

Surat Municipal Corporation

Section 6: Employers Requirements

Vol-1 (Part - I) Technical Bid

BIDDING DOCUMENT

for the

Work for 24 x 7 Water Supply System under Smart City Mission in 07 (Seven) T.P. Schemes area of East and South East Zone of Surat Municipal Corporation including Refurbishment of existing network in part area of TP Scheme No. 53 (Magob-Dumbhal), TP Scheme No. 64 (Magob-Dumbhal), TP Scheme No. 19 (Parvat-Magob) including all work of Mechanical, Electrical, SCADA, Household Connections, Consumer Water Meter Fittings work including Management of 24 x 7 Water Supply in SMART CITY for a period of 10 years.

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6.1 Introduction

6.1.1 Brief History of Water Supply of Surat city

1. The Surat city is a major commercial and trade Centre of Gujarat state. The Surat city is situated at latitude of 21 12 N and a longitude of 72 52 E on the bank of river TAPI and having coastal line of Arabian sea on its west at distance of 19.4 km .The Surat city is about 9 to 13 km meter above mean sea level. The city forms the major urban core development on the Ahmedabad-Mumbai regional corridor. The city has witnessed tremendous growth of various trade and industry during last four decade. This has enabled this city to occupy a place of prominence not only in south Gujarat region, but also in the whole of INDIA.
2. Surat city is managed and governed by Surat Municipal Corporation (SMC) and is responsible for providing infrastructure services to the citizens of the Surat city. Surat Municipal Corporation has well planned infrastructure for Water supply system, which covers approximate area of 327.12 sq. km with a population of over 44.66 lakhs.

The present water supply source, their capacity and capacity of water treatment plant is given in table below :

Sr. No.	Components	Location	Capacity in mLD
I	Intake Well	Rander	360
		Katargam	503
		Sarthana	600
		Motavarachha	200
		Sarthana Valak	370
		Location yet to be decided (Proposed)	400
	Total		2433
II	WTP	Rander	250
		Katargam	390
		Warachha	68
		Sarthana	470
		kosad	90
		Mota warachha	32

		Sarthana Valak	90
		Dindoli	78
		Location yet to be decided (Proposed)	210
	Total		1678

6.1.2 Brief description of the present project :

SMC wants to provide continuous i.e 24 x 7 water supply to the project area under Smart City Mission. The project area is divided in two parts.

- (1) Part-1 i.e. 5.97 sq.km. area covers TPS No. TP-7, TP-8, TP-33, TP-34 and TP-64(P) where infrastructure facilities required for 24 x 7 water supply is not available. So, infrastructure facilities such as WDS, ESR, Rising Main, Distribution Network, Mechanical / Electrical / Instrumentation works, SCADA system and House Service Water Meter connection is to be executed in this contract. Till takeover by the contractor, SMC will supply intermittent water supply to the project area through its existing water distribution station and pipeline network.
- (2) Part-2 i.e 2.87 sq.km. area covers TP-19, TP-64(P) and TP-53(P) where infrastructure facilities i.e. WDS, ESR, Distribution Network is already available for 24 x 7 Water Supply. However, Refurbishment is required such as valves, FCV, SCADA system and House Service Meter Connection is to be provided.

Part-1 contract is divided in two phases.

Phase-1 : Design and construction phase - 2 years

Phase-2 : Operation and Maintenance system - 10 years.

Total period = 2 + 10 = 12 years

Part-2 contract is divided in two phases.

Phase-1 : Design and construction phase - 1 year

Phase-2 : Operation and Maintenance system - 11 years.

Total period = 1 + 11 = 12 years

3. The Scope of Services described hereunder is indicative and may not be exhaustive or complete. The Contractor shall undertake its own detailed investigation and verification of the Project Facilities and of the designs prepared by the Employer to ensure that specific objectives of the project can be achieved.
4. The Scope of Services shall include all technical, managerial, administrative, commercial, environmental, and social interventions as required in accordance with acceptable, prudent water utility construction and management practices, ensuring safe and sustainable drinking water supply services to the Consumers in the Service Area.

6.1.3 Definitions

5. The words, terms and expressions beginning with capital letters and defined under this Section 6, including those in Section 7 - General Conditions of Contract and those in Section 8 – Particular Conditions of Contract shall, unless the context otherwise requires, have the meanings ascribed thereto/herein;

“Boundary Limits” shall mean the boundary within which the Contractor has the responsibility of providing Services in accordance to the terms and conditions under this Contract;

“Bulk Water” means the treated bulk water supplied by the Employer to specific Supply Points of project area;

“Consumer” or “Customer” means all entities (including individuals) to which/whom SMC provides water services through the existing water distribution system and will supply through the newly developed system and includes all existing consumers at the time of the Commencement Date and entities which become consumers after the Commencement Date;

“Contract Date” means the date on which the contract is signed.

“Contract completion date” means the final takeover date that includes operation services.

“Commencement Date” means the stipulated date of commencement of contract indicated in Work Order. Work order is issued after signing of the agreement or as decided by the Employer.

“Consumer Water Connection Points” means the water connection points from which Consumers take delivery of water.

“Construction Completion Date” is the date when all Design & Construction works have been completed and commissioned.

“Construction Plan” or “System Improvement Plan” means the Contractor’s Plan for implementation of Design & Construction works.

“CPHEEO” means the Central Public Health and Environmental Engineering Organization under the Ministry of Urban Development, Government of India;

“Customer Service Centers” or “CSC” means the special infrastructure provided by Employer and furnished & operated by the Contractor to provide public relations services to consumers under this Contract;

"Critical Measurement Points" shall mean the locations as agreed by the Employer in the Construction Plan and also as added during the term of the Contract for undertaking measurement of flow and pressure in the water supply system for facilitating the monitoring of Minimum Service Levels stipulated in Schedule 7: Performance Targets & Standards as per Employers Requirement;

"Design & Construction" means the period commencing from contract commencement date to completion of design and construction of the permanent works.

"DMA" or District Metered Area (DMA) means a discrete area of water distribution network, created by closing boundary valves so that it remains flexible to changing demands.

