

2 SCOPE OF WORK

Preamble

This is a single–point responsibility Contract for design, supply, construction, operation and maintenance of a sewage collection, conveyance and treatment for Mira Bhayandar City for capacities as described herein. The Employer has carried out surveys, investigations and preliminary designs of important components. Suitable locations of the pumping stations, Sewage treatment plant have been finalized and the required land identified and acquired or being acquired. The details of the same have been presented in the subsequent subsections and elsewhere in the document. The main parameters and specifications decided upon and laid out in the document are to be honored and maintained. However, detailed design and preparation of working drawings are required to be done before construction and procurement commences, and form a part of the Contractor's responsibility. The Contractor is responsible for ensuring that the Project when commissioned fulfills the objectives for which it has been designed. The Contractor is required to double check the stipulations, surveys, investigations and design of the system independently. He may propose upgrades where he feels that a change is required to achieve the objectives.

It is the intent of the Employer to construct a facility using the highest standards for construction and supply of Plant and equipment to enable a sustained, reliable system for performance over next 50/100 years.

1 General Scope of Work

The scope of work under this Contract includes the design and construction of all Works for the sewerage system as described in subsequent paras, sufficient to collect and treat expected flows of raw water in all zones, and other works listed herein or any other works necessary to achieve the above objective and complete the system as per the specifications and Employer's Requirements, including operation and maintenance of the entire system for 10 years.

The electric power will be supplied from from MBMC (on behalf of Reliance) at the campus boundary of each treatment plant on 4/6 pole structure. The connection at take-off structures with necessary equipment (such as insulators, ACSR, hardware, clamps and connectors etc.) shall be in the scope of Contractor.

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

A) Investigations, Surveys and Submissions

Setting up fully equipped/staffed field offices to carry out the required surveys and investigations and preparing the necessary designs and drawings at the very start of the Contract. The design offices shall interact with the Employer's staff to ensure team work for early submission and approval of the design and drawings required.

Carrying out necessary topographical survey/sub soil investigations for sewage collection system, treatment plant, pumping stations and outfall sewers in consultation with the Employer's Representative so as to verify and check the data provided in the document

Carrying out required subsoil investigations for design of foundations including the tests for determination of safe load. Carrying out various other subsoil investigations such as the type of soil, the strata, and the level of ground water, optimum

moisture content, soil resistivity and chemical composition, bearing capacity, etc., as may be required.

Carrying out required raw water quality analysis.

Preparation of system designs where required (e.g. sewage treatment plant, pumping stations, surge protection system, power supply system, automation, local SCADA systems for monitoring and control, communications etc.) for approval of the Employer's Representative.

Planning, design and preparation of the working drawings for the proposed Works. Preparation and submission of the L-sections, layout plans and cross sections and conceptual drawings etc. and all other drawings at appropriate scale and details for planning and construction of all components of the project.

Submission of documents (designs, drawings, data sheets, etc.) and samples required according to the Contract for approval by the Employer's Representative of all design and drawings, material to be used, equipment specifications, etc., prior to construction.

Preparation and submission of General Arrangement Drawing (GAD) and Architectural Elevation drawings of all structures proposed to be constructed for approval.

Preparation of the structural design and drawings (including reinforcement detailing) for all the Works taking into consideration the functional reliability and structural safety of the buildings.

Preparation and submission of all detailed working drawings on the basis of conceptual designs and plans approved by the Employer's Representative.

B) **Works**

Setting up of suitably equipped/manned field offices for supervision of the works for the Contractor's staff and the Employer's Representative and Engineers.

Development of suitable storage spaces for construction material and equipment to be received for the works.

Identification of suitable quarries/sources for construction material and get them approved from the Employer's Representative.

Setting up, and staffing with qualified engineers/ technicians, of suitable laboratories for following the Quality Assurance Program.

Setting up of suitable labor camps with all water and sanitation arrangements and other facilities required under the relevant Labor laws.

Implementation of all the environmental and relevant social mitigation measures as required.

Making arrangements for equipment and material required for maintaining safety of the sites and the workmen on site (helmets, boots, jackets, safety belts, gloves, scaffolding, barricading, etc.)

Submission of initial work program and updating the same every month for approval by the Employer's Representative.

Site clearance and leveling of site. Layout of the works as per the approved drawings.

Disposal of surplus soils as directed by Employer's Representative, construction of civil components of all the units, and maintaining the construction site in orderly manner.

Carrying out tests on materials received and finished works and maintaining complete records and registers required on site.

Manufacturing, shop testing, pre-dispatch inspection, packaging, transportation to site, providing

transit insurance, storage, handling at site, installation, sectional testing, pre-commissioning testing, trial runs and commissioning of all components of the system including the pipes, fittings, hydraulic, mechanical, electrical, electro-mechanical and instrumentation equipment.

Providing spares, tools and tackles.

Remedying the defects during the Contract period

Site Clearance and tidying up and restoration of the premises after completion of the Works

Submission of 'As Built' drawings and Operation and Maintenance Manuals

- C) Operation and Maintenance, Preventive Maintenance and Repair of Complete System for 10 Years.
- D) Training of the MBMC Staff on all Aspects of Operation and Maintenance of the Full System.
- E) Handing Over of the Full System at the End of the O&M Period to MBMC.

