VOLUME - II, PART - 2

SECTION – 8

GENERAL SPECIFICATION FOR 3 YEARS OPERATION AND MAINTENANCE

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VOLUME – II

SECTION – 8

DETAILED TECHNICAL SPECIFICATION FOR 3 YEARS OPERATION AND MAINTENANCE

1.0 SCOPE OF WORK

1.1 The contract includes operation and maintenance of the entire 2 X 0.5 MLD Desalination Plant including complete Raw water supply system (Four nos borewell, submersible pumps, raw water conveyance piping , Pond water supply system with clarification plant) reject water piping till discharge terminal point, treated water discharge piping till terminal point , for a period of 3 Years (36 Months) after successful completion of trial run, commissioning and demonstration of performance guarantee and Reliability test. The Commercial Operations and the O&M period shall begin only after completion of PGTR and on issue of the Taking over Certificate.

Additional information is given in the following sections to facilitate the O&M work. The contractor shall note that preparation of the Operation and Maintenance Manual for the Desalination Plant and set up by them is included in Scope of Work. This manual shall be duly approved by the Owner's Representative prior to commissioning of the facility.

The Bidder shall provide a comprehensive O&M concept comprising measures, strategies and guidelines for Plant operation and maintenance:

- Facilities in the Borewell and Raw water conveyance systems, Pond water & conveying system
- Facilities in the Pre-treatment Plant include ASF, Ultra filtration, which make it possible within defined limits to adapt the operation of the Plant to fluctuations in water quality.
- Facilities in the RO Plant structure, which make it possible within defined limits to adapt the operation of the RO Plant to fluctuations in water quality.
- Facilities, which protect the RO Plant in case the normal range of fluctuations in water quality exceeds the reference point operating conditions.
- Organizational measures which, in the event of a major reduction in water quality or in the event of an extreme mishap, lay down the procedure, measures and responsibilities for the operation and maintenance of the Plant.

Payments and all general conditions for O&M are as detailed in respective clauses of Volume-1,

The Operation and Maintenance Service shall not commence until the Design-Build of the Works, or any Section is completed. The Contractor shall thereafter provide the Operation and Maintenance Service in compliance with the requirements of the Operation, Maintenance and Safety Manuals.

The Contractor shall Operate and maintain all units and equipment's of the desalination plant as per the requirement of the process to meet continuously and consistently desire quality of permeate water as describe in Section 2, Annex-2.3 of Volume – II of TS.

GIPCL will station representative in the plant on a continuous basis. The O&M shall normally report to the station in charge of day-to-day activities.

Plant shall be operated 24 hours/day throughout the year or as required by GIPCL with at least 95% annual availability. The contractor shall be responsible for providing all consumables, spares, chemicals, membranes, labour, transportation, storage and other charges, taxes and duties including all cess as applicable from time to time by the statutory bodies for efficient operations of the facility except Power, which shall be provided by the Owner. The owner may at any time choose to operate the plant at part capacity or may choose to keep the plant under shutdown.

Lubricants shall be supplied in accordance with the recommendations of the various equipment and Plant manufacturers. The Contractor shall limit the various types of lubricants by consolidating these, with the manufacturer's approval, into the least number.

1.2 Contractor shall Operate and maintain the Desalination plant, all instruments and mechanical, electrical equipment's in accordance with the aim and purpose of treatment. The plant & equipment's covered under the above contract will be totally attended to, by the contractor including any "Troubleshooting" to ensure smooth and trouble-free operation.

Contractor shall incur all the costs, taxes & duties, cess or another tax or cess levied for Operations of the said facility, transportation, labors, repairing & replacing making good any part or all part of equipment's, consumable, motors, pumps, gear unit, Capacitor, HT/LT Switchgear, Control Panel, Ultra filtration, valves chemical and laboratory equipment's, Pressure vessel, Membrane or any other part in the RO System, pipes etc. Only on account of agreed

changes.

The maintenance service provided by the Contractor for the period specified in the Contract shall ensure the continuous operation of the Plant and that the breakdown or deterioration in performance, under normal operating conditions, of any items of Plant and equipment and component parts thereof is kept to a minimum. The Contractor shall carry out the Maintenance of the plant installations in accordance with the requirements of the O & M Manual and also to the approved Maintenance Plan as mutually agreed.

The Contractor shall provide the facilities and equipment required for a proper functioning of the Operation Service, before starting with the Operation Service and immediately after commissioning.

The contractor should have necessary Tools & Plants including lifting devices etc for emergency repair and maintenance of the plant including bore well, pond water pump house & conveying system, Raw water pipeline, treated water pipeline and Reject water pipeline.

Mobilization of all personnel, tools etc required for O&M shall be done before the commencement of trial run.

During the Operation Service period, the Contractor shall make use of the new facilities and equipment provided during the Design-Build part. The Contractor shall hand over the facilities and equipment complete and in good condition at the end of the Operation and Maintenance Service period.