"DMA Start of Operations Date" is the first date when water supply services in the first DMA will be based on a 24/7 basis of water supply operations also means "Initial Take Over date"

"DPR" means the Detailed Project Report of SMC Water Supply Project for Smart City approved by the Employer;

"Electricity Department" means the local service provider supplying electrical energy for Operation Service of the Facilities;

"Engineer" means the person named in this section 6 or Section 7 GCC or Section 8 PCC (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Engineer) who is responsible for supervising the execution of the Works and Services and administering the Contract.

"Existing Assets" means those infrastructure components, plant, machinery, equipment and any other units existing in the Service Area as on the Commencement Date;

"ESR" means Elevated Service Reservoir; GLSR (Ground Level Service Reservoir), SR (Service Reservoirs), OHSR (Over Head Service Reservoir) has the same meaning as ESR;

"Final Take Over Date" means the date on which the Contractor finally takes over the entire water supply distribution system including from all ESRs and distribution system from ESRs to consumer end laid under this contract including existing & new consumers.

"Initial Take Over Date" means the date on which the Contractor takes over the first zone / DMA for operation and maintenance, after completing works of water distribution network and making house connections.

"Mandatory Works" means those works which are listed in the Bill of Quantities and are required to be constructed, installed or erected as the case may be and commissioned in line with the provisions of this Contract unless such works may require change of scope or design as agreed by the Parties as part of the Construction Plan / SIP Plan;

“Mandatory key personnel” means expert services to be provided by Contractor during construction as well as Operation & Maintenance period under this contract;

“Minimum Service Levels: means the levels of service to be maintained in the operations, maintenance and management and service delivery to consumers more so described in Schedule 7– Performance Targets & Standards in PCC;

“Mobilization period” means the period in which activities defined in section 6: Employers Requirement would be completed. It is the period commencing from the date of commencement of contract and extends up to 30 days.

NRW in a DMA in area where 24 x 7 water supply facilities already available : A district metering area refers to a zone of a water supply network that can be isolated, and provided with input bulk meter, to measure input water quantity and consumer meters to measure consumption. The difference is used for assessing NRW in the district metering area.

“New Assets” means those infrastructure components, Water Distribution Station, Elevated Service Reservoir, Rising Main, Distribution Network, Mechanical / Electrical / Instrumentation work in WDS, SCADA system and House Service Water Meter Connection shall be provided and commissioned by the Contractor during the Contract Period.

“Operation and Maintenance Plan” means the plan for operating and maintaining the water supply system, submitted by the Contractor, and approved by the Engineer

“Contractor” or Operator is synonymous to the Contractor.

“SMC” means Surat Municipal Corporation;

“Performance Related Payment” means payment to the Contractor based upon achievement of Performance Standards as per Schedule 5 & 7 of PCC

“Performance Standards” mean the Minimum Service Levels to be achieved and maintained by the Contractor during each period of the Contract set forth in Performance Targets & Standards in this Section 6;

“Potable Water Specification” means the water quality requirements of potable water to be supplied to the Consumers as stipulated under Recommended Guidelines for Physical and Chemical Parameters and Bacteriological Quality of Drinking Water, in the Manual on Water Supply and Treatment, CPHEEO, Government of India, Ministry of Urban Development, New Delhi;

“Preparatory Period / Phase or System Improvement Plan period” is the period commencing from the contract commencement date during which time the Contractor will prepare the Service Improvement Plan (SIP) for Selected Operational Zones within 90 days;

“Project Facilities” or “Facilities” means all existing and proposed infrastructure facilities including open lands, Pipelines, buildings, structures, Plant, machinery, software’s, and equipment under SMC;

“Project Information Memorandum” or “PIM” shall mean the report prepared by the Employer detailing the Project as provided in Supplementary Information and available at the e-data room set up by the Employer;

“Project Management Consultant” or “PMC” means the agency appointed by the Employer to provide project management advisory services to the Employer;

“PRV” means Pressure Reducing Valve;

“FCV” means Flow Control Valve;

“Scope of Services” shall mean all those services to be provided by the Contractor in accordance to the obligations, activities, responsibilities and tasks in implementing the Project to achieve the Minimum Service Levels in accordance to the Employers Requirements and Contract Conditions;

“Sectional Completion period” means period between Initial takeover date and final Takeover date.

“Services” means all those activities, interventions, actions and tasks required as part of the implementation programme including all planning, verification & validation of detailed engineering design, procurement, construction, rehabilitation, operations, maintenance, and management in providing continuous pressurized water supply to the consumers of project area of SMC;

“Service Area” or “Project Area” means the area within SMC administrative municipal boundaries selected for implementation of project where SMC is responsible for provision of water supply services to consumers. The Service Area can be either within the administrative municipal boundary as extended from time to time and also include future growth areas where SMC decides to provide expansion of water services and undertake operation, maintenance and management services;

“Supply Points” or “Bulk water supply points” means the points where the SMC will supply Bulk Water to the Contractor;

“Training Plan” means a report containing the detailed SMC staff training program;

6.2 SCOPE OF SERVICES

6. The Scope of Services (SoS) described hereunder is neither exhaustive nor complete and is indicative only. The Contractor shall undertake detailed investigation of the Project Facilities, study, make assessments and ascertain all by itself the required tasks, interventions, inputs, and all other necessities to determine the complete Scope of Services for achieving the Minimum Service Levels as stipulated in Schedule –7 Performance Targets & Standards

The Services shall include all technical, managerial, administrative, commercial, social interventions as required in accordance to acceptable, prudent water utility management practices for ensuring safe and sustainable drinking water supply services to approximately total number of 27018 Consumers in the project area of SMC.

