SUBSECTION 14: OPERATION AND MAINTENANCE

14.0 GENERAL

This section applies to the specifications of materials used for operation and maintenance, the workmanship, period for routine maintenance, specifications for the acceptable quality of treated water, maintenance of records, and responsibilities during operation and maintenance period.

The Contractor shall operate and maintain the entire Mira Bhayandar sewerage system including Collection System, Sewage treatment plant, Sewage pumping stations, instrumentation system, communication system, the PLC systems, all ancillary buildings, campus area, roads and ancillary civil structures along pipeline and road for the entire period specified in the Contract.

14.1 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 Employer's Representative prior to commencement of the operation and maintenance period and must be incorporated in the O&M manual. Without being limited by this clause, during O&M period 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. The approved material will subsequently form a part of the O&M manual.

14.2 ACTIVITIES DURING O&M PERIOD

14.2.1 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 term and conditions of Contract or to fulfill the Contractor's responsibilities or are essential as per good industrial practices. The Contractor shall be responsible for, but not limited to, the following:

a) Collecting water from all the zones, pumping and treatment with quality of effluent water as specified or as directed by the Employer's Representative.

b) Providing the required staff, but not less then the minimum specified numbers/ level, during operation and maintenance period and additional staff as per requirement during periodic maintenance and in emergencies.

c) Providing all required consumables required for functioning of plant and equipment except for chemical consumables(Alum and chlorine) and power charges.

d) Maintenance of pump houses, sewage treatment plant, administrative buildings, STP campus, renovated buildings and their campuses, staff quarters and their surroundings, etc.(all works constructed in this Contract) in neat and clean condition.

e) Entering into AMC contracts with system / equipment suppliers, as necessary. It is mandatory to enter into an agreement for a 10 year maintenance contract with the PLC and SCADA system supplier or the authorized system integrator, whosoever has executed the work for this project.

f) Maintenance of the lighting fixtures and the lighting system of all areas and replacement of all non-functional lighting fixtures within 24 hours.

g) Maintaining;

- Repair history of all mechanical, electrical and instrumentation control equipment in pumping stations, water treatment plant, water transmission mains and communication instruments;
- Logbooks through PLC system;
- Every day power availability, input voltage and current, frequency, power factor, kWh meter readings and kW reading for Substation at Intake

and clear water pump house;

- Daily log of operations of all the important equipment such as clarifiers, filter, dosing electrically actuated valves, etc., with time tag;
- Daily start–stop operation of pumps with every hour readings for operating voltage, amperage and power factor;
- Hourly readings of pressure on the manifold, flow rate in manifold and integrated quantity of water;
- Hourly levels of sumps;
- Influent and effluent water quality test results on turbidity, residual chlorine levels, etc. (every 6 hours);
- Daily list of alarms with time tag;
- Logbook format and the data to be included in the logbook shall be decided during commissioning in consultation with department;
- Last periodic maintenance done for all equipment/buildings of the system;
- Observations made during patrolling of the pipeline and roads.

In addition to maintenance of above logbooks the Contractor is required to maintain one inspection book at each pumping station and filter plant. The complaints entered in the complaint register must be investigated and remedial measures must immediately be taken.

h) Providing required spares and maintaining adequate inventory of required accessories or equipment itself for repair of system so that the electrical, mechanical, instrumentation and control system, pipe and pipe appurtenances and surge system and the communication system can work efficiently as per the guarantees given or minimum required efficiencies asked for in the Contract, without any additional costs to department. The Contractor may use spares and tools and tackles supplied with the Contract as required by him. However at the end of the Contract the Contractor shall hand over the full spares, tools and tackles as supplied with the Contract by replacing the used items with fresh supplies of the same specifications.

i) Providing manpower for the required repairs of all facilities along with the manpower and materials for repair of the roads, buildings and campus area utilities.

j) Maintaining the drinking water supply facilities in pump house building, STP campus and all its units.

k) Maintaining stores for the electrical, mechanical and instrumentation and control equipment as well as that for the chemicals and laboratory consumables at the filter plant. The maintenance of stores will include but shall not be limited to:

- Loading / unloading of materials received and issued for works;
- Proper arrangement of material in stores to ensure its safety and easy availability;
- Maintaining store areas in a neat and tidy condition;
- Keeping records and accounting for the incoming materials,
- Keeping records and accounting for the consumed materials.