During the Operation Service, the Contractor shall acquire and make use of the vehicles and trucks necessary under the Contract to operate and maintain the Works. Such vehicles and trucks are the property of the Contractor and need not be handed over to the Owner.

1.3 The Contractor shall submit with his tender to the Owner the methodology for the operation and maintenance of desalination plant with the Schedule of 'Manpower' and 'Organization Chart showing the structure of the organization for his administration and operation of the Contract. The contractor shall depute a plant manager for operation and maintenance contract of desalination plant.

1.4 Desalination Plant manager

The Contractor shall at least one month prior to commissioning, appoint an individual as Desalination Plant Manager for Operations who shall be authorized and empowered to act as the agent for and on behalf of the Contractor on all matters concerning this Contract. The

Contractor shall be bound by the communications, directions, requests and decisions issued by the Desalination Plant Manager. The Desalination Plant Manager shall have the requisite level of skill and experience to manage the Desalination Project. The Desalination Plant Manager holds a Key Position. Any agreement, contract, notice or other document that is expressly permitted under this Contract or expressly envisaged to be executed by the Contractor shall be executed by the Desalination Plant Manager or, subject to prior written notice to the Owner, such other representative of the Contractor who is authorized and empowered by the Contractor to execute such documents.

1.5 Safety Requirement

The Contractor shall submit a Health and Safety Plan as required by international standards and confirming to Indian Legislation.

The Contractor shall provide a safety specialist being responsible for the preparation, implementation and maintenance of a comprehensive safety programme, which shall be approved by the Owner, and which shall be evaluated whenever appropriate and at least at the conclusion of the Operation Service. The specialist shall develop the safety and health policies, standards and procedures. The responsibility of the safety specialist includes performing safety training and conducting safety inspections, sessions and practice. He will also be responsible for the investigation of accidents. A safety committee shall be formed, and regular safety meetings shall be organized. All safety equipment and tools shall be provided and maintained by the Contractor at this own cost and the price shall be deemed included in his price bid. The safety specialist shall prepare, implement and maintain a comprehensive fire protection and prevention program, which shall be approved by the Owner's Representative. The safety specialist will also be responsible for the inspection and maintenance of the fixed and portable fire protection equipment and for the investigation of fire incidents. During Operation Service, the safety specialist shall develop and implement a project emergency action plan and fire hazard inspection procedure.

In order to protect property, materials and facilities against unauthorized entry and trespass, pilferage and theft, destruction, damage, sabotage, embezzlement, fraud and other dishonest, illegal or criminal acts during the Operation Service, a security program shall be prepared, implemented and maintained. The Owner's representative shall approve the security program.

Only highly skilled and trained personnel shall be assigned to perform inspections, repairs and preventive maintenance tasks. Specific skills are required for the maintenance of mechanical, electrical and instrumentation machinery and equipment. All the electrical equipment shall be

handled and operated by a trained and qualified person only. All the equipment shall be checked for its proper earthing and loose connections prior to starting equipment. Naked wire, loose connections and faulty connections shall be repaired immediately prior to starting operation.

Contractor shall Employ appropriate and skilled manpower, provide all tools, tackles, equipment, laboratory instruments, glassware and chemicals, reagents etc. required for effective implementation of the Services detailed above. The contractor shall have to issue identity cards with photographs to all the staff employed for Operation and Maintenance.

The Contractor shall comply with all safety rules and regulations and all inter-disciplinary measures as followed by the Owner. The Owner will not be responsible for any accident/injury to the staff or any person of the Contractor or loss or damage to any property. Further, the Owner will not provide any insurance or free medical facility to the staff of Contractor. Providing necessary security arrangements for safety of the plant and the contractor's personnel will be the responsibility of contractor.

The Contractor shall provide a Notice Boards/Display Boards at appropriate locations detailing precautions to be taken by operation and maintenance personnel in work in conformity with Industries and Labour Regulations and Department of Explosives.

The Contractor shall at his own cost provide and maintain at the Site of Works standard first aid boxes at minimum two locations as directed and approved by the Owner for the use of his own as well as the Owner's staff on Site as stipulated by local regulations. Contractors shall arrange to train all their staff in first aid treatment.

Emergency Conditions

The Contractor shall establish requirements for dealing with potentially hazardous conditions. All possible situations of emergency shall be scheduled within an emergency plan. Herein, the required services, additional required structures, equipment, staff and other resources shall be planned and recorded for the possible situations of emergency. The emergency action plan shall be submitted for approval to the Engineer. Every effort shall be made to ensure that any emergency situation at the treatment shall be limited to the shortest possible period to minimize any negative effects on the environment. Any necessary shutdown of the plant for operational adjustments shall be restricted to the possibly shortest period with minimum flow at the inlet works and shall be approved by the Owner's Representative.

1.6 The Contractor shall develop and maintain a chemical treatment program to minimize corrosion, extend system life and maintain efficiency of the desalination facility. The project systems shall be reviewed and recommended in relation to the chemical treatment program. The required improvements of the systems shall be carried out, after approval by the Owner's Representative. The Contractor shall provide the staff necessary for implementation of the chemical treatment program.