The Scope of Services is detailed hereunder;

6.2.1 Scope of Contract

7. The Scope of contract for design & construction and Operating period is detailed out in Table below.

Part-1 Area : Scope of Contract during Design & Construction Period

S.N.	Components	Indicative Quantities
1.	Preparation of System Improvement Plan SIP within specified period and according to the contract conditions. SIP Preparation & Implementation shall include but not limited to the Survey & investigations of existing assets, distribution network, mapping, freezing selected DMA boundaries, Hydraulic Modelling, ascertain the necessity and the extent of rehabilitation required. SIP submission for priority zones shall be within 180 days.	5.97 sq kms
2.	Construction and Commissioning of Water Distribution Station – 2 Nos. (Detailed Design and working drawings shall be provided by Employer)	2 nos of approximate capacity 48 lacs liter and 51 lacs liter
3.	Construction and Commissioning Elevated Service Reservoirs (ESRs) (Detailed Design and working drawings shall be provided by employer)	6 nos of approximate capacity 15 lacs liter – 2 Nos. 21 lacs liter – 3 Nos. 24 lacs liter – 1 No. Staging height -24 m
4.	Supply, laying, testing & commissioning of Rising Main of Ductile Iron (DI) K9 from WDS to ESR. (Detailed Design and working drawings shall be provided by employer)	5.0 Kms

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5.	Supply, laying, testing & commissioning of Distribution Network of Ductile Iron (DI) K9 from ESR to Consumer. (Detailed Design to be provided by Employer duly modified by contractor as per SIP requirements and approved by Employer)	50.0 Kms
6.	Supply and installation of Pumping units including mechanical, electrical and instrumentation items at Water Distribution Station – 3 Nos. (Detailed Design and working drawings shall be provided by employer)	3 Nos.
8.	Design, Supply and Installation of SCADA system required for effective management of the water supply system based on the continuous data, its analysis and management . (Design shall be provided by employer to be modified as SIP requirements)	Entire water supply including Pumping station, ESRs and pipeline
10.	Provide consumer service connections on approval or sanction by Employer (SMC) with DI Strap saddle, Ferrule, MDPE pipe, ball valve, meter box etc (Meter will be supplied by SMC).	Approx 23,620 nos. of different sizes viz 15 mm, 25 mm, 40 mm and 50 mm.
11.	Finding invisible leaks in pipeline network, carrying out repairs and allied works in Project area	55 kms length

Part-2 Area : Scope of Contract during Design & Construction Period

S.N.	Components	Indicative Quantities
1.	Preparation of System Improvement Plan SIP within specified period and according to the contract conditions. SIP Preparation & Implementation shall include but not limited to the Survey & investigations of existing assets, distribution network, mapping, freezing selected DMA boundaries, Hydraulic Modelling, ascertain the necessity and the extent of rehabilitation required. SIP submission for priority zones shall be within 90 days.	2.87 sqkms

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2	Instrumentation and SCADA work for 3 Nos. of existing ESR and Distribution Network, installation of flow control valve, flow meter, construction of SCADA control room, valve chamber and flow meter chamber . . (Design shall be provided by employer to be modified as SIP requirements)	2.87 Sq.km. Area of TP-19, TP-53(P) and TP-64(P) where existing 24 x 7 Water Supply facilities already available (As per DPR of East Zone).
3.	Provide consumer service connections on approval or sanction by Employer (SMC) with DI Strap saddle, Ferrule, MDPE pipe, ball valve, meter box etc (Meter will be supplied by SMC).	Approx. 3390 nos. of different sizes viz 15 mm, 25 mm, 40 mm and 50 mm.
4.	Finding invisible leaks in pipeline network, carrying out repairs and allied works in Project area	21 kms length

- Note:-**
- Quantities indicated in the Table above are indicative and need to be confirmed by Contractor through SIP.
 - All components of implementation of SIP are to be understood including commissioning and duly approved by Engineer / PMC.

6.2.2 Scope of Operation & Maintenance period

- From the design, construction completion date (which shall also mean sectional/ priority works completion date of priority zone) the Contractor shall take over the Operation and maintenance services from SMC for the project area within selected DMA's. Contractor shall be responsible for operation, maintenance and management of water supply in project / service area as detailed below. Contractor shall act as back office support to SMC while managing the customer related services or complaints. The Scope of O&M shall include but not limited to the following: -

Part-1 Area : Scope of Works under Operation Phase

No	Obligation	Period
1.	Operation and Maintenance of Entire system including water distribution station (3 WDS with Valve and Valve Chamber), ESR (7-nos.), pipeline network (55 km), mechanical / electrical / instrumentation works and SCADA System for 10 years.	5.97 sq.km. project area
2	O & M of the distribution network for distributing water efficiently, equitably and minimizing water loss / non-revenue water (NRW), providing expert services for leak detection, reduction and maintaining the infrastructure on DMA basis	From initial takeover date
3	Providing continuous (24 x7) pressurized water supply to the connected consumers and maintaining the infrastructure	From initial takeover date
4	Collection, providing water Samples to SMC lab of treated water collected from ESRs / consumer end to ensure that it meets the Potable Water Specification and monitor on regular basis;	From initial takeover date

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5	Detecting and monitoring non-revenue connections and consumption and inform such connections to SMC and install meters to measure consumption	From initial takeover date
6	Operation and Maintenance of House Service Meter Connection for 10 years.	Approx. 23620 connections of
7	Bill generation of Water Supply for 10 years	Approx. 23620 connections of different sizes.

Part-2 : Scope of Works under Operation Phase

No	Obligation	Period
1.	Operation and Maintenance of Entire system including water distribution station, ESR-(3 No. of Existing ESR), pipeline network (21 km), mechanical / electrical / instrumentation works and SCADA System for 11 years.	2.87 sq.km. project area
2	O & M of the distribution network for distributing water efficiently, equitably and minimizing water loss / non-revenue water (NRW), providing expert services for leak detection, reduction and maintaining the infrastructure on DMA basis	From initial takeover date
3	Providing continuous (24 x7) pressurized water supply to the connected consumers and maintaining the infrastructure	From initial takeover date
4	Collection, providing water Samples to SMC lab of treated water collected from ESRs / consumer end to ensure that it meets the Potable Water Specification and monitor on regular basis;	From initial takeover date
5	Detecting and monitoring non-revenue connections and consumption and inform such connections to SMC and install meters to measure consumption	From initial takeover date
6	Operation and Maintenance of House Service Meter Connection for 11 years.	Approx. 3390 connections of different sizes.
7	Bill generation of Water Supply for 11 years	Approx. 3390 connections of different sizes.