The Contractor shall be solely responsible for the safety and security of the goods in the store and will be responsible for any loss or damages in stores for any reason. He may opt for insurance cover against the value of the goods to be stored without any additional costs on the Department.

l) Daily patrolling of the raw water and clear water main from Intake to Balawala, to identify and report the damages / defects of road, road embankment, pipe and pipe appurtenances, CD works, en-route structures.

m) Periodic and routine maintenance as per the manufacturer's recommendations and recommended schedules, as well as emergency (breakdown) maintenance as and when required. Maintaining a fleet consisting of at least one JCB or other equivalent or superior hauling machine, sufficient inspection/patrolling vehicles and material hauling vehicles and any other vehicles/ machinery/ equipment for adequate and timely repairs and/or for routine/

periodic maintenance/ patrolling of the system.

n) Periodic routine maintenance of structures/buildings of intake pumping station and others built in the Contract, campus areas of treatment plant and pumping station(s). Such maintenance must ensure adequate cleanliness, ventilation, illumination and structural safety. In addition to this, the general hygienic standards must be maintained and adequate plantation, horticultural activities must be taken up to maintain the total environment of the campus / building pleasant.

o) Providing transportation facilities between various areas.

p) Updating and periodic submissions of the operation and maintenance manual as defined in specifications for O&M works. The Contractor shall take up all periodic maintenance works provided in the approved O&M manual.

r) submission of monthly report.

s) Co-ordination with other contractors and/ or agencies responsible for the execution, operation and maintenance of the transfer system and distribution within Jaipur city and enroute villages, including the O&M contract for the Ajmer Water Supply and Electric Supply Company.

t) Providing all machinery like JCB, generator, drain pumps, crane, welding machine, etc., as required for proper and timely maintenance activities.

u) Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities, insure;

I. The work together with material and plant for incorporation therein, to the full replacement cost (term "cost" in this context shall include profit).

II. The Contractor's equipment and other things brought onto site by the Contractor, for a sum sufficient to provide for their replacement at the site.

III. The insurance shall be in the joint names of the Contractor and the Employer at the Contractor's cost and shall cover the Employer and the Contractor against all losses or damages from whatsoever cause arising from the start of the O&M until the date of completion of O&M in respect of the facility or any section or part thereof as the case may be.

IV. Any amount not insured or not recovered from the insurer shall be borne by the Contractor

14.3 EXPERIENCE AND QUALIFICATION OF STAFF

For all operation and maintenance works, the Contractor shall provide skilled staff, which has adequate qualifications and sufficient experience of similar works. CV of General Manager, Shift-in-charge, Plant Supervisors will have to be got approved from the Employer. The following Table 4.14.1 describes the minimum levels of staffing, and their minimum qualifications and experience in similar works, theta the Contractor will be required deploy for carrying out the O&M functions:

Table 4.14.1: Minimum Requirements for Staff and Qualifications

Sr.No	Designation	Qualification	Experience	Nos.
A. General Staff (common for the whole project)				
1.	General Manager	Graduate Engineer (E/M)	15 years	1
2.	Electrical Engineer	Graduate Engineer-Electrical	5 years	1
3.	Foreman-Electrical.	Diploma /ITI	5/10 years	1
4.	Foreman-Mechanical	Diploma/ITI	5/10 years	1
5.	Wireless Communications Operator	Diploma in wireless communications or equivalent	5 years	3
6.	Foreman Instrumentation	Diploma	5 years	*1*
7.	Instrumentation Technician	ITI Instrumentation	10 years	*2*
8.	Helpers	10th Pass	-	4
Total of A.				***14***