1.7 Access to Facility

GIPCL gate passes will be necessary for all personnel deployed. It may be noted that the desal plant shall be under the access control of GIPCL and only those personnel possessing required gate passes will be permitted entry into the premises.

1.8 Maintenance

Maintenance covers all the techniques and systems which by means of regular monitoring of equipment and scheduled maintenance procedures, prevent failures and, in the event of problems, enable repairs to be carried out with the minimum disruption of the process. Maintenance is therefore a combination of technical, administrative, and management activities. Maintenance consists of preventive and corrective procedures.

Administrative maintenance policies shall be prepared and implemented by the Contractor, based on the developed maintenance program. The policies shall be approved by the Owner's representative and shall include, but not be limited to:

- Preventive maintenance,
- Overhauls and half-overhauls plan,
- Failures and unexpected repair work plan.

A basic maintenance management system shall be implemented after approval by the Owners Representative. It shall include, but not be limited to:

- Planning and Scheduling,
- Maintenance Personnel,
- Maintenance Instructions,
- Inventory Control of Items,
- Equipment Records,
- Forms for Costs and Budgets.

The Contractor Shall take Annual Maintenance Contract (AMC) from Original Equipment Manufacturer (OEM) or OEM authorized service provider for a period of three years for UF/RO Membrane, Pumps & Blowers, Energy Recovery Device, PLC and DCS/SCADA system or any other major system. The cost for the AMC is in contractor scope.

The Contractor shall periodically carry out maintenance. It shall include but not be limited to the provision of all required spare parts, material and personnel. All items of equipment shall be inspected and maintained in accordance with the manufacturer's specifications and with the local conditions. Replacements, repairs and paintings shall be carried out immediately and when necessary. Maintenance records showing all maintenance work carried out on each item of equipment shall be updated daily and shall be made available at any time for examination by the Engineer. The installed equipment shall be checked and serviced daily during working days.

The operating conditions of any instrument shall be maintained by function checks and services. Calibration shall be checked and corrected whenever necessary. After submission of the calibration data for approval, the instruments shall be calibrated as required and directed by the OEM as well as Owner/GIPCL. The buildings, HVAC, electrical and sanitary installations shall be kept clean and continuously maintained in a proper and orderly manner. All interior and exterior structures, structural elements, equipment, installations, infrastructural elements and others shall be maintained, repaired, painted and replaced if necessary and/or as directed by the Owner's Representative.

The maintenance of site works shall include, but not be limited to the repair, painting and the replacement of defective items for traffic areas, pipes and fittings (including protection), cables, channels, roads, drains, gardening areas, lighting poles and fences and shall also include the maintenance of lawn areas, plants, shrubs, bushes and trees.

The Management of Maintenance shall include, but not be limited to:

- Implementation and Operation of a Separate Maintenance Budget System Comparing the Budget with the General Budget of Operation and Maintenance,
- Planning and Controlling the Work of Subcontractors, If Applicable.
- Establishing of Requirements for Equipment Manuals for Each Item of Equipment,
- Setting Out Procedures for Installation and Commissioning, Instructions for Operation and Maintenance and Listings of Component Parts.

1.9 Planning and Schedule

The performance of maintenance shall be administered using a maintenance work package system in which the job priorities, the work assignment and the available personnel are listed. The required daily work shall be scheduled in charts by the hour or more detailed. The maintenance work package system shall consider the manufacturers' maintenance manuals and also conditions like topography, climate and operation of the treatment plant. The maintenance work package system shall include a chart for periodic maintenance of any equipment and Plant on Site. The chart of every equipment and Plant shall indicate any necessary step of preventive maintenance. The maintenance work package system shall be submitted to the Owner's Representative for approval.

1.10 Inventory Control of items

A central storeroom for spare parts, equipment and supplies shall be maintained. All parts shall be assigned with item identification codes, each of them possibly being an extension of the design and construction documents. The Contractor in the operation and maintenance manuals, shall furnish a complete schedule of recommended oils and other lubricants.

A computerized system shall be implemented using the item identification code to record all necessary information of any item, to place the items in the storeroom and to re-order the items in case of requirement. This system shall keep a record of the quantity of each item remaining in stock, shall allow a direct comparison with the recommended stock level, as well as indicating the replacement lead-time.

The performance and the future requirements of maintenance shall be recorded daily and updated in the equipment records. All maintenance of equipment, identification of occurred problems and action taken to avoid failure shall be recorded. The records shall be made available at any time for examination by the Engineer.

1.11 Work Control and Failure Management Planning

Work control shall be established by preparing and implementing procedures of Corrective and protective maintenance, of tool control and of spare parts issues. Failures of maintenance shall be bridged or repaired as soon as possible so as to minimise negative effects on the environment. Therefore, the Contractor shall use a standard procedure such as the critical plan method (CPM), or equivalent, to sufficiently schedule for maintenance failures. Resource planning shall be carried out in order to find out the requirements for special materials, special tools and/or special equipment for bridging or repairing any failure as soon as possible.