9. The Scope of Services shall include all technical, managerial, administrative, commercial, environmental, and social interventions as required in accordance with acceptable, prudent water utility construction and management practices, ensuring safe and sustainable bulk drinking water supply services to total number of 27000 connections spread out in the Project Area. The Scope of contract mentioned in Tables above is indicative only and the Contractor is required to undertake his own detailed investigation of the Project Facilities to determine the complete Scope of Services for achieving the Minimum Service Levels.

6.3 Phasing of contract Works

10. The Contract is divided into two phases ;

- i. Design & Construction phase
- ii. Operation & Maintenance Phase spread over the contract period; from the stipulated

date of Contract Commencement up to the Contract Completion Date.

Design & Construction phase includes;

- I. mobilization, consumer survey, topographical surveys, investigations, mapping, preparatory works for DMA Establishment works and construction period as per approved service improvement plan (SIP) and

O & M Phase includes;

- II. Operation, Maintenance, Manage, Repairs of the entire water supply system (all civil works, pipeline network, mechanical / electrical / instrumentation and SCADA system) and consumer meter connection and Monitoring and Service Delivery Period during the contract period as per the sectional / priority completion of work.

6.3.1 Mobilization Phase

11. During mobilization period Contractor is required to:

- Arrange / rent for Office space within project area
- Establish a furnished project office in Surat city limit
- Employ the staff required for starting the preparatory work
- Mobilise the team for survey and investigations
- Mobilise the teams for baseline studies of selected priority DMAs
- Provide the computer hardware, software required for, mapping preparation, hydraulic modeling, project management etc. along with connectivity
- Provide vehicles to SMC as per set up requirements
- Establish furnished Engineer's office
- Start of Baseline study works for priority DMA's

6.3.2 Baseline study and SIP phase for Priority DMA's

- Survey, investigations, mapping
- Door to door consumer survey
- Distribution network assessment
- Freezing of boundary of DMA
- Water inlet / outlet flow measurement
- Pressure measurement,
- Design, drawings, hydraulic modeling, System Improvement Plan

6.3.3 Preparatory Phase for DMA Establishment Phase

During the Preparatory Period, the Contractors required to:

- Be Familiar with the project site condition after required consultation
- Collect data and maps, reports, freezing of boundary etc.
- Conform/ conduct survey to ascertain the data, information, designs, existing services etc.
- Network mapping surveys and investigations, isolation of areas
- Install boundary valves, flow meters, zero pressure test etc.
- Conduct door to door survey and prepare data base of the existing properties with service connections details, using base map image of the service area
- Review the detailed project report in water supply provided by SMC and prepare a Distribution Network Improvement Plan for water supply
- Prepare System Improvement Plan in water supply
- Prepare an asset inventory report, baseline water balance and strategy for improving services with a focus on improving Consumer services.
- Submit revised SIP

6.3.4 Final System Improvement Plan

Deliverables of Final SIP phase are:

- Final output for survey, design, drawings, mapping etc.
- Hydraulically District network and frozen boundaries for DMA
- Completion all baseline studies, demand assessment etc.
- Hydraulic Network model built on Digital Elevation model (DEM)
- The results of flow and pressure management, water balance
- Improved pressure management plan, SCADA plan
- Implementation plan, procurement plan, design drawings, as built etc.

6.3.5 Sectional Completion of DMA or Requirements for Initial Take Over of DMA's

Requirements of this phase are:

- Hydraulically district network establishment

- Completion of zero pressure test
- Completion of construction works
- Water balance
- Commissioning of selected DMA and etc.
- SCADA installed
- Achieving 24 x 7
- Commissioning of selected DMA Water loss detection & reduction.
- Taking over of O & M of DMA

6.3.6 Design &Construction Work Phase:

Requirements of this phase shall be completion of ;

- SIP should be approved & started for execution based on Employer's requirement including priority work completion requirement. The civil construction works will start simultaneously with the preparation of SIP.
- Detailed design, survey & investigations, drawings and cost estimates of work and improvement as a part of Value Engineering should be completed to meet the Performance Standards.
- Door to door consumer survey for 14625 number connections shall be completed
- Work plan, Methodology and timelines for implementation should be in line with the employers' broad concept /requirement, GCC & PCC.
- Detailing of integrated Contract Management Information System by using latest software like Primavera, Microsoft office architecture, data capture, management and reporting structures, protocols including all related hardware, software, installation;
- Contractor Personnel deployment plan;
- Construction Plant and equipment deployment plan;
- Cash-flow for both parts;
- Detailed methodology for continuous monitoring of the performance of the Contractor in achieving and maintaining the Performance Standards for release of the eligible Operating Payments;
- Compliance matrix of contract and service requirement, O&M requirement and other requirement like social, environmental etc. and;

6.3.7 Operating and Management Phase:

- i. Annual Operating Plan (AOP) covering all operations, maintenance and management requirements in the selected DMAs of operational zones within project Area for 27000 number of connections;
- ii. Emergency Response Plan (ERP);
- iii. Consumer Management Plan;
- iv. Standard Operating Procedures (SOPs) for routine operations and emergency responses;
- v. Water Quality Surveillance Program;
- vi. Energy optimization program;
- vii. Connections policy for all types of connections including services to the urban poor and treatment of illegal connections;
- viii. Network expansion policy;
- ix. Detailing of an Integrated Management Information System (MIS) including computerized water distribution management software, its architecture, data capture, management and reporting structures, protocols including all related hardware, software, installation, and operation and maintenance requirements; and
- x. Periodic reporting plan including the formats for different performance reports.

The computer hardware and software improvement plan for continued operation of the MIS, instrumentation, SCADA & Web Server etc.