2 System Components

The project contemplates execution and satisfactory commissioning of Underground Sewerage Scheme to Mira Bhayandar City Municipal Corporation and the major components of the system are :

2.1 Collection & conveyance System

Providing & laying of 89 Kms of Np-4 & NP-3 RCC/HDPE pipes having diameters ranging from 150 mm to 1200 mm and RCC manholes having depths ranging 1.5m to 9 meters from along with the allied items & works.

2.2 STPs & Pumping Stations

Since the scheme is based on decentralized waste water system, the Sewage Treatment Plants proposed are packaged Treatment plants because of acute scarcity of land in the city. There are ten STPs proposed in nine zone having treatment capacity Ranging from 7 Mld to 17 Mld, the total capacity of 110 Mld .

2.3 Flow Measurements

Electromagnetic 18 numbers of bulk Flow meters with GSM capability to measure the inflow to the system and flow from STP are provided in estimates.

2.4 Outfall sewer

The treated effluent from each sewage treatment plant is to be pumped to the nearest nalla through GRP pipes of diameters ranging from 400 mm to 600 mm and length varying from 200 meters to 2000 meters.

2.5 Miscellaneous Works

2.5.1 Construction of Security Guard Rooms, Meter Rooms, Compound walls, etc. at STPs.

2.5.2 SCADA for complete network

Since the entire system is broken into different sub-systems and the treated water is intended to use for non-potable uses, there is need for a continuous monitoring of treated water quality and analysis of various scenarios which is proposed through SCADA.

2.5.3 Computer, Plotters, GPS etc.

The municipal corporation is in the process of implementing sewerage scheme and this shall require considerable establishment for implementation & further operations & maintenance of the scheme. A provision towards equipment purchase like computers, scanners, plotters etc have been made.

2.5.4 Communication strategy, public awareness campaign for water tariff rationalization and judicious use of water assets

The treated water is supposed to be reused by industries and housing societies which requires an effective communication program & awareness campaign.

2.5.5 Shifting of Existing Utilities

Since the collection and conveyance pipelines are required to be laid on main roads which shall require shifting of existing utilities like telephone cables , electric cables , water pipelines etc.

3 PROJECT INFORMATION

3.1 SITE INFORMATION

3.1.1 Location

Mira Bhayandar area is located on the north-western periphery of Mumbai under Thane district and is located between 18°2'N – 20°20'N latitude and 0° 25'E – 73° 44'E longitude

3.1.2 STP Site Topography

It is located in the northern part of the Konkan region to the west of Sahyadri hill ranges. The whole town is on a plain level land. The Vasai creek surrounds the city from east to north, followed by the Arabian Sea, till the west. The Mumbai city is situated on the southwest. To the south is the Sanjay Gandhi National park and on the southeast, the Thane city.

3.1.3 Climate

The climate of Mira-Bhayandar is typically coastal, sultry and not really hot. There are virtually two distinct seasons, namely, rainy and dry seasons. The latter covers both summer and winter periods.

4 PROPOSED COMPONENTS

4.1 Zone wise Length of Various types Pipes:- In Meters

Zone 1	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	1516.8	646.4	108.16
200 mm	1008	566.4	78.72
250 mm	1086	460.4	77.32
300 mm	1000.2	408	70.41
400 mm	338.4	264.8	30.16
500 mm	411	191.2	30.11
600 mm	122.7	268.5	19.56
700 mm	468		23.4

Zone 2	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	674.2	894	78.41
200 mm	514	593.6	55.38
250 mm	155.2	129	14.21
300 mm	237.8	388.8	31.33
400 mm	249.8	1474.1	86.195
500 mm	634	848.5	74.125
600 mm	84.5	-	4.225
700 mm	89.5	34.5	6.2
1100 mm.			
1200 mm			

Zone 3	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	-	-	-
200 mm	259.2	28.80	14.4
250 mm	487.4	57.60	27.25
300 mm	498.6	57.60	27.81
400 mm	1293	172.80	73.29

500 mm	602.4	90.60	34.65
600 mm	397.8	278.00	33.79
700 mm	-	121.80	6.09
800 mm	-	-	-
900 mm	-	289.60	14.48
1000 mm	-	341.00	17.05
1100 mm.	275	183.50	
1200 mm	132.5	-	

Zone 4	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	372.4	57.60	21.5
200 mm	364.4	57.60	21.1
250 mm	478.6	115.20	29.69
300 mm	552.4	172.20	36.23
400 mm	544	332.60	43.83
500 mm	358.4	56.40	20.74
600 mm	195.4	44.40	11.99
700 mm	-	408.00	20.4

Zone 5	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	5423	812.60	311.78
200 mm	3390.5	392.10	189.13
250 mm	2143.8	-	107.19
300 mm	1401.9	-	70.10
400 mm	1401.9	480.50	94.12
500 mm	1533.8	648.50	109.12
600 mm	323.3	209.00	26.62

Zone 6a	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	1183.20	258.00	72.06
200 mm	1001.40	233.60	61.75
250 mm	878.20	338.40	60.83
300 mm	885.20	283.00	58.41
400 mm	1015.20	418.20	71.67