1.12 Disposal of sludge and residuals

The Contractor shall arrange for the disposal of any screenings, grit, sand, other waste, debris and residuals or generated at the treatment plant to an identified disposal landfill. Disposal shall be arranged through GSPCB authorized agencies only. Toxic wastes shall be disposed of at a site to be agreed with the concern local body. Unless a public sanitary landfill site can be used for the disposal of non-toxic residuals, the disposal site has to be approved by the local bodies responsible for public health.

The disposal costs as such outside the boundaries of the facility shall be borne by the Contractor.

The sludge along with the reject water shall be disposed of to the designated area as directed by the owner. However, in future if it becomes necessary to dispose of the sludge at the defined landfill by the Owner or at any other location as desired by GSPCB or any statutory authority, the same shall be paid extra as mutually discussed between the Owner and contractor.

1.13 Reporting

The contractor shall monitor the performance of the RO Plant, conduct the analysis of various parameters as indicated Technical Specifications for the inlet Borewell water, Pond water filtered Water and permeate water. Contractor shall initiate and take adequate actions to ensure smooth and satisfactory performance/ running of the plants on a 24 hours/ round the clock basis.

The Contractor shall submit monthly reports including any important details concerning technical performance, staffing, training and Operation and Maintenance of the Works by the 10th day of the successive month. After approval by the Owner's Representative, the reports shall be used as a guide for regulation, adjustment and modification of the plant facilities. The reports shall continuously record and demonstrate the performance of staffing, training and operation and maintenance. The number of copies of each monthly report shall be one hard copy and e-mail to notified personnel, the number of the final report at the end of the Operation and Service period shall be one hard copy and e-mail to notified personnel. The layout of the reports and other general requirements shall be discussed with the Engineer and arranged to his satisfaction. The shift leaders in charge of operation shall prepare a daily machine journal. The journal shall be a record of all the readings of flow rates, counter readings, pressure values, temperatures, odours, etc. for all facilities and equipment of the treatment plant. A file shall be maintained at site for storage of hardcopies from supervisory control panel printouts showing the listed parameters. In addition, all characteristic operation data of any major item of the

treatment plant and all remarks and comments of the shift leaders concerning abnormal readings, overloads, stoppage, failures and other operation events shall be recorded.

Sampling, analysis and reporting of intake, permeate, discharge etc as required by statutory guidelines etc shall be carried out.

Monthly laboratory reports shall be prepared presenting the results of the records of laboratory tests and continuous quality control measurements. The monthly reports on daily sample and measurement shall be prepared including, but not being limited to:

- Results of Borewell water, Pond water quality analysis.
- Results of filtered water analysis.
- Results of analysis of effluent from pre-treatment plant, including effluent pH records.
- Pre-treatment plant specific energy consumption profile.
- Pre-treatment specific chemical consumption for each chemical.
- Pre-treatment plants run times between backwash and cleaning operations.
- Pressure and flow profile through pre-treatment plant, showing success or otherwise of backwash / cleaning events.
- Turbidity profile of pre-treatment plant permeates.
- Pressure and flow profile through RO plant.
- RO plant specific energy consumption profile.
- RO specific chemical consumption for each chemical.
- RO Average Membrane Lifetime (AMLT) estimate.
- Results of Normalization software projection for the BWRO plant (each train) including, calculated pump net pressure profile, Salt rejection profile, element flow profile, differential pressure profile, pH profile, temperature profile.
- Conductivity results over RO plant.
- Data on any CIP cleans carried out on the RO plant (each train) along with justification for performing such cleans.
- RO system overall performance summary
- Proactive maintenance / cleaning program for the following month along with justifications for any cleaning activities.
- Summary of performance of membrane treatment process.
- Summary of plant disinfection performance including free chlorine residual profiles for each free chlorine analyzer.
- Any other analysis that may be required for statutory reporting.

1.14 The contractor shall prepare and implement an effective plant maintenance program in consultation with the Owner. It is absolutely the contractor's responsibility to look after all sorts of maintenance whether preventive, Minor, Major, or break down. The Contractor will be responsible to carry out day to day as well as periodic maintenance necessary to ensure smooth and efficient performance/running of all equipment. The contractor shall attend all the breakdown of civil, mechanical, electrical; piping and instrumentation works and maintain the plant and equipment throughout the Contract Period.

1.15 Quality Control

A quality control management system shall be developed and maintained, based on the prepared quality control manual. All employed staff shall be trained in the application of the quality control management system. All programs and systems prepared for Operation and Maintenance as well as for Staff Training shall be integrated in the quality control management system. The quality control management system shall be approved by the Owner's representative.