6.4 System Improvement Plan (SIPs) requirements

12. **Works of priority DMAs** on immediate basis- The Contractor is required to validate and finalise and execute the works in selected 4 DMAs on priority as specified by SMC and shall responsible to start baseline study of these selected DMA's and submit /prepare the SIP on immediate basis i.e. within 90 days from the commencement date. After approval of SIP all procurement and construction works of this priority DMA's shall be on top priority. The work of such DMAs should be completed within stipulated time as suggested in Contract Milestone.
13. In case of any interventions proposed in the SIP, which are not part of the DPR or those interventions which are part of the DPR but require improvement from conventional design practices, the Contractor shall provide sufficient explanation and justification as to how implementing such interventions would influence the achievement of the Performance Standards stipulated in the document.
14. In a situation where the Employer does not agree to the interventions proposed in SIP, there may be mutually agreed revision of the Performance Standards.

15. The Scope of Services during the implementation Period shall essentially comprise of implementing the approved SIP based on the hydraulic model prepared for water distribution based on DMA approach. SIP will be implemented in accordance to international best practice and industry standards and sufficient care shall be taken by the Contractor in minimizing supply interruptions, traffic disruptions and ensuring good and timely communications with the Consumers in the Service Area. During work execution, Contractor would be required to inform the residents, say, of a particular street, well in advance about the type of work, inconvenience expected, timelines for various works, etc. Contractor to have a strong Public Relations and Community Outreach team. Contractor will plan sequencing of activities to synchronize water pipeline works with other related works to minimize the road excavation and restoration in the streets.
16. All the Works and interventions proposed as part of the SIP shall be in conformity with the Specifications set out in the Employer's Requirements.
17. After implementation SIP plan and upon successful commissioning of DMA's for continuous water supply within stipulated constructed period or actual commissioning period whichever is earlier shall be handed over to Contractors for further Operation and Maintenance per DMA wise.
18. The Contractor shall submit the draft SIP within 90 days for Priority DMA first from the Contract commencement date and within next 90 days for complete DMA's / operational zones to allow the Employer to undertake a thorough review of the SIP and suggest amendments if any.

6.5 Design Requirements

6.5.1 Survey, Mapping, investigations etc.

19. A detailed topographical survey, of the components involved as shown in the boundary limit, within the project area shall be carried out using Total Station equipment and the spot levels and the contours at 0.5 m interval shall be carried out & stored in editable digital format on the GIS base. Contractor will survey all underground utilities located within the Sub Project Area up to 1.5 m depth and mark on GIS based maps.

6.5.2 Recommended Design Norms

20. Water Supply components are to be designed as per design norms given in Manual on Water Supply and Treatment, Published by CPHEEO, Ministry of Urban Development and Government of India.

6.6 Commencement Date

21. The Contractor shall make a comprehensive assessment & due diligence of water supply distribution system in the Project Area and prepare a holistic and comprehensive System Improvement Plan (SIP) for transforming all DMA's of selected Operational Zones into continuous (24x7) pressurized water supply for project area of SMC. This will include baseline study of the water distribution system and network, updation / preparation of distribution network, condition assessment, consumer survey, validation of network data / details, finalizing the boundaries of operational zones, assessing operational feasibility of DMA's selected for converting into 24 x7 water supply, developing a working hydraulic network model, developing strategy for water loss reduction / leak detection, pipeline laying & replacement for improving services with a focus on optimization of performance of existing assets and improving Consumer services.

6.7 Bulk Supply point and Boundary Limits

22. Scope of Contractors obligations starts from the Bulk Water Supply point i.e. ESR/ GSR Inlet point onwards for total 27000 number of connections. Boundary Limits for undertaking planning, validation of baseline data, verification of designs, construction, rehabilitation, distribution, operations, maintenance and management by the Contractor, include the water supply operational zones as marked project area and extending up to the customer boundary limits including the customer meter if installed on the existing connections and up to the customer meter in all the new or rehabilitated connections of selected Operational zones.

Selected operational zones (Tentative) as indicated above and mentioned below are subject to change / modify within 27000 number connections as per requirements of SMC.

Details of Selected Water districts / operational zones is as following;

Table 8: Tentative Operational Zones / Water Districts Details

Sr. No.	WDS No.	Description of Operational Zone	Remarks
1	WDS-1	ESR-1 (TP-7 (Anjana), FP-157)	Infrastructure facilities (i.e. WDS, ESR, Pipeline Network, Mech./Elec./Inst./SCADA) for 24 x 7 Water Supply to be implemented.
2	WDS-1	ESR-2 (TP-7 (Anjana), FP-45)	
3	WDS-1	ESR-3 (TP-7 (Anjana), FP-45)	
4	WDS-2	ESR-4 (TP-33, FP-106)	
5	WDS-2	ESR-5 (TP-33, FP-106)	
6	WDS-3	ESR-6 (TP-53, FP-R-13)	
7	WDS-3	ESR-7 (TP-8 at WDS Dumbhal)	
8	WDS-E3	ESR SE -11	Infrastructure facilities (i.e. WDS, ESR, Pipeline Network) for 24 x 7 Water Supply is already implemented.
9	WDS-E3	ESR E-9A	
10	WDS-E3	ESR E-10	

Note:- Above operational zones / water district areas are tentative and shall be subject to addition of additional zones depending upon technical feasibility for bulk water supply and hydraulic modeling for total 27000 number of connections.

23. Boundaries for selected operational zones shown above are tentative and indicative only. Finalization of boundaries of selected operational zone is responsibility of Contractor. Contractor while assessing the operational feasibility shall verify the boundaries of DMA's for hydraulically districts zones. In the process, if any adjoining area is being affected for water supply, it is in the scope of Contractors to make alternative arrangement of water supply for the area affected. Drawing of selected 10 Operational Zones is enclosed.

The project area under selected operational zones is within the existing jurisdiction of Surat Municipal Corporation which may decrease or increase at its sole discretion for total 27000 numbers of connections.