Sr. No.	Designation	Qualification	Experience	Nos. Shift-1 8-4pm	Shift-2 4pm-12	Shift-3 12-8am	Total
B. Collection System for all Zones							
1.	Shift-in-charge	Graduate (Elect/Mech.) OR Diploma (Elect/Mech.)	5 years 10 years	2	2	2	6
3.	Helpers	8th Pass	-	12	12	12	36
4.	Security Guards	8th pass	-	--	--	--	--
	Attendant	-	-	1	-	-	1
		Total		*15*	*14*	*14*	*43*
Total of B.				***43***			
C. Pumping stations and Sewage Treatment Plants for all zones							
1.	Plant Supervisor	Graduate Engineer-Mech /Elect /Civil/ M.Sc.(Chemistry)	7 years	9	-	-	9
2.	Shift-in-charge	Diploma (Elect/Mech.)	5 years	9	9	9	27
3.	Electrician	ITI (Elect.)	5 years	9	-	-	9
4.	Chemist	BSc-Chemistry	5 years	5			5
5.	Lab Assistant	Diploma in Lab Tech.	3 years	5	-	-	5
6.	Helpers	8th pass	-	18	18	18	54
7	Security Guards	8th pass	2 years	9	9	9	27
8	Gardener	8th pass	2 years	3	-	-	3
		Total		66	36	36	138
Total of C.			***138***				

Note:

1. The above requirement is minimum only. The Contractor will arrange extra work force, as and when required, so as to smoothly run the operation and maintenance including preventive maintenance, repairs etc. and general cleanliness of the installations.

2 The above staff strength is exclusive of leave reserve required for different category of staff. The Contractor shall ensure availability of the personnel given in the above table for all seven days in a week.

4. The Contractor shall make appropriate arrangements for maintenance of items like road work, buildings, arboriculture, patrolling and maintenance of civil structures, vehicle operations and other activities defined to fulfill its obligations under O&M Contract.

14.4 PUMPING STATIONS

(i) Operation of plants as required, including provision of required manpower for routine operation of pumping station.

(ii) Periodic upgrading, as required, of the initial impellers and wearing rings by replacement with the intermediate impellers and wearing rings, and subsequently with the final impellers and wearing rings, for the clear water pumping station (replacement impellers and accessories to be provided as a part of the Contract).

(iii) Maintaining the pumping station PLC, including hardware and software along with all instruments, in proper working condition. The downtime of the control system shall not exceed 2 hours. During the downtime, the Contractor shall continue to operate the pumping station in manual mode using the local panel controls and the readings from local instruments.

(iv) Routine and periodic maintenance of the entire control system and instruments as per the manufacturer's recommendations.

(v) Replacement of damaged control, communication cables, and power supply cables.

(vi) Repair or replacement, as required, of all instruments such as flow meters, pressure sensors, pressure gauges, level sensors, float level switches, temperature scanners, vibration sensors, noise meter, data loggers along with all other equipment. The down time of any individual instrument as referred above shall not exceed 24 hours.

(vii) Periodic site calibration of all measuring/metering equipment at every 6 months minimum or as recommended by the manufacturer. The calibration at the manufacturer's works/ independent laboratory shall be carried out only in case of major failure of the instrument.

(viii) Preparation and submission of daily and monthly customized reports, produced from the local SCADA system

(ix) Repair or replacement, as required, of damaged electrical equipment/ parts for proper functioning of electrical system.

(x) Maintenance of the cooling and lubricating systems.

(xi) Routine maintenance of the pumps/ motors as per recommendation of the manufacturer.

(xii) Replacement of bearings, damaged impellers and other damaged parts so that the operation of pumps ensures the guaranteed efficiencies with desired noise and vibration levels.

(xiii) Routine and periodic maintenance of the EOT cranes as per the manufacturer's recommendations.

(xiv) Breakdown maintenance of all electrical, mechanical, instrumentation and control equipment, EOT crane, etc.

(xv) Re-painting of the exposed mild steel components of pipe line, ladders, railings etc. in the pump house in the 3rd and 5th year of O&M to keep them in good shape.