1.16 The Contractor shall follow the manufacturers' recommendations with respect to equipment maintenance, consumables, the types and grades of lubricants to be used, frequency of lubrication, adjustments to be made regularly and recommended spares to be held in store**.**

1.17 The contractor should plan & procure all spares, chemicals and all consumables including chemicals, grease, lubricating oil, cleaning agents, laboratory reagents etc. Further the contractor shall plan about the requirement well in advance and procure the material from the market and have minimum storage for all chemicals including but not limited to coagulant, lime, chlorine, hypo, polymer, CO2 etc.

1.18 The contractor shall prepare and submit daily, fortnightly and monthly reports of plant performance and will assist the Owner in preparing the necessary documents for their purpose and records and for submission to owner/statutory authorities, in their prescribed format.

1.19 Carry out regular and frequent sampling, analysis and result recording of raw and permeate water as per the procedures laid out by the Owner and in conformity with standard methods.

1.20 The contractor shall be responsible for maintaining the lighting and other equipment.
Daily on/off operation and routine cleaning of all type of electric fixtures. Replacement of lamps / Tubes / Fans in case of failure shall be at contractor's cost.

1.21 Contractor shall be responsible for the maintenance of Garden, lawn, green belt etc. work shall include the watering, grass cutting, removal of shrubs, weed cutting of branches of tree/ plant, growth of garden, Plantation etc. The contractor shall be responsible for the maintenance of all buildings in the plant. Work all buildings, bathroom, toilet to be kept, swept, cleaned and washed daily. Consumable requirements for cleaning such as acid, Harpic, phenyl, air freshener, washing powder, brooms, wire brushes, duster, bamboos, toilet shop, lotion waste shall be provided and used as required. All windows and doors shall be cleaned and keep in good aesthetic condition.

1.22 Contractors shall be responsible for keeping watch on overflowing of sump. If such overflow takes place the contractor shall have to bear the damage caused to surrounding properties.

1.23 On the expiry date of his contract operation and maintenance, the contractor shall hand over the plant back to Owner in fully working condition satisfying the requirement of permeate water as per the process guarantees specified in technical specification. All the electrical, mechanical and instrumentation, including standby, shall be in perfect working condition.

1.24 GIPCL shall at its cost take out and maintain an all-risk insurance covering loss of and damage to the Desal the Plant including Borewell water main. The contractor shall be added as additional insured under such coverage. People & own machinery by contractor.

1.25 Except where otherwise expressly provided herein, neither Party shall be liable to the other Party for any loss of profit, loss of use, loss of contract or for any indirect or consequential damage whatsoever which may be suffered by the other Party.

1.26 The contractor shall grant the Owner a royalty free, non-exclusive, license to use and reproduce its IP rights contained in its O&M documents furnished to the Owner in accordance with the provisions of the Contract, for the sole purposes of the operation and maintenance of the Plant. There shall be no transfer of legal title to any IP rights, which shall remain vested with the Contractor. The Owner shall grant the Contractor a royalty free license to use and reproduce all IP rights held by the Owner, which are necessary to enable the contractor to lawfully perform its obligations under the O&M Contract.

1.27 All Central / State Government/Semi-Government/Local Body's rules, ESI, Minimum wages and regulation pertaining to this contract, all legal formalities pertaining to provident fund, factory act, and all legal formalities shall be followed and observed by the Contractor without any extra cost to the Owner. Please note that failure in complying so, all liabilities arising as per laws will

be to the Contractor's account. The proof of compliance will be the pre-request to monthly payment under the contract.

1.28 Operation & Maintenance report to be filled in given format as mentioned in Annexure 8.1 of Operation report.

2.0 CHECK LIST FOR HAND-OVER AT THE END OF OPERATION & MAINTENANCE PERIOD

2.1 General

This section applies to procedure(s) on how to transfer the RO plant to GIPCL after three (3) year period of operation and maintenance by the Contractor. The handover of the plant shall be in totality that shall include the Desalination plant with Borewell with raw water conveyance piping, Reject water systems, Product Water Pumping facilities, instrumentation system, communication system, substations, Transformers, DCS/SCADA systems, and all ancillary buildings associated with the Desalination package.

The procedure for Handover shall be verified through the final examination by the Owner's Representative. A completion approval Certificate shall be issued after the successful final examination and submission of the completion documents before the contract deadline.

The results of the inspection and the detailed inventory of all materials and equipment components shall be presented in a comprehensive Hand over Report.

The criteria for the Hand-Over of the Works shall be based on a fair evaluation by both parties during the joint inspection and the Contractor's O & M proposal.

It shall be based on the criteria that all the equipment of the plant is in running condition and considering the normal and reasonable wear and tear up until such an inspection.

There will be no special major replacement or renewal to enable such transfer, considering that a normal Assets Replacement and major overhaul of plant has been carried out during the Operation Services in accordance with the Operation and Maintenance Plan.

2.2 Joint Inspection Prior to Contract Completion

Not less than Three months prior to the expiry date of the O&M Service Period, a third party appointed by GIPCL or by contractor shall carry out a joint inspection with the Owner's Representative and contractor of the mechanical, electrical, instrumentation and civil Works.