500 mm	497.60	-	24.88
600 mm	109.80	222.60	16.62
700 mm	341.00	164.00	25.25

Zone 6b	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	513.00	750.80	63.19
200 mm	547.00	863.20	70.51
250 mm	474.20	637.40	55.58
300 mm	379.80	396.80	38.83
400 mm	352.60	876.40	61.45
500 mm	123.00	1064.30	59.37

Zone 6c	Class NP III	Class NP IV	D I K-9 grade Pipe
250 mm	374.40	-	18.72
300 mm	408.20	-	20.41
400 mm	681.00	-	34.05
500 mm	655.80	-	32.79
600 mm	244.40	-	12.22
700 mm	367.20	-	18.36
800 mm	119.60	-	5.98
900 mm	161.20	-	8.06
1000 mm	234.80	-	11.74
1100 mm.	199.60	-	-
1200 mm	-	-	-
Zone 7	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	460.80	230.40	34.56
200 mm	944.20	472.20	70.82
250 mm	829.20	516.60	67.29
300 mm	626.80	483.20	55.5
400 mm	1371.20	566.00	96.86
500 mm	888.60	284.00	58.63
600 mm	384.80	828.00	60.64

700 mm	353.60	-	17.68
800 mm	-	-	-
Zone 8	Class NP III	Class NP IV	D I K-9 grade Pipe
150 mm	576.00	57.60	31.68
200 mm	1491.60	169.80	83.07
250 mm	1557.00	161.20	85.91
300 mm	2174.40	319.40	124.69
400 mm	1844.40	544.80	119.46
500 mm	1595.40	94.60	84.50
600 mm	423.20	-	21.16
700 mm	240.40	34.50	13.75
800 mm	793.60	-	39.68
900 mm	625.50	-	31.28
1000 mm	554.00	-	27.70
1100 mm.	583.50	-	
1200 mm	410.50	-	

4.2 Zone wise Minimum & Maximum Invert Depth:-

Zone	1	2	3	4	5	6a	6b	6c	7	8
Flow (Mld)	16	12	50	20	14	20	14	65	40	55
Minimum depth of downstream Invert (m.t.)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Maximum depth of Invert (m.t.)	6.6	6.2	7.5	4.5	7.7	7.7	6	4.4	6.0	10.2

4.3 Zone wise Manholes details:-

Zone	1	2	3	4	5	6a	6b	6c	7	8
Providing and constructing on sewer.R.C.C circular manhole concentric cone 1.2 m dia at bottom and 0.5 m dia at top and up to a depth of 2.0 M with 23 cm brick work in CM 1:4 proportion excluding excavation including foundation concrete 250 mm thick and haunches and channels in C.C.1:2:4 proportion, finishing channel, in smooth rendering, providing C.I dapuri type steps each weighing 5.5 kg., 1:2:4 coping and providing and fixing approved make and quality SFRC frame and cover of 56 cm dia etc.,	22	37	60	85	33	51	25	78	104	103
up to a depth of 5.0 m with	218	172	106	68	378	213	200	49	235	310
up to a depth of 9.0 M with 23 cm	72	45	38	-	192	25	23	-	16	98

4.4 Zone wise Pumping station

Zone wise consideration for pumping station /equalization tank shall be as follows:-

Zone	1	2	3	4	5	6a	6b	6c	7	8
Total Flow in Mld	16	12	50	20	14	20	14	65	40	55
Invert depth, m	7	6	8	5	8	8	6	4	6	10
Max liquid depth, m	3	3	3	3	3	3	3	3	3	3
Total depth, m	10	9	11	8	11	11	9	7	9	13
Retention time at avg. flow, minutes	30	30	30	30	30	30	30	30	30	30
Liquid hold-up volume, cum	333	250	1042	417	292	417	292	1354	833	1146
Area, sqm	111	83	347	139	97	139	97	451	278	382
Overall capacity including freeboard volume, cum	1067	767	3646	1042	1040	1486	875	3340	2500	5042

Zone wise Pumping machinery

Zone No	Flow	Total Head	Pump Capacities and Nos.		
			Quarter Capacity (1/4 th of Flow)	Half capacity (1/2 Of Flow)	Full Capacity
		(Tentative To be worked out by Bidder)			
	Cum/hr	m	No.	No.	No.
1	583	18	1 W + 1S	2 W+2 S	1 W + 1S
2	333	18	1 W + 1S	2 W+2 S	1 W + 1S
3	708	18	1 W + 1S	2 W+2 S	1 W + 1S
4	500	18	1 W + 1S	2 W+2 S	1 W + 1S
5	292	18	1 W + 1S	2 W+2 S	1 W + 1S
6a	542	18	1 W + 1S	2 W+2 S	1 W + 1S
6b	292	18	1 W + 1S	2 W+2 S	1 W + 1S
6c	458	18	1 W + 1S	2 W+2 S	1 W + 1S
7	500	18	1 W + 1S	2 W+2 S	1 W + 1S
8	375	18	1 W + 1S	2 W+2 S	1 W + 1S

4.5 Sewage Treatment Plant Capacity

Bidder shall design sewerage plant with following capacities

ZONE	PHASE I
	Mld
1	14
2	8
3	17
4	12
5	7
6A	13
6B	7

6C	11
7	12
8	9
Total	110

5 Land available for the STP's

Land available for the STP's at ultimate stage shall be as follows:

Status of Land availability for STP					
ZONE	PHASE I	PHASE II	PHASE III	TOTAL	Total Land available for STP design for all three phases
	Mld	Mld	Mld	Mld	Area in Sq.mt
1	14	2	-	16	4385
2	8	2	2	12	5000
3	17	17	16	50	3675+5700
4	12	4	4	20	4590
5	7	4	3	14	3360
6A	13	4	3	20	1500
6B	7	4	3	14	4460
6C	11	27	27	65	6115
7	12	14	14	40	1555+1350
8	9	23	23	55	8295
Total	110	101	95	306	

Bidder has to submit the hard & soft copy of drawing showing plant layout for ultimate stage with proposed technology. Also detail drawing of plant for phase 1.