(xvi) Maintaining the surrounding areas of the pumping stations free from shrubs, weeds, grass and other unplanned vegetations.

(xvii) Routine monitoring of substation equipment and taking preventive measures as required

(xviii) Routine maintenance of VFD as per manufacturer's recommendation.

(xix) Keeping the hourly records of:

- Status of pumps
- Current
- Voltage
- Frequency
- Active and reactive power
- Water level at suction reservoir
- Suction and delivery gauge readings
- Rate of flow
- Pump head
- Keeping daily records of:
  - Total number of hours of operation
  - Total quantity pumped
  - Total energy(kWh) consumption

(xx) Specific requirements of pumping station maintenance are as listed in the following Table 14.2:

Table 14.2: Maintenance Schedule for Pumping Stations

Activity	Frequency
Removal of clogged materials from screens (only for raw water pumping plant)	Daily 6 times
Temperature of WTI/OTI w.r.t ambient temperature	Daily 4 times
Oil level in the conservator	Daily
Oil level in the bushing	Daily
Temperature of RTD, BTD in motors w.r.t. ambient temp.	Daily
Watering garden around plant, if provided	Daily 4 times
Checking of disconnectors' operation	Weekly
Operation of crane for all motions	Weekly
Cleaning of level sensors	Weekly
House keeping plant and its surroundings (Includes removal of dust, dirt, cobweb etc)	Daily
Checking vibration and noise level of pump sets	Daily
Fully closing and opening of sluice gates and valves	Monthly
Submission of report on maintenance to Employer	Monthly
IR and PI values of motors	Monthly
Condition of silica gel in breather and replacement(if required)	Monthly
Replacement of bearings	Within a day of breakdown
Replacement of bulbs, lamps etc	Within a day of breakdown
Tightening of gland	When leakage increases beyond acceptable limit

Activity	Frequency
Greasing, oiling	As per manufacturers recommendation
Attending breakdowns	As and when it occurs
Preparation of list of spares for satisfactory operation	Half-yearly
Transformer oil sample checking	Half-yearly
Inspection of switchboard, cable box, etc.(i.e. visual inspection, tightness of nuts and bolts, IR values, earthing contacts, checking tightness of terminal block, etc.)	Halt-yearly
Measurement of earth resistance	Yearly
Checking of relays/ alarm (trough secondary injection)	Yearly
Condition of gasket and replacement (if required)	Yearly

(xxi) Disposal of screened material.

(xxii) Providing all consumables such as grease, oil, stationery, water for gardening, etc.

(xxiii) Providing office furniture for operating and maintenance staff.

(xxiv) Providing safety accessories such as gloves, shoes, first aid box etc.

(xxv) Ensuring safety of plant and equipment.

(xxvi) Furnishing required information to Employer.

(xxvii) Any compensation charges levied by Vidhyut Nigam towards low power factor, overloading or any other such penalties will be borne by the Contractor.

(xxviii) Contractor will be given a minimum of 15 days advance notice by the Employer's Representative for changing the impellers when required.

14.5 SEWAGE TREATMENT PLANT

i) Operation and maintenance of all the water treatment process facilities from inlet chamber to treated water reservoirs/sump

ii) Providing required manpower for routine operation of all the process units ,compressor room, HV/LV switchgear room, PLC control, all motors and valves in the system, and laboratory.

iii) Maintaining the PLC, including the hardware, software and all instruments, in good working condition. The downtime of entire control system shall not exceed 2 hours. During the downtime, the Contractor shall continue to operate the water treatment plant in manual mode using the local panel controls and the readings from local instruments

iv) Routine and periodic maintenance of the entire control system and instruments as per the manufacturer's recommendations.

v) Replacement of damaged controls, communication cables and power supply cables.

vi) Repair or replacement, as required, of all instruments such as flow meters, pressure transmitters, pressure gauges, level sensors/transmitters, float type level switches, on-line pH meters, on-line turbidity meters, on-line residual chlorine meters and laboratory instruments along with all other equipment. The downtime of any individual instrument as referred above shall not exceed 24 hours.