The cost of third party shall be deemed included in the price of the contractor and no extra payment to this shall be made by GIPCL on the said account.

The contractor proposes a list of TPIs. GIPCL shall approve the TPI . The contractor shall appoint an agency as approved by GIPCL.

During the joint inspection the conditions of the installed membrane shall be evaluated based on internationally recognized procedure with applicable standard. This will involve the evaluation of the operational trans-membrane pressure across the elements.

It is anticipated that before the Hand back, test on certain number of membranes among those who are the oldest shall be identified and autopsied in order to determine the membrane expected worst condition.

Within 30 days of the completion of the joint inspection, the third party shall submit a report on the condition of the Works identifying maintenance works (excluding routine maintenance works and the correction of defects), replacements and other work required to be carried out to satisfy the requirements of the O&M Plan after the Contract Completion Date.

Visual inspection of the plant, jointly by the Contractor, GIPCL and the third party (independent expert) jointly appointed by the Contractor and GIPCL shall evaluate the physical aspect of the equipment like random check of cleanliness, leakage, noise, vibration, temperature etc.

All cost for the examination/test/ training, and preparation of any document of the activities shall be the Contractor's sole responsibility to facilitate the handover at the end of the stipulated O&M period.

The Contractor shall submit the completion documents after pass the final examination before the deadline on the contract time. The typical report consists of relevant documents, for request for issue the Completion certificate of 3 years O&M period as stated in table below:

This data shall be provided in soft and hard copies in proper professional format.

GIPCL may choose to carry out subsequent O&M through a contractor or directly. In case required, necessary data as may be required for floating a new tender and access to list for potential bidder shall be provided by bidder.

Typical Items to be examined at the End of 3 Years O/M Period

Sl. No.	Items	Description
1.	Appearance test /Visual Examination (Damage/crack, Expansion joints, differential settlement, soil settlement, peel off painting, missing/lost, leakage of water/solution/gas, corrosion, decolonization, condition of maintenance, others)	- All Civil structures, building including interior/exterior, fence/gate, stairs, others All Mechanical & Electrical equipment/accessories, others including all Pipeline valves and gates, others etc. - All Instrumentation and control equipment, others including All water quality analysers, etc.
2.	Performance examination (Selection of operation mode, selection of facilities, flow/water level, overflow, leakage of water/solution/gas, heating, vibration/noise level, speed of rotation, smoothness, gap/spaces, accuracy, setting value, condition of maintenance, others) including all mechanical, electrical and Instrumentation and Control equipment's and software.	- Check Sequence, or Manual operation including water level sensors/protections, others - Check specification of all Processes facilities, others - Check specification of all Mechanical equipment including pressure gauges, pressure relief valves, others - Check specification of all Electrical equipment, others - Check specification of all pipeline including valves, gates, others - Check specification of all accrual condition after troubleshooting, others - Functional Checking of all Laboratory instruments/ equipment and ICA equipment including online analysers, flow meters, pressure and level instruments, vibration monitoring instruments, and wireless equipment being used for communication. - Loop checks will be conducted. - All instrument cabling shall be inspected for continuity. If found faulty, the same shall be replaced and demonstrated. - All instrumentation cable conduits shall be checked for damage. If found faulty, they should be rectified or replaced and sealed to the satisfaction of the Owner's Representative

Sl. No.	Items	Description
		- Earth Resistance of individual, Combined Pits for Substations should be checked during Hand over. -
3.	The detailed mechanical inspection of the following major equipment (Unit Installed power > 30 kW) of the plant :	The inspection shall be for: - Pressurisation pumps - Air Compressor - Clarified water pumps - Auto self-cleaning strainer - Ultrafiltration Backwash system - Cartridge filter feed pumps - High pressure pump and ERD Booster pumps - BWRO high pressure feed pumps - CIP Pumps - RO flushing system pumps - Permeate water transfer pumps The detailed inspection shall consist in: - measurement of the vibration and electrical current of the equipment, - 1 hour run test of the stand-by machines to check their availability
4.	Test Prior to O&M Contract Completion	- Testing and calibration (if required) of protection systems and control settings of RO Trains - Testing of safety and security of the plant including trip systems. - Testing at 3 different plant capacities (25%, 65% and 100%) during 2 hours for each stabilized regime to demonstrate the ability of the plant to accept capacity variation in transient conditions and comply with Product water quality requirements.
5.	Spare parts and others	- Check inventory list (parts, chemical, reagent, others) - Check the quantity of inventory, others

Sl. No.	Items	Description
		- Check maintenance tools and equipment, vehicles, others

The contractor shall be required to do Net Dependable Capacity Testing and will have the following additional verifications along this specific test:

- Steady SDI at membrane inlet in accordance with membrane manufacturers guarantee requirements.
- Normalized RO train inlet pressure, trans-membrane pressure and pressure drop shall comply with the performance guarantees written in the RO Membrane Supplier Agreement. Those measurements shall help to determine the general conditions of the RO membrane
- Specific power consumption (SPC)

The above tests are applicable for second pass RO (BWRO) also.