6 Raw Sewage Quality

The bidder shall consider the raw water characteristics is indicated in the following table.

Sr.	Parameters	Unit	Design Values
1	pH		6 to 8
2	Total Suspended Solids	Mg/l	300 – 500
3	BOD ₅ at 20 °C	Mg/l	200 – 250
4	COD	Mg/l	400 – 450
5	Oil & Grease	Mg/l	10 – 20
6	Fecal Coliform	MPN / 100 ml	2 x 10 ⁷

7 Required Treated Sewage Quality

Sr.	Parameters	Unit	Discharge Standards
1	PH		6.0 to 8.0
2	Total Suspended Solids	mg/l	< 20.00
3	BOD ₅ at 20 °C	mg/l	< 10.00
4	COD	mg/l	< 100.00
5	Oil & Grease	mg/l	< 10.00
6	Fecal Coliform	MPN / 100 ml	< 500.00

8 Proposed Treatment Scheme

The process proposed shall be well-established process for treatment of sewage. The tenderers are to adopt the same nomenclature used for various treatment units in their design report as used in the tender documents. The Tenderer is required to fill up/complete the Datasheets presented in this document as a part of the tender submission.

9 Scope of Work for treatment plant

The treatment plant shall have following minimum units apart from Proposed process unit :-

- Inlet Chamber
- Mechanical and Manual Screen unit
- Mechanical and Manual Grit removal unit

- Flow Measuring unit
- Division and distribution boxes
- Chlorination system
- Roads and pathways
- Gas holder
- Interconnecting Piping
- Plant Utilities
- Land development

10 Electrical Works

The contractor shall carry out the necessary up gradation of existing 4-pole structure as per RELIANCE ENERGY and make the power available at the transformer.

Power stepped down to 433 V shall be fed to the existing electrical panel by laying new 1.1 kV Grade cables and to the new Main Electrical Panel proposed for this plant. The contractor shall also assist the MBMC in liasioning work with RELIANCE ENERGY authorities to get the additional power sanction from the RELIANCE ENERGY.

As the area is wide spread, sub-panels are to be provided, located near the respective load centers. All motors and starter control panels for operation of all equipment (viz. sewage pumps, screens & degritters, return sludge pumps, filter feed pumps etc.) except aerators, secondary classifiers submersible pumps panels are to be supplied as part of the equipment, the same have not been considered as part of scope of work for electrical work. However, these should meet the requirements as specified under electrical works.

11 Miscellaneous Works

11.1 Road and Pathways

An access road through the site along with a network of pathway shall be provided to link the existing approach road and permit access to the STP site for necessary maintenance, delivery of consumables and personnel access. All internal roads shall be of WBM ,BBM with asphaltting BM + AC and minimum 6 metres wide. Vehicular access shall be provided for such plant units that may require frequent access. All roads shall be provided with drainage and shall be constructed to prevent standing water. The approach road shall be 6 m wide of WBM with asphaltting BM + AC and pathways shall be in PCC M15 with nominal reinforcement or pre cast blocks given in the drawing.

WBM shall be constructed with 80 mm metal 150 mm thick, 40 mm gravel 100 mm thick with hard murum casing. BM shall be 75 mm thick with 4% bitumen and AC shall be 40 mm thick with 6.25% bitumen content.

Paved pedestrian (Pathways) access ways shall be constructed to provide a network of logical routes inter-linking entire plant areas and road network. Minimum width of pathways shall be 2 m.

Pathways shall be in coloured and glossy interlocking blocks. Damage to any existing roads, on account of their use by the Contractor shall be made good to the satisfaction of the PMC.

Hardstanding areas in coloured and glossy interlocking blocks shall be provided to permit the parking of vehicles involved in the delivery of consumables from blocking site roadways during unloading or loading. The road system shall be designed such that vehicles involved in the delivery of consumables can follow a continuous route through the works and out again.

The work of approach road and storm water drainage shall be carried out as per approved layout during execution of the contract.

11.2 Site office

The contractor shall provide temporary site office during entire contract period. The minimum area of this office shall be 40 m². It shall have at least two rooms each of 20 m² area.

The contractor shall provide following for MBMC use in the office of MBMC for this project at initial stage.

Sr	Item of work	Work
1	Personal Computer	02 No: core 2 duo or latest Version & Configuration, with the latest microprocessors, 160 GB HD 02 nos, 4 gb RAM, DVD CD ROM, CD writer ROM additional, 19" colour monitor, 1500 w speaker system etc. As per approved
3	Printer	01 No: HP or equivalent- All in one- A3 size Xerox, Scanner, Fax, Printer, Laser Mode.