vii) Periodic site calibration of all measuring/metering equipment or as recommended by the manufacturer. The calibration at manufacturer's works shall be done only in case of major failure/ repairs of the instruments.

viii) preparation and submission of daily and monthly customized reports produced by the local SCADA system.

ix) Provision and maintenance of all consumables for printing without any additional costs to the Employer.

x) Inspection of each clariflocculator at least once in a year after complete dewatering for damages caused to the moving parts, steel structures, and the RCC structure. Subsequently the repairs, cleaning and disinfection must be done.

xi) Maintaining all filters in good and proper operating condition irrespective of the inflow and outflow rates, except for filters under repair or periodic inspection.

xii) Maintenance of the filter beds and under drainage system in good and proper operating condition including providing gravel and sand as required.

xiii) Weekly lubrication of all gears of reduction motors, motorized valves, gates and other parts of the system.

xiv) Periodic operating and checking check all valves and gates for their manual and electric operation. Operation of valves must be checked from local control console, switchgear and through PLC system. Any defect observed must be made good.

xv) Ensuring environmentally friendly disposal of sludge at approved site(s), within a radius of 30 kilometers from the treatment plant.

xvi) Operation and maintenance of all circuits and buildings associated with the treatment works.

xvii) Breakdown maintenance of all electrical, mechanical and instrumentation equipment.

xviii) Routine monitoring of substation equipment and take preventive measures (as required)

xix) Routine maintenance works of lighting and earthing system.

xx) Re-painting of the exposed mild steel components of pipeline, ladders, railings etc. in the filter plant in the 3rd and 5th year of O&M to keep them in good shape.

xxi) Maintaining the surrounding areas of the filter plant free from shrubs, weeds, grass and other unwanted vegetation.

xxii) The raw water shall be used for watering plant and washing.

xxiii) Providing safety accessories, e.g. gloves, shoes, first aid box, etc.

xxiv) Ensuring fire and safety equipment.

xxv) Minimum 15 days stock of all the consumables shall have to be maintained to ensure that quality of water does not suffer. The Contractor will use chemicals to ensure their most economic consumption and minimize wastage.

14.6 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. In case of grease lubricated bearings for electric motors, lithium base grease is preferred.

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 effected by means of grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Frequent, 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.

14.7 SPARE PARTS

All spare parts used for the equipment in 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 labeled on the outside of its packing with its description, number and purpose and, if more than one spare is packed in a single case, a general description of the case contents shall be shown on the outside and a packing list enclosed.

14.8 PIPELINE

The MS clamps and pipe sections used must have thickness as per design requirement at the point of installation and shall be coated internally and externally as specified for MS pipes in Subsection 5 and 9.

The rubber gaskets/rings, nut and bolts, etc., to be used shall be as per the specifications given for the respective items in Subsection 5 and 9.

After each repair the damaged coating of pipes must be repaired and, if in trench conditions, the trench must be filled with approved soil, well compacted to its original density, up to the existing ground level.

Stretches along pipe alignments where cover is washed out or removed due to other reasons must be rehabilitated so that the minimum cover required is always maintained.

All cracks in pipe supporting structures, valve chambers and their edges must be raked, filled and made good with cement sand mortar 1:2.

The repairs may include but not limited to items: -

a) Repair of leaks, damaged portion of road, embankment, pipe and pipe appurtenances, CD works and en-route structures identified during patrolling.

b) Emergency repair(s) of burst(s) for maintaining regular supplies.

c) Operation of all motorized valves quarterly to check its proper functioning electrically as well as for manual operation. Maintenance of all valves in leakless conditions. Quarterly inspection of, expansion joints and surge protection equipment/system, insulating joints and repairs if required. Contractor shall submit quarterly reports of all such activities done.

d) Maintenance of inventory for repair of pipe leak(s) and burst(s), valves (air valve, sluice valves, butterfly valves), expansion joints, surge protection devices, anti-corrosion devices or any other pipe appurtenances or equipment(s) installed.

e) Quarterly lubrication of all motorized gear boxes along the alignment.

f) Maintaining the valve chambers along the pipeline in clean and dry conditions.

g) Maintaining portable generating set for operation of valve actuator and dewatering of scour valve chambers and dewatering in case of burst/repair of pipe.

h) Maintaining the soil cover on the pipe damaged due to rains, runoff or any to other reason.

i) Repair of damaged coatings during maintenance operations.

j) Maintaining clean conditions at saddle and ring girder supports and oiling/greasing of all supports.