More generally, the most reliable values of varied parameters listed above which will be checked, shall take into account the running conditions over the 3 years of operation, and considering the normal and reasonable wear and tear of such equipment.

2.3 ITEMS TO BE HANDOVER AT THE END OF THE TERM

The Contractor shall handover to GIPCL the following:

- Chemicals required for the operation of 100% production in RO plant for 60 days from the date of Hand back. The quantities for 60 days will be calculated using the average numbers (quantities in kg for the last 2 years of O&M period)
- Mandatory spares as per Annexure 1.2 of Volume II section - 1.
- All spares and consumable available in the inventory at free of cost.

Typical Completion Documents to be handed over at the End O & M

Sl. No.	Contents	Description
1.	Outline	Outline - Summary of project, scope of work, location of project, main component with specification, others
2.	Completion Photographs	Photographs with short description - Civil (structural buildings, others)

Sl. No.	Contents	Description
	(At acceptance complete inspection, completion inspection and final inspection)	- Mechanical and Mechanical (equipment, facility, others) - Piping works
3.	Inspection summary (At acceptance complete inspection, completion inspection and final inspection)	Appearance test /Visual/ performance examination - Table of Summary of test activity based on daily and monthly. - List/ of type of test, date, inspector, evaluation, comments. - Civil (name of structure, drawing No., drawings, design dimension, previous dimension, actual dimension, photograph with short description others). - Mechanical, Electrical, C&I (name of facility and equipment, Tag.No.,Q'ty., others)
4.	Water quality certification data (At acceptance complete inspection, completion inspection and final inspection)	- Location of sampling and time, and date - Raw water and treated water - Each process - Issued from Authorized certificate
5.	Operation/maintenance manual (Civil, Mechanical, Electrical, C&I)	Update –as per Contract.
6.	List of spare parts & consumables	- Mechanical, Electrical, C&I (name of parts, Tag. No., Qty, location of stock, others)
7.	Report	- Monthly and annual report - Others

2.4 SPECIFICATIONS

The specification of materials used for repairs shall be the same as have been used in the original work. Specifications for any materials which were not used during construction shall be approved by the Owner's Representative prior to Hand Over. Without being limited by this clause, the Contractor shall use appropriate material for repairs even if material required for such repairs has not been approved earlier, and no delay in making such repairs shall be subjected to such limitation. However, subsequent to use of such material the Contractor shall submit proposals for the approval of specifications of such material.

2.5 LUBRICATION

The Contractor, in the operation and maintenance manuals, shall furnish a complete schedule of recommended oils and other lubricants. The number of types of lubricants shall be kept to a minimum.

The Contractor shall indicate the brand name of indigenously available equivalent lubricants, with their complete duty specifications, in the O&M manual. The Contractor shall also furnish the schedule of quantities for each fill, frequency of filling and annual requirement in O&M manual. Where lubrication is affected by means of grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Frequently, for this purpose, means more than once in a month. Where more than one type of special grease is required, a grease gun for each special type shall be used.

All lubricant systems shall be designed so as not to cause a fire or pollution hazard. The Contractor shall supply flushing oil for such lubrication system when an item of plant is ready for preliminary running.

2.6 SPARE PARTS

All spare parts used for the equipment for the maintenance of the system must be from the manufacturer of the equipment or, if the equipment itself has been made with parts from other manufacturers, the parts must be of the same make as used in the equipment supplied and installed.

All spare parts shall be packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be labelled on the outside of its packing with its description, number and purpose and, if more than one spare part is packed in a single case, a general description of the case contents shall be shown on the outside and a packing list enclosed.

2.7 CHECK LIST

A General

Within the framework of the Contractor's responsibilities given above, the Contractor shall carry out the following activities. However, these shall not limit the requirement for other activities which otherwise are required as per terms and conditions of the Contract or to fulfill the Contractor's responsibilities or are essential as per good industrial practices. The Contractor shall hand over the components of works in good working condition for the following, but not limited to:

a) All process units in good working condition with replaced wear and tear parts to the satisfaction of the Owner's Representative
b) All civil works intact without any evidence of crack, peeling of plaster or surface finish.
c) All Electrical Equipment's such as Transformers, LT Switchgears / MCCs, Control Stations, Cables, Earthing, DG Set, AMF Panel, Battery etc., at the Desalination plant, administrative buildings etc. (all works constructed in this Contract) in neat and clean condition.
d) All consumables required for the functioning of the plant for next 60 days from the date of handover with inventory of materials.
e) A M C contracts with system / equipment suppliers, as necessary for UF/RO Membrane, Pumps & Blowers, Energy Recovery Device, PLC and DCS/SCADA system supplier or the authorized system integrator as executed the work for this project.
f) Lighting fixtures and the lighting system of all areas and replacement of all non- functional lighting fixtures.
g) Records for:
   - Repair history of all mechanical, electrical and instrumentation control equipment in water treatment plant, and communication instruments.
   - Logbooks through PLC System.
   - Daily log of operations of all the important equipment with time tag;

B Electrical System

The Contractor shall hand over the following at the end of Operation and Maintenance Period

(i) Revised as built drawings based on all modifications during O&M Period. All Electrical Drawings like Single Line Diagrams, Control Circuits Equipment Layout, Cable Layout, and Cable Schedules, earthing Layouts should be maintained and should be handed over.