The above computer and printer shall be handed over to MBMC as initial stages of work for MBMC's use.

11.3 PROVISION OF VEHICLE

The contractor will have to provide four vehicle (AC Car) of eight sitter with driver during the contract period for the use of employer and two vehicle of four sitter capacity (AC Car) for engineer's representative. This vehicle will be used only for duties related to the works of this contract. Vehicle must be in very good condition and to the satisfaction of the Engineer's representative. Necessary fuel/oil/driver/maintenance etc. will have to be born by the contractor. During the course of the contract in case the contractor does not provide the vehicle then employer will engage the vehicle and the actual charges incurred by him will be recovered from the contractor's bill.

11.4 PROVISION FOR COMMUNICATION

During execution of work the contractor has to make necessary arrangements for Six number of decent Walkee Talkee sets and Six mobile phones of 3G and blackberry capability with SIM card including monthly expenses incurred for facilitating speeding decision making and execution of the contract scope in contract period and up to completion of defects liability period for effective communicative arrangement at no extra cost to employer. If not provided then the corporation shall make a rebate of equal amount from the bill of the contractor as deemed fit by the employer's representative.

12 START UP AND PERFORMANCE RUN

12.1 TEST ON COMPLETION

12.1.1 General

Prior to the commencement of Tests on Completion the Contractor shall submit for approval the following:

- Site Acceptance Test Documents
- As-Built Drawings
- Operation & Maintenance Manuals

Tests on Completion shall not be commenced until the aforementioned documents are approved.

The initial charges necessary for Tests on Completion shall be provided by the Contractor. Electricity required for Tests on Completion will be provided by MBMC free of charge for a period not exceeding 30 days. In case the test on completion period exceeds 30 days, the cost of power till start of performance run shall be borne by contractor.

The cost of any consumables and chemicals required for the Tests on Completion shall be borne by the Contractor.

12.1.2 Dry Test Requirements

As a minimum requirement, the following dry tests shall be carried out as a general requirement:

- a general inspection to check for correct assembly and quality of workmanship,
- a check on adequacy and security of Plant fixing arrangements
- a general check to ensure that all covers, access ladders, water-proofing, guard railings etc. are in place,
- a check on damp proofing, rust proofing and vermin proofing and particularly the sealing of aperture between building structure , chambers, etc. and the outside.

12.1.3 Civil and Building Works

As a minimum requirement the following dry tests shall be carried out on the civil engineering and building works:

Check for the presence of foreign bodies in pipework and structures.

12.1.4 Mechanical Works

As a minimum requirement the following dry tests shall be carried out on the mechanical systems:

- Carry out preliminary running checks as far is permitted by circumstances in order to ensure smooth operation of Plant.

12.1.5 Electrical Works

As a minimum requirement the following dry tests shall be carried out on the electrical systems:

- Check phasing and polarity
- Carry out point to point check on all cables;
- Check on security of cable terminations
- Check on completeness and adequacy of earthing systems;
- Check setting on protection relays, sizes of fuses and motor overload settings;
- Carry out checks on cabling systems in accordance with the requirements of the relevant standards;
- Check operation of main circuit breakers by secondary injection methods;
- Check rotational direction of plant;
- Check instrument loop integrity, functionality and calibration;
- Check operation of standby generator installation and mains/generator changeover procedures; a 4 hrs load test (using the normal load of the Works) shall be carried out on the generator when the load is available;
- Check plant functionality
- Check functionality of the central MMI and its power supply;

12.1.6 Process Plant Item / Equipment

All process plant items/equipment shall be tested to ensure they meet the Employer's Requirements for quality of workmanship, construction and performance.

12.1.7 Hydraulic Wet Test Requirement

Hydraulic wet tests shall be carried out on completion of dry tests.

Potable water shall be used for hydraulic wet tests. The purposes of the tests is to prove as far as is practical the hydraulic performance of the Works. In order to demonstrate this the Contractor shall ensure that each part of the Works is hydraulically loaded to its maximum rated load throughout for a period of at least seven days at twenty-four hours intervals.

In order to ensure a sufficient supply of potable water to carry out these tests the Contractor shall provide facilities for the disposal off site in an approved manner.

In order to remove doubt the following tests inter alia shall be carried out.

- Pressure testing of all piped systems laid direct in ground in accordance with the relevant standards;
- Fill all structures and check for leaks as per IS:3370;
- Running of all pumped systems in order to check for
 - Correct functionality
 - Absence of leaks
 - Correct running temperatures
 - Smoothness of running and the absence of undue vibration or stress;
 - Check drive running currents
- Carry out calibration of instruments where appropriate

- Carry out valving, diversion etc. to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element;
- Demonstrate correct functionality of electrical, control and instrumentation systems.

The Contractor shall simulate where practical the conditions that will prevail when operating as a process in order to demonstrate the correct functionality of process control loop etc.

During these tests a check on the performance of Plant shall be made, as far as site facilities will allow, to compare its site performance with the factory test data and to identify and constraints on performance due to site conditions.

12.1.8 Process Wet Test

On approval by the MBMC the Contractor shall carry out process wet tests.