No water losses are admissible in the transmission system.

14.9 PUMPING STATION, TREATMENT PLANT AND ALL OTHER BUILDINGS

The Contractor shall carry out ordinary repairs to buildings during the O&M period. The repairs may include but not limited to the following items:

(i) Easing of doors and windows, monsoon repairs to roofs, attention to drains, rain water spouts, attention to plinth protection.

(ii) External white or color wash, external or internal painting, internal distempering, renewal of approach roads within the campus.

The frequency of repairs must not be less than as specified below:

Sr.No.	Nature of Repair	Frequency of repair for Residential Buildings	Frequency of repair for other Buildings
1	External finishing (color washing) after attending minor repairs such as damage to plaster, etc.	Once in a year	Every two year
2	Internal finishing (distemper / painting) after attending minor repairs such as damage to plaster etc	In 3rd and 5th year of O&M	In 3rd and 5th year of O&M

(iii) Repairs to other administrative buildings must be carried out during May to June except for white and color washing work, which should be done in September and October after monsoon in residential buildings.

Following repairs prior to onset of monsoon are essential:

1. Any faults in the electric installation, leakages, earthing, exposed wire ends and any hazards on this account to the users/inmates of the buildings, should be taken care of suitably; wiring, which is damaged or outlived, should be replaced.

2. Damaged sanitary lines should be replaced and choked lines cleared.

3. Proper drainage of the area around the building should be ensured to avoid stagnation of rain water/ house effluent, in order to prevent malarial conditions. Where courtyards exist in the buildings, their drainage into the outer drains should be ensured. Any choked drains should be cleared properly.

4. Leaking roofs should be attended to immediately with suitable repairs/ treatment, as the case may be. The rain waterspouts should also be cleared of blockages, etc. The roof should be swept clean of leaves, debris, etc., if any.

5. The plaster on outer walls of the building, which is exposed to weather, should be repaired before rains in order to prevent dampness inside. Where plinth protection has been provided, it should be checked and the damaged portions, if any, should be repaired before rains.

6. Damaged flooring should be repaired/ replaced as per requirement, in order to prevent dampness inside the rooms, etc., during rains.

7. Periodic repairs of damaged floors, door/window fittings, water taps, water coolers, furniture, desert coolers, electric circuits, must be taken up on complaints using the material of same quality as used during construction.

to ensure trouble free communication.

14.10 OPERATIONS AND MAINTENANCE MANUAL

The comprehensive manual shall be submitted before the operation and maintenance period, as specified. It shall be periodically updated to incorporate the “best practices” experience gained while carrying out the O&M activities, broadly on the principals listed below:

1. Up-dating any changes in the procedures set out in the O&M manual, as deemed necessary based on any limitations observed during the maintenance period, including incorporating additional procedures for maintenance of other repairs/break downs not incorporated in the maintenance manual but faced during O&M period.

2. Procedures for repair of leaks/burst in different types of pipes must be provided, with supporting drawings. The O&M manual must be updated if any differences are observed during O&M period.

3. Frequency of spares used in maintenance of valves (air-valve, sluice valves and butterfly valves), expansion joints, equipment installed for surge protection and protection against corrosion must be recorded for updating the contents of the manual.

4. Records of trouble shooting points and details of events causing trouble (breakdowns) during maintenance of inlet chamber, chemical mixing unit, flash mixer, clariflocculator, filter bed(s), sludge thickener and drying beds, pre-chlorinator and any other part of the treatment plant must be maintained and used for updating the contents of the manual.