(ii) Details of Protective Relay Settings and time relay settings including any changes done during the Operation and Maintenance period, Details of Oil Changes /Filtration of Transformers, Records of any changes made in the System during the Operation and Maintenance period etc should be maintained.

(iii) Equipment wise maintenance record during O&M Period, as per daily checking out/inspection and regular

(iv) Motor wise Power consumption Details and over all power consumption detail of plant. Details of IR Test of all Equipment's like HT/LT Panels, HT/LT Motors, Generators, Transformers.

(v) Switchgears, and Cables etc. should be maintained.

(vi) Logbook showing details Electrical faults that have occurred in the plant and record of corrective actions taken during O&M period.

(vii) Equipment wise technical data given by equipment supplier, Documents showing Bill of Materials and Operation & Maintenance Manual (hard copy or soft copy).

(viii) List of mandatory spares that are to be maintained at stores and their actual availability in plant, if it is below same has to be replenished.

(ix) Details of Measurement of Earth resistance, Earth Pit wise and Overall Values during the O&M Period.

(x) Details of Illumination Levels during the O&M Period along with details of changes, if any effected during the O&M period.

C Instrumentation, Control and Automation System (ICA)

The Contractor shall hand over the following documents/drawings/manuals/programs at the end of Operation and Maintenance Period

i. Revised As built drawings approved by the Owner's representative based on all modifications during O&M Period. All ICA Drawings like P&ID, System configuration diagram (PLC & DCS/SCADA architecture), Instrument installation drawings, Instrument cable schedule, and cable layouts should be maintained and should be handed over.

ii. Handing over document/manuals shall include on a soft copy and 5 sets of hard copies. The hard copies shall be spiral bounded clearly indicating the version/revision submitted. All the contents shall be indexed. The contents of handing over document/manual shall be clearly legible and shall include original manufacturer's literature at a minimum, and in-corporate any changes as per site conditions.

iii. Detailed drawing and manual of the PLC installed. The manual shall include the PLC series installed along with complete details on I/O modules, Ethernet switch, Relay modules, and converters (if any).

iv. A complete manual shall be provided which shall include operating instructions and troubleshooting techniques of the PLC and accessories installed illustrated with examples. This shall be provided along with the standard manufacturer's literature.

v. A complete manual shall be provided, which shall include operating instructions and troubleshooting techniques of the SCADA and accessories installed, illustrated with examples. This shall be provided along with the standard manufacturer's literature.

vi. A complete manual shall be provided which shall include operating instructions and troubleshooting techniques, if any installed illustrated with examples. This shall be provided along with the standard manufacturer's literature.

vii. A complete manual shall be provided which shall include operating instructions and troubleshooting techniques of the interface control panel, where applicable. This shall be provided along with the standard manufacturer's literature.

viii. Interoperability testing tool/software shall be provided along with relevant manuals and operating instruction with examples.

ix. All software's used under ICA shall be handed over along with their original licenses.

x. Complete list of database /addresses shall be provided clearly indicating the spare tags for PLC, DCS/SCADA.

xi. List of mandatory spares that are to be maintained at stores for complete ICA package and their actual availability in plant, has to be provided.

xii. Any password set to access the internal PLC program; interface control panel shall be provided and demonstrated.

xiii. All passwords (PLC, Interface control panel & DCS/SCADA and other software/hardware) shall be provided in a sealed envelope and addressed to the Engineer in Chief (GIPCL).

xiv. Manufacturer's literature/Manuals for flow meters, level transmitters, switches, pressure transmitters etc and analytical instruments installed.

xv. A complete and updated list of all manufacturers/system integrators/contractors of ICA with contact numbers shall be provided. The same shall also be made available on site for ready reference.

xvi. The latest versions of all drawings of ICA, which will include cable termination details, I/O mapping, database details etc shall be provided in PDF format and editable format and loaded in the operator machine available on site. The same shall be demonstrated to the Owner's Representative

ANNEXURE 8.1

OPERATION REPORT

Data of Normal Train – Monthly

Data	Feed Flow	Permeate flow	Recover Rate	pH	Feed Pressure	Pressure drop of used RO system	Conductivity of Product Water	Production per Day	Temp. of Raw Water	Conductivity of Raw Water	Temp. Ambient Air
Unit	m^3/h	m^3/h	%		Bar	Bar	µS/cm	m^3/Day	°C	µS/cm	°C
(DD-MM-YYYY)											

Date of Normal Train – Weekly

Data	Permeate Flow	Permeate Conductivity	Salt Rejection
Unit	M^3/hr	µS/cm	%
(dd-mm-yyyy)			