Raw water shall be used as the primary feed stock for process wet tests. These tests shall be carried out to demonstrate the process performance of the Works. In order to demonstrate this, the Contractor shall ensure that each part of the Works is located to its rated throughput (including a period of overload if required in order to demonstrate compliance with the Employer's Requirements) for continuous stable operating period of not less than 48 hours.

The Contractor shall provide facilities for the disposal off site in an approved manner.

The following tests inter alia shall be carried out;

- Check and rectify leakage on civil structures, pumps and pipework;
- Running of all pumped systems in order to check for;
 - Correct functionality,
 - Absence of leaks,
 - Correct running temperatures,
 - Smoothness of running and the absence of undue vibration or stress,
 - Check drive running currents where the solution pumped is different from that pumped during hydraulic wet tests;
- Carry out calibration of instruments;
- Carry out valving, diversion etc to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element;
- Demonstrate correct functionality of electrical, control and instrumentation systems not checked during dry or hydraulic wet tests or which may have changed as a result of the different operating conditions now prevailing.

On completion of process wet test on the various parts of the works the Contractor shall run the plant as a whole in order to demonstrate the full functionality and performance of the Works at various throughput rates for a continuous period of not less than 7 days. This shall be considered as completion of 'Test on Completion' and shall be certified by MBMC.

12.2 PERFORMANCE RUN AFTER START UP

12.2.1 General

On successful completion of 'Test on Completion' i.e. Start up and commissioning, certified by MBMC, Contractor should start the performance run of the plant for 3 months.

The Contractor is to carryout Operation & Maintenance (O&M) of the whole plant including civil works for 3 (three) months under performance run. MBMC shall monitor the operation and maintenance by the Contractor.

During performance run period, the Contractor shall provide following as minimum for round the clock operation.

(1) Staff

Plant in charge	: One
Chemist	: One
Operators	: One for each shift
Maintenance unit	: One fitter, One electrician
Helpers	: One for each shift
Watchmen	: One for each shift

(2) Chemicals and consumables: As required

(3) Spares: The spares used from the spare supplied under the contract shall be replaced by the Contractor.

MBMC shall supply power and water during Performance Run period free of cost. All other material such as chemicals, consumables, lubricants, tools & plants, spares etc shall be provided by the contractor. The contractor, if required, shall provide activated sludge or any other material for the stabilisation of the plant.

The Contractor shall provide operators for various units/plants for three shifts and other staff/supporting personnel in general shift.

The Contractor shall submit a weekly report to the Employer, about the operation and maintenance indicating the manpower, electric power, chemicals and other consumables consumed and also problems faced and rectified.

During this period, the Contractor shall ensure that the design treated sewage quality standards are met in accordance with the specification within the rate of power and chemical consumption as committed by the Contractor. The raw and treated sewage analysis pH, SS, BOD and oil & grease shall be carried out on daily basis from the day of commissioning at a reputed laboratory as approved by Engineer-in-Charge. 90% of the treated sewage samples should fall within prescribed limits of the treated sewage. The sampling location for raw sewage shall be at raw sewage sump and that of treated sewage shall be at outlet of chlorine contact tank.

The analysis of sewage for the above parameters at different locations such as outlet of secondary clarifier shall also be carried out on weekly basis. The Contractor shall take immediate steps to correct the operation of the plant to meet the guaranteed performance. The charges for analysis at the laboratory are to be borne by the Contractor.

The Contractor's responsibility includes the safety and security of the works/plants during the course of performance run of three month.

The Contractor shall provide the key personnel for performance run with the minimum qualification and experience as given below.

Sr.	Category	Qualification and Experience
1.	Plant in charge	Graduate in Engineering/Technology (Civil/ Environmental Engineering) having 5 years of experience in O & M/ Maintenance of water /wastewater treatment plant.
2.	Plant Operator	Diploma in Engineering/Technology (Civil/ Environmental/ Chemical Engineering) having 3 years of experience in Operation/ Commissioning of water/wastewater treatment plants.
3.	Chemist	Graduate in Environmental Science/ Chemistry having 5 years of experience in sampling/ analysis in water /wastewater treatment plants.
4.	Electrician / Fitter	Diploma in respective field with 5 years of experience in erection, commissioning and O&M of M&E equipment in water/ wastewater treatment plants.

12.2.2 Performance Guarantee Test

In Performance run of three months there shall be Performance Guarantee Test (PG test) for 168 hrs.

PG test shall be carried out over 168 hours period at a stretch. During PG test atleast one of the streams shall be operated on design flow applicable for the stream. Balance flow shall be diverted to the remaining stream(s) and this/these stream(s) shall be operated on the available flow.

From the stream operation on design flow, four grab samples shall be collected at equal interval and a composite day sample shall also be prepared by collecting samples proportional to flow at the above intervals. All the samples described above for the day i.e. 4 grab samples and one composite sample shall be analysed for the guaranteed parameter both at the inlet and at the outlet. Quantities of samples collected shall be adequate to divide the sample into three parts for independent testing by the contractor, by the client and by the consultants. All the costs associated with collection, preservation, transportation and testing of samples by all three agencies shall be included by the contractor in his quoted price.

Collection, preservation and testing of samples shall be carried out as approved by Engineer / his representative following the latest edition of Standard method for examination of water and wastewater published by APHA et.al.

