period, the Engineer-in-Charge shall be at liberty to finalize the measurements and prepare the Final Bill ex parte, based on available records.

18.3.4 In such cases, payment shall be released only after submission by the Contractor of:

- A formal request for release of payment
- A No Claim Certificate
- All required contractual and statutory compliances

18.4 Verification and Processing of Final Bill

18.4.1 The Field Engineers and the Engineer-in-Charge shall verify and certify the Final Bill within a reasonable period, generally 60 days, subject to corrections and compliance with contract provisions.

18.4.2 The Engineer-in-Charge shall process and arrange payment of the Final Bill at the earliest subject to:

- Fulfilment of all contractual obligations
- Submission of required documents (such as as-built drawings, test reports, etc., as applicable)
- Clearance of statutory dues
- Settlement of audit observations, if any
- No outstanding claims, unless specifically found admissible

18.5 Deductions

18.5.1 All statutory deductions, including but not limited to Income Tax, GST (as applicable), labour cess, and other applicable levies, shall be made from Interim and Final Bills in accordance with prevailing laws.

18.5.2 Recoveries towards penalties, damages, or any other dues payable by the Contractor under the contract, including safety violations, shall also be effected from payments due.

18.6 No Interest Clause

18.6.1 No interest shall be payable to the Contractor on any delayed payments, Interim Bills, Final Bill, Retention Money, or Security Deposit, unless expressly provided otherwise in the contract.

EMPLOYER'S REQUIREMENTS

APPENDIX – 1

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX – 2

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX – 3

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX – 4

APPROVED MANUFACTURERS / SUPPLIERS

Approved Manufacturers/ Suppliers List is enclosed separately with this document.

EMPLOYER'S REQUIREMENTS

APPENDIX 5

DELETED