6.8 Preparative Activities

24. The Contractor shall establish contact with all relevant stakeholders and become familiar with the SMC water supply system, and the applicable standards and guidelines for water supply design, and with past and current on-going works in the Service Area.
25. The Contractor shall satisfy itself to the nature and scope of work and the prevailing site conditions.
26. The contractor shall be deemed to have carefully examined the work & site conditions including labour, the general and the detailed specifications, schedules & drawings & shall be deemed to have visited the project area /site of the work & to have fully informed himself regarding the local conditions & carried out his own investigations to satisfy himself. In this regard, he will be given necessary information to the best of knowledge of Employer/SMC, but without any guarantee about it. If the Contractor have any doubts as to the meaning of any portion of the general conditions, the special conditions, the scope of work, the specifications and drawings, or any other matter concerning the contract he shall, in good time before submitting his tender, set forth, the particulars thereof and submit them to the Engineer in writing, in order that such doubts may be clarified authoritatively before or during prebid meeting. Once a tender is submitted the matter will be decided in accordance with the tender conditions.
27. The Contractor shall liaise with the SMC, the local traffic police and other Government Agencies regarding governing laws and regulations in order to undertake studies and construction activities under the Contract such as:
- 43.1. Environmental and social impact assessments and prevention, mitigation and monitoring of impacts during construction;
 - 43.2. Compensation for damages to property;
 - 43.3. Occupational health and safety including workers compensation;
 - 43.4. Consultation of beneficiary populations; and
 - 43.5. Signage for construction works.

28. There are several other water supply related works on-going or have been recently been completed by SMC for the entire water supply system. The Contractor shall review all the reports and ensure that the Construction Plan, the Operation and Maintenance Plan and the Training Plan to be prepared by the Contractor do not duplicate any measure already financed and implemented. The Contractor shall also ensure that investments proposed as part of the Construction Plan are well coordinated and scheduled so that it can be adequately implemented, constructed, managed, supervised, monitored and finally be evaluated in terms of its impact.
29. The Contractor shall make a comprehensive assessment of baseline data & details, drawings, designs provided under the Detailed Project Report of Project area for capacity, performance and condition of existing water supply and distribution facilities. Contractors scope shall starts from Inlet supply point onward at service reservoirs (ESR's/GSRs). Bulk water up to service reservoirs shall be ensured by SMC.
30. The Contractor shall acquaint himself the Detailed Project Report (DPR) and relevant sections of the Hydraulic Modeling and drawings that have been prepared for the project and validate the improvement and construction plan mentioned in DPR.
31. The Contractor will prepare three Plans,
 - 31.1. Construction Plan describing implementation of all System Improvement Plan with emphasis on the time sequence followed for the implementation and completion of Works in the different Sections, taking into account the conversion of priority DMA's in continuous (24x7) pressurized water supply and laying of pipelines (primary mains to Selected DMA's).
 - 31.2. Operation and Maintenance Plan, after successful commissioning of DMA's in continuous (24x7) water supply for selected operational zones;
 - 31.3. Training Plan, describing all SMC staff training activities to be conducted.
32. A preliminary draft of the Construction Plan or SIP Plan shall be submitted by the Contractor with the detailed time program as required under the Section 7 [*General Conditions of Contract*], in sufficient detail to support the detailed time programme.
33. A draft of the three Plans shall be submitted by the Contractor to the Engineer at least three (3) months from the Commencement Date for review and comments by the Employer. Any comments on the Plans will be furnished within one (1) month from receipt of the draft Plans and the final Plans shall be submitted by the Contractor at least five (5) months from the Commencement Date for approval.
34. Two types of office space shall be provided:
 - 34.1. For all Works-related Services: The Contractor shall make its own arrangements for renting and acquiring sufficient land for erection of its own offices, facilities, as required, for carrying out test at site and of stores plus parking / maintenance area for vehicles and equipment to be used for the Works at its own expenses. It shall include provisions for the Engineer as further detailed in the Technical Specifications.

34.2. For the Operation and Training Services: The Employer shall provide unfurnished office facilities to accommodate the Contractor's operation staff and of staff provided to the Contractor by SMC. The cost of operations maintenance of the office shall be included in the Contractor's Operation fees.

35. The Contractor shall supply software for GIS, Hydraulic Modeling and maintenance management.

6.9 DMA Establishment Requirements

6.9.1 Assessment of Distribution System on DMA basis

36. The distribution network assessment and updation shall be based on DMA's selected under Project Area of SMC. During this phase of the work the Contractor shall study the water transmission and distribution network within the Service Area i.e. selected operational zones to establish and improve network management and for ensuring the minimum Service Levels as specified under this contract to the Consumers within the Service Area.

37. The Contractor shall review previous studies and reports; interview the existing key staff in the Service Area; line staff, other consultants, companies, and Contractors currently working on the distribution system in order to prepare a baseline report describing the water transmission and distribution system including water sources, boundary limits, storage, and supply zones; and their condition to include pipe materials, dimensions, age, and condition; extent of Consumer water connections, meters and their operating condition; current estimates of illegal connections.

38. Contractor shall review the Detailed Project Report for project area and shall immediately start working on priority DMA's which can be easily converted into continuous water supply and submit the procurement plan on immediate basis. It is assumed that the available information and drawings in DPR are indicative and Contractor shall validate such information on pipeline location, length, diameters and materials on his own during baseline study. Contractor shall submit the condition Assessment Report of such network information.

39. The Contractor shall review the present network management practice and develop an improved robust network management practice for improving the services.

6.9.2 Distribution Network Improvement on DMA basis

40. The Distribution Network Improvement shall be executed based on priority DMA selected under operational zones. The Contractor shall finalise the boundaries of DMA while assessing the operational feasibility and proceed to isolate the same without affecting the adjoining areas for water supply. Contractor shall be responsible to provide alternative arrangement for such affected areas, if any, for water supply. The Contractor shall, set up hydraulically isolated District Metered Areas (DMAs) within the Service Area/ operational zone of each ESR. Each DMA comprising of about 500 -2000 consumer connections shall be considered as basic administrative unit for the purpose of sectional commissioning and management services. The

Contractor shall design water supply distribution network on DMA basis to ensure equitable, continuous, pressurized water supply to the Consumers by using the hydraulic model and simulating both present (2019) and future (Year 2046) conditions,. Each DMA preferably have one inflow point and be isolated by installing valves / end plugs. DMA at entry point will be provided with a bulk flow meter. Each DMA will have at least five Critical Measurement Points (CMPs) for continuous logging of pressure, and the CMPs shall be such that they should be at the highest and farthest points from the command reservoir. The performance parameters of the Contractor including O& M period shall be started after successful commissioning of DMA's for continuous water supply. DMA wise monthly reports will be generated to assess the DMA performance. Monthly meter readings will be taken and data shall be provided to SMC billing department. Contractor, Consultant / thirty Party also may suggest good management practices. Lessons learnt from other utilities/agencies will also be incorporated for better management services.