5. Records of trouble shooting points and details of events causing troubles (break down's) during maintenance of pumps / motors / measuring equipment(s), / electric panel and accessories there in must be maintained and used for updating the contents of the manual.

6. Records of locations and type of damages observed during maintenance of road which are of recurring nature must be used in updating the manual.

8. Records of Inventory used must be maintained and the relevant portion of O&M manual must be updated to list out the inventory requirements for maintaining the system for 12 months.

9. Records of the raw water quality, as monitored during very day of the O&M period, must be maintained and handed over after the expiry of Contract period. The chemical requirement in the worst conditions of operation must be identified and incorporated in the manual.. Record keeping must be sufficient so as to assist in forming a relationship between the chemical dosages required for treatment with respect to the raw water input quality.

10. The provisions in the manual must incorporate every aspect of good industrial practices even if not elaborated here or in other parts of the bid document. The provisions in the approved operation and maintenance document shall be valid and binding for both the parties during operation and maintenance along with the additions and deletions made.

11. The manual so prepared must be updated after the end of every year of operation and maintenance, giving effect to the experience gained and the observations made by the Department during the maintenance period.

12. At the time of handing over after completion of O&M period, all the equipment, including standby equipment, must be in good working order.

14.11 PENALTIES FOR FAILURE TO ACHIEVE THE FUNCTIONAL GUARANTEES

In case of failure to deliver the required effluent quality , liquidated damages shall be imposed for such failure to meet the performance criteria, as described in the following. The Employer will be entitled to recover any such damages from the monthly progress payments to be made to the Contractor in the month in which the failure occurred, or at any time thereafter from the subsequent monthly progress payments.

14.11.1 Power Consumption in Pumping Stations:-

The expected power consumption shall be calculated every month on the basis of the characteristic curves submitted by the Contractor along with the offer and the actual duty conditions for the month (calculation can be done on hourly basis). It will be compared with the actual power consumption and if the consumption is higher than the expected consumption, after taking into account the tolerances, liquidated damages shall be recovered from the Contractor at the rate of two times of the charges for the extra power consumed and paid to Reliance.

Application of liquidated damages for excess power consumption will not be subject to any upper limit.

14.11.2 Quality of Treated Water: -

Water will be provided within the permissible chemical and bacteriological parameters and, in general, there should be no lapse in it. The treated water will be checked for required quality parameters.

In case the permissible parameters are not achieved

(i) In case of lapses in more then two occasions in a calendar month, liquidated damages will be applied at the rate of 0.5% of the Contractor's monthly charges for O&M for each day of lapse.

(ii) In case there are lapses in two consecutive days, liquidated damages will be applied at the rate of 1.5% of the Contractor's monthly charges for O&M.

(iii) In case the Contractor has continuous lapses beyond two days, liquidated damages will be applied at the rate of 5.0% of the Contractor's monthly charges for O&M for each day of lapse. In such case, the Contractor will be notified and the Employer will have the option of making the necessary inputs to control and improve the supply. All costs for such improvement, including 10% for overhead and administration, will be charged to the Contractor, along with the penalty for the lapses.

14.12 FACILITIES TO CONTRACTOR

The Contractor will be permitted to use the premise and quarters developed under the Contract for use by his staff during operation and maintenance to the extent agreed and approved by the Employer's Representative.

14.13 PAYMENTS

The Contractor, at the time of bidding, will be responsible to ensure the completeness and adequacy of his Bid Price to fulfill the entire responsibilities as described above. His bid price, as quoted on a monthly basis in the Schedule of Prices, shall include all costs for carrying out all O&M responsibilities, except for the following items for which the Employer will bear the cost:

(i) The cost of electric power consumed, which will be paid directly to Relianceby the Employer

(ii) The cost of the chemical consumables used in the water treatment plant processes (except laboratory chemicals), which will be either be supplied by the Employer, or reimbursed to the Contractor, on a monthly basis, at the actual cost paid by him plus a 5% handling fee.