Thus over 168 hrs, 28 grab samples and 7 composite samples shall be collected for testing from the results obtained by the three agencies the most conservative value (unless it is considered to be absurd as decided by engineer-in-charge) will be selected and the average of these values over 168 hrs shall be considered for deciding whether the plan meets the guaranteed parameters.

It shall be contractors responsibility to ensure that throughout PG test period, organic (BOD, N and P) and SS loads in the stream operation on design flow shall be maintained around the design value by external means (if required) such as recirculation the sludge of the remaining stream(s) sludge from other plants, septage, chemical etc. More details on protocol for testing shall be discussed on formalized by the client/contractor/consultant after award of work and before starting the PG test.

12.2.3 PERFORMANCE RUN CERTIFICATE

The conditions for issuance of a Performance Run Certificate as detailed in the Conditions of Contract shall comprise:

- The completion of the six months operation and maintenance under performance run of the treatment plant to the satisfaction of MBMC.
- 90% of the treated sewage samples fall within the prescribed limits of the treated sewage as mentioned in the tender document.
- Successful completion of PG test for 168 hrs.
- The O & M Manuals have been updated following six month's operational experience and approved by MBMC.
- All defects identified during the three months operation of the works have been rectified

MBMC shall issue a Completion Certificate for "Performance Run of Plant" after successful completion of Performance Run of plant for 90 consecutive days by Contractor to the satisfaction of MBMC.

13 OPERATION AND MAINTENANCE

13.1 General

The contractor has to maintain sewage collection system in all zones along with pumping stations

As detailed subsection 14 of this section 4.

The contractor is to operate, maintain and monitor the 110 MLD STP 120 months after successfully completing performance run. The scope of work is given below but not limited to the following. This may include other incidental items of work connected with the regular operation & maintenance of the treatment plant as decided by Engineer-in-Charge from time to time.

1. The contractor shall ensure proper running of the plant to give the desired effluent standards i.e. BOD less than 10 mg/l, TSS less than 20 mg/l, O & G less than 10 mg/l. The contractor shall also be responsible for overall maintenance of the plant i.e. civil, electrical,

and mechanical system. The contractor shall also be responsible for all repairs of equipment/machinery.

2. The contractor shall monitor the quality of raw and treated sewage. The contractor shall intimate and take adequate action to ensure smooth and satisfactory running of the plant. The raw and treated sewage analysis for pH, SS, BOD and oil & grease shall be carried out on weekly basis during O & M period at a reputed laboratory as approved by Engineer-in-Charge.
3. The contractor shall prepare and implement an effective plant maintenance programme in consultation with Engineer-in-Charge (E&M). It shall be absolutely contractor's responsibility to look after all sorts of maintenance whether preventive or break down. The contractor shall maintain the operational activity record as prescribed in this volume.
4. The contractor shall be responsible for keeping updated record of documents including History-Card for equipment and maintaining every day logbook relating to running of machinery, consumption of energy, and other consumables etc. and various analysis performed. In addition to above the contractor shall maintain the operation and maintenance data for the following.
 - Daily status record of STP
 - Daily flow record
 - Daily analysis record
 - Operation records of mechanical screens
 - Operation record of grit channel
 - Operation record of Surface aerators
 - Operation record of Secondary clarifier
 - Operation record of Return sludge pumps
 - Operation record of chlorination system
 - Record of quantity of sludge generation
 - Operation record of Centrifuge unit
 - Performance data of Aeration tank.
 - Performance data of Chlorination system
 - Any other allied works required by EIC during O&M.
5. The Contractor shall submit a monthly report to MBMC, about the operation and maintenance indicating the manpower, electric power, chemicals and other consumables consumed, problems faced and rectified along with various analysis performed for raw and treated sewage.
6. The contractor shall be responsible to carry out day to day as well as periodic maintenance necessary to ensure smooth and efficient performance/running of all equipment/instruments installed at the Sewage Treatment Plant. The contractor shall hand over the machinery & site

to the department after expiry of the contract period in good running condition.

7. The contractor shall maintain all treatment plant and pumping station units and other civil structures in the STP premises including boundary wall in sturdy manner to complete its natural / designed life. He should paint all MS / CI / GI structures at least once in a year to prevent rusting as and where required and as directed by EIC.
8. The contractor shall also be responsible for proper upkeep of administrative block of the Sewage Treatment Plant.
9. He shall be responsible for proper maintenance of all the pumps and allied items including mechanical screens, gates, Aerators, sludge pumps, chlorinator etc.
10. He shall be responsible for timely removal and safe disposal of the dried sludge including transportation, loading and unloading etc. He should get approval for the location of the disposal of the dried sludge from MBMC.
11. He shall be responsible for maintenance of streetlight, poles & fixtures also.
12. The sewerage system in the STP premises, roads and pathways provided at the sewage treatment plant shall be maintained properly.
13. Round the Clock watch and ward of the entire premises including plants/machinery etc. will also be the responsibility of the contractor.
14. The entire STP premises including Administration building will be kept neat and clean.
15. The records maintained by the contractors shall be produced periodically to the Engineer-in-charge for proper monitoring as desired by him.
16. Operation & maintenance of boundary wall of STP, Landscaping and Forestation done in the Sewage Treatment Plant premises etc. shall be carried out.