6.9.3 Establishment of DMA's in Operational Zones

41. The Contractor shall prepare the designs submit to the Employer and rehabilitate and build the distribution network for the priority operational zones while establishing DMA's in project area .Contractor shall immediately submit the procurement plan for these priority zones and start executing the construction works. This activity will be simultaneous with baseline studies of other DMA's and shall be completed within three months from the commencement date.
42. The Works will be implemented DMA wise. The Contractor shall be allowed to do works for Selected DMA's of Project area (tentative 10 operational zones) simultaneously and subsequently. Operational zones indicated below are tentative and are subject to add / modify depending upon feasibility of bulk water supply or as specified by SMC within 27000 numbers of connections. Works in priority DMA (ESR SE-11, ESR-9A and ESR-10) shall completed and commissioned first in parallel to construction works in other DMA's.
43. The Contractor shall make arrangements for maintaining the service of the presently connected consumers at the current level during the execution of the Works or arrange for alternative arrangement for water supply at his own cost.
44. The Contractor shall also lay pipelines for the extension of the distribution network to the areas presently populated but uncovered in terms of piped water supply services.
45. All installed pipelines and appurtenances shall be disinfected to the satisfaction of the Engineer.
46. All Works involving excavation shall be finalized through reinstatement of the surface to the initial condition.
47. The Contractor shall make arrangements for maintaining the service of the presently connected consumers under selected operational zones though not covered under DMA's

finalised at the current level during the execution of the Works.

48. All Works involving traffic blocking shall be coordinated timely with SMC / traffic department and traffic diversion measures shall be implemented by the Contractor. The Contractor shall endeavour at any time to maintain the inconvenience caused by the construction works at the lowest possible level.

6.9.4 DMA Creations

49. One of the main activities of this Contract is the Creation of District Metered Areas (DMAs) for 27000 connections. The population projections and ward wise water demand as included in DPR will be applicable. The Contractor has to confirm the DPR and define DMA boundaries actually on ground. If needed the Contractor has to redefine the DMA boundaries. The total number of DMAs are tentative to 10 numbers & Contractor may revise as per site condition but total number of connections are limited to total 27000 maximum. Total area can be increased or decreased within total number of 27000 connections at sole discretion of SMC/ Employer.
50. The scope of work for each DMA established includes (but is not limited to):
- 50.1. detailed site investigations, updating of distribution network drawings, complete with all trial holes that might be required to verify pipe connections (and the consequent re-instatement of road, sidewalk or any other surface);
 - 50.2. Hydraulic modeling as basis for optimum DMA design and determination of feeder main diameter. The Contractor shall use either Water Gems or any equivalent software that has the same functionality or better.
 - 50.3. Verification and finalisation of suggested DMA boundaries; locating of existing boundary valves, functioning and tightness checks of existing boundary valves, identification of location for additional boundary valves to be installed, identification of locations where the pipes will be disconnected and capped.
 - 50.4. selection of location for DMA inflow chamber;
 - 50.5. Identification of customer service connections that have to be re-located from a trunk or distribution main outside the DMA (or in a neighboring DMA) to a distribution main inside the DMA.
 - 50.6. site survey for DMA inflow point and location of underground assets
 - 50.7. detailed design of:
 - i. all pipelines that have to be laid
 - ii. location and installation details of new boundaries valves
 - iii. DMA inflow point arrangement design, pressure reducing valve chamber complete with all pipe work and structural design; inflow meter and PRV specifications; location and design of above ground instrumentation box
 - iv. standard design and map with location of all customer connections to be

- relocated
 - v. all other civil, mechanical, installation or plumbing works that might be required
 - vi. construction of FCV chamber, underground installation of electromagnetic flow meter, construction of above ground instrumentation box; including supply of all required pipes, materials, fittings and equipment, as per the specifications
- 50.8. construction of the critical point above ground instrumentation box; including supply of all required materials, fittings and equipment, as per the specifications
- 50.9. execution of all other civil, mechanical, installation or plumbing works, including supply of all required pipes, materials, fittings and equipment required for DMA establishment, as per the specifications;
- 50.10. for all works carried out: reinstatement of road and sidewalk surface
- 50.11. Supply and installation of all instrumentation and SCADA work as per Schedule.
- 50.12. Execution of zero-pressure-test and execution of all subsequent investigations and works should the first zero pressure- test have failed until the test is successfully performed.
- 50.13. commissioning of FCV and controller
- 50.14. Preparation of as-built drawings for all works executed.
51. Where hydraulically possible, DMAs shall be single feed as proposed in the DPR. In cases where it is advisable (for hydraulic or other reasons) to establish multiple feed DMAs, the same shall be subject to approval by the Engineer.
52. The Contractor shall verify the DMA boundaries specified in the DPR, on the pipelines to be kept in use: locating of existing boundary valves, functioning and tightness checks of existing boundary valves, identification of location for additional boundary valves to be installed, and identification of locations where the pipes will be decommissioned. No consumer connection pipe shall cross a district boundary. If a boundary is in the middle of the road, the main needs to be on the side of the road of the district to which it belongs, or the boundary should be behind the line of houses.
53. The Contractor shall identify customer service connections that have to be re-located from a trunk or distribution main outside the DMA (or in a neighbouring DMA) to a distribution main inside the DMA.
54. In preparation of Sections of DMA Works, the Contractor shall undertake a Consumer Water Connection survey in the concerned DMA. The parameters to be surveyed will at least include: type of Consumer (residential, commercial, governmental, etc.), geo-location, type of structure or dwelling, type of existing water connection. The Consumer Water Connection survey will determine the present status of water supply to each Consumer, whether they have an authorized water connection, illegal water connection or no water connection. The data so collected shall be shared / submitted to SMC for transfer to GIS for web enabled

application software and will be used at the time of rehabilitation of existing consumer

connections and while releasing new consumer connections in future. The structure of data base and details of the Consumer Connection survey shall be finalized in consultation with the Engineer. SMC shall provide the consumer connections list with unique ID of existing billing database for consumers of selected operational zones. Contractor shall maintain and update database of such consumers with same unique ID while pre-fixing any letter for further segregation /identification.