14.14 FORMAT

Suggested formats to be followed for proper recording of pumping and treatment plant operations are given below. The format can be finalized during execution stage.

A PLANT DATA

Pumping Station:

Date:

2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

19							
20							
21							
22							
23							
24							
			Total =				

B. PUMP OPERATION

Pumping Station:

Date:

Time Hrs	Pump no								
	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
Total hours of operation									

Mark ‘X’ if pump is not available

Indicate Starting and Stopping time

C PUMP DATA

Pumping Station:

Pump No.

Date:

Time Hrs	Voltage (V)	Current	Suction gauge reading* (m)	Water level in sump (m)	Delivery gauge reading (m)	Total head (m)	Signature
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

* For Horizontal pumps only

D POWER STATEMENT

Pumping Station:

Month:

Date

Date	Theoretical power consumption (kWh)	Allowances	Actual Power consumption (kWh)	Difference	Signature
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Date	Theoretical power consumption (kWh)	Allowances	Actual Power consumption (kWh)	Difference	Signature
31.					

E MONTHLY REPORT

Pumping station:

Month and year

	Pump no									
	1	2	3	4	5	6	7	8	9	10
Number of hours of operation										
Vibration mm/sec										
Noise level dBA										
Total quantity pumped ml										
Energy consumption kWh										
Total no of hrs of power failure										
Total no of pump set hrs not available										
Reason for non availability of pump set										
Action taken for rectification										
Non availability of any other equipment and reason										
Action taken for rectification										

Signature:

FORMAT 1

Daily Report

on

Operation and Maintenance of

_____ MLD Sewage Treatment Plant

At_____

Prepared by: **[Name of Contractor]**

Report For: **[Date]**

A. Consumption Records						
Sr. No.	Item	Meter Reading or other records		Daily Quantity	Average per m^3 of raw water	Remarks
		At 6:00 hrs of reporting day	At 6:00 hrs of previous day			
A.1	Raw water quantity received at plant inlet					
A.2	Alum,Chlorine Quantity consumed					
A.3	Electrical Power consumed					

B. Quality Records							
Particulars		At 6:00 hrs	At 12:00 hrs	At 18:00 hrs	At 24:00 hrs	Average	Remarks
B.1	Dissolved Oxygen						
B.2	T.S.S of raw sewage						
B.3	PH Of Raw sewage						
B.4	PH of treated water						
B.5	DO in treated water.. etc.						

E. Operational					
Sr. No.	Unit	From hrs.	To hrs.	Total time	Remarks
E.1	*				
E.1.1	*				
E.1.2	*				
E.2	*				
E.2.1	*				
E.2.2	*				
E.3	Other Units				
E.3.1	…… Downtime				
E.3.2	…… Downtime				
E.3.3	…… Downtime				

* Process units as installed by contractor

Signed by: _____

Designation: _____

On behalf of Contractor:_____

FORMAT 2

Monthly Report

on

Operation and Maintenance of

_____ MLD Sewage Treatment Plant

At_____

Prepared by: **[Name of Contractor]**

Report For: **[Month]**

A. Consumption Records						
Sr. No.	Item	Reading on last date of month	Reading of month	Quantity daily month	Average per 1000 m^3 of raw water/day	Remarks
A.1	Raw water quantity received at plant inlet					
A.2	Chlorine Quantity consumed					
	For pre-chlorination					
	For post-chlorination					
A.3	Alum Quantity consumed					
A.4	Electrical Power consumed					

B. Quality Records					
Particulars		Average during month	Maximum during month	Minimum during month	Remarks
B.1	As above in daily report				
B.2					
B.3					
B.4					

E. Operational				
Sr. No.	Unit	Total time during month	Average daily	Remark
E.1				
E.1.1				
E.2				
E.2.1				
E.3	Other Units			
E.3.1	…… Downtime			
E.3.2	…… Downtime			
E.3.3	…… Downtime			

* Process units as installed by contractor

Signed by: _____

Designation: _____

On behalf of Contractor:_____