13.2 GENERAL TERMS AND CONDITIONS

1. MBMC shall supply power, Alum and chlorine to the contractor free of cost during O & M period of 120months.
2. During O & M period the contractor is to keep their staff engaged continuously without any break for Operation, Maintenance and Monitoring of STP.
3. The contractor will supply all consumable and reagents. The contractor will employ its own staff for testing purpose. However the department will be at liberty to get

- random sampling & testing done on its own or from any other agency, to the entire satisfaction of Engineer-in-charge. In case of testing from other agency, charges will be borne by MBMC
4. Contractor's labourers and supervisors shall have to normally observe office timings of general shift.
 5. Plant and equipment covered under this contract shall be totally attended to by the contractor including any "Trouble Shooting" to ensure smooth and trouble free operation.
 6. For effective maintenance of STP, the contractor shall employ sufficient staff with proper qualification. For his guidance the pattern and no. of minimum staff to be engaged is described in this chapter.
 7. The maintenance period shall be 120 months from the date of completion of successful performance run of sewage treatment plant.
 8. The contractor shall take operational measures that there shall be no flooding of STP area.
 9. The contractor shall abide by all central/state govt./Semi govt./Local Bodies rules regulations, pertaining to this contract, without any extra cost.
 10. In the event of any damage/loss of life/theft of property, due to negligence on the part of contractor, the contractor shall be solely responsible and liable for compensation and damages, regarding negligence and the decision of Engineer-in-charge shall be final.
 11. The contractor should maintain all kinds of securities in the premises round the clock for that he should arrange manpower to prevent theft, robberies and malpractice. No unknown person shall be allowed to enter the STP premises except municipal staff, officials and elected representatives of the MBMC body without permission. Educational study visits of the students are permissible only on written permission from EIC.
 12. The site will be open for inspection by the designated officers/official of MBMC at all times during the contract period.
 13. The contractor should observe all safety rules and regulations corresponding to electricity, factory act, bio-chem process fire and as per building codes. Any accident causing by overlooking the rules, the contractor at his own cost and risk shall handle the related cases. Insurance of the entire staff at site is compulsory under insurance policy drawn from Govt. of Maharashtra. The copy of the cover note should be submitted to MBMC.

13.3 FINANCIAL TERMS AND CONDITIONS

During the operation and maintenance period Electricity charges, Alum and chlorine will be borne by the department. The electricity charges will be paid directly to RELIANCE ENERGY by MBMC on actual basis as per electricity bill raised by the RELIANCE ENERGY. All other consumable material and required staff for Operation & Maintenance will be provided by contractor.

The operation & Maintenance cost approved by the Department shall be payable on monthly basis on completion of every month on submission of bill by the contractor. The contractor shall maintain the attendance record of the staff employed by him, which can be checked by the department any time. The contractor will also submit copy of all the data sheets every month for evaluation.

The Sludge available from Sewage Treatment Plant shall be property of the contractor and suitable credit for the same shall be considered by the contractor while offering his price bid. The wastewater will not be sold by the Contractor. However, department is at liberty to do so, and retain the proceedings, if any.

All sorts of Tool & Plant, required for proper operation & Maintenance of the plant, shall be arranged by the contractor at his own cost.

13.4 DESCRIPTION OF STAFFING

Details of minimum staff required to be employed for the operation and maintenance of each of the sewage treatment plant for 10 years is given below. However, additional staff, if required for proper operation and maintenance of STP, will be provided by the contractor without any additional charges.

Sr.	Personnel	No.	Main Task of the Personnel
1	Plant In Charge (Civil Engineer)	1	Coordination of activities for satisfactory performance of the STP & pumping station and reporting to the Engineer-in-charge and responsible for the proper functioning & maintenance, data collection of STP & pumping station.
2	Operators (ITI Qualified)	4	Responsible for overall operation for STP and pumping station.
3	Electrician (ITI Qualified)	1	Responsible for maintenance of electrical equipment.
4	Fitter (Mech.) (ITI Qualified)	1	Responsible for maintenance of mechanical equipment.
5	Helpers	4	Responsible for keeping the STP premises clean and neat. Also they will assist operators in day to day activities
6	Watchman	2	To protect the plant from the trespassers, animals etc.
7	Gardener	1	To maintain the garden/landscaping of the plant

13.5 DEPLOYMENT OF STAFF DURING OPERATION AND MAINTENANCE PERIOD

The Contractor shall arrange at his cost the staff required during the Operation and Maintenance period of 10 years. The Lump sum tender cost shall also include all expenditure likely to incurred for repairs/replacement of any items executed in the tender during this period.

The department shall provide electric power free of cost. The Contractor should submit detailed information regarding the staff likely to be deployed by him during O&M period of 10 years.

13.6 TAKING OVER

The plant will be taken over on satisfactory completion of the operation and maintenance of the contract for 10 years provided that,

- The plant/equipment are in running condition
- The result of the treated sewage quality during O & M of the plant is within the limits specified for 80% of time.
- All treatment plant units including interconnecting piping, hand railings, ladders, staircases, buildings, various tanks, machines, panel etc are neatly painted.
- All records of operation and maintenance during the 120 months period are handed over to MBMC in proper condition.
- The O & M manuals have been updated following 120months operational experience and approved by MBMC.

In case taking over is delayed on account of Contractor's failure, the O & M period will be extended further till it meets the above requirement without any extra cost to MBMC.