55. In preparation of Sections of DMA Works, the Contractor shall undertake a detailed site condition survey in each DMA. The survey data shall be sufficient to develop a comprehensive Geographical Information System (GIS) clearly showing the location of underground and over ground water supply assets and all physical features like roads, culverts, drains, nalas, electrical transformers and any other relevant features which would influence installation and maintenance of existing and/or new pipelines. All key elevations with geo-reference shall be captured in the survey and the DMA service area maps are to be prepared in 1:2000 scale.
56. For each DMA, the Contractor shall apply hydraulic modelling as basis for verifying the optimum DMA design and determination of feeder main diameter. Flow velocities should be less than or equal to 1.5 m/s. Pressures shall not be less than 0.8 bar and should not exceed 2bar. The Contractor can use the hydraulic model used by the Employer or may use either Water Gems or any other software that has the same functionality or better and transfer the results to the GIS system. The data pertaining to reservoirs, pipes, valves and demand locations shall be included in the model. DMA specific hydraulic models shall be integrated into one Overall Hydraulic Network Model covering the entire Service Area.
57. A sufficient number of valves for future operation shall be provided for each DMA, in such a way to enable 4 or 5 steps for Step Test to be executed in leak detection campaigns.
58. The complete detailed design of the each DMA thus verified shall be submitted to the Engineer for approval.
59. Public awareness programs planned to achieve people's participation in managing demand by using the continuously available water to their absolute need only and not to waste, and to communicate importance of metered system and its benefit
60. The Contractor shall construct the 5 pressure monitoring stations including protection encasement and data logger facility.
61. The Contractor shall construct the above ground instrumentation box at strategic locations, including supply of all required materials, fittings and equipment, as specified. However, if suitable place is not available for locating the above ground instrument box, the same may be placed in the Monitoring station chamber.

62. Monitoring stations and meters shall be installed at safe locations onto the sidewalk where possible. Proposed instrumentation and SCADA shall be provided as per tender specification and items.
63. After the finalization of the construction, the DMA will be commissioned according to the requirements set out for Testing and commissioning of this Section.

6.9.5 Consumer Survey requirements

64. A complete consumer survey to ground truth the footprints and the properties in the project area shall be carried out. It may happen that the base map image (available with SMC) may give one footprint but the footprint may be divided in several properties internally either horizontally or vertically. The foot print shall be divided to show clear distinction.
65. The Contractor shall undertake a door-to-door survey of all properties whether connected to the network or un-connected and obtain the details in regard to name, address, number of resident members, categories of general residential households (independent housing, group housing connections, societies and apartments), urban poor households, government housing, non-domestic, commercial, institutional, religious places, industrial and fire services and any other category of resident, consumers income status in the Service Area ,availability of water connection, metering status, estimated consumption levels, alternate water supply arrangements, willingness to pay, etc. The Contractor shall get the data from SMC billing department about the authorised water connection and their location of properties. The data collected from household survey shall be geo coded to the satellite image / base map. This database will be used for the water demand of each property to be collected at the junction of distribution network pipe and the system shall be designed and modelled accordingly.

6.9.6 Hydraulic Modeling requirements

66. The Contractor shall develop a Hydraulic Network Model (HNM) for water supply system based on DMAs of Operational zones. The data related to water supply infrastructure like Reservoirs, Pumping Stations, rising mains and distribution system , valves and demand allocations shall be obtained through field baseline study and consumer survey captured on the network model.
67. The hydraulic network modelling by using latest soft-wares shall be carried out by collecting the actual property wise water demand allocated to the nearest junction. Following broad guidelines may be followed during hydraulic modeling:
 - 67.1. The junction shall be placed at the branching out/ at the crosses at the valves and where there is a large straight length at every 200 m. The model shall be worked out by considering the domestic demand as 150 lpcd water supply and actual demand for commercial and industrial requirement.

- 67.2. The hydraulic water use pattern for the day spread over 24 hours shall be based on the survey data captured through consumer habits of water use in different hours at present and by following the standard pattern, after continuous water supply is successfully implemented.
- 67.3. The storage reservoir capacities shall be modelled to verify the water level in various hours. It shall neither be empty nor overflow. The incoming flow at constant rate shall be decided accordingly.
- 67.4. The DMAs which are still to develop where the present water requirement is quite less as compared to the design demand, the present scenario with existing water demand shall be run and the incoming flow shall be adjusted accordingly.
- 67.5. The minimum pressure in the distribution network when full demand in the zone cum DMA is developed shall not be less than 17 m of water column at consumer meter point. The excessive pressure in the typical areas shall be managed using the appropriate pressure management techniques at distribution system level and other at the individual connection level.
- 67.6. All new connections shall considered and captured as additional demand in the model and updated model.

6.9.7 Pipe laying requirements

68. After validation of DPR data and completion baseline study of distribution pipeline network, Contractor shall carry out the old pipeline replacement programme and laying of new pipelines. The discarded pipelines may remain in the ground. The old pipe line shall be left open at both ends (not plugged) to ensure that it is not brought back into service.
69. For successful transformation and operation of DMA's selected for 24 x 7 water supply, strengthening of primary network is suggested in the DPR. As per DPR no transmission line need to lay. Construction of primary network shall be executed on top priority. Contractor shall be responsible to submit the procurement and time schedule for works within 60 days from the commencement date.
70. The pipe network in the selected area shown in the enclosed drawing is as per DPR.
71. Operation and Maintenance of above distribution network / pipeline laid / executed as per SIP shall be covered in Contractors O & M Plan.
72. Ductile Iron class K-9 pipes and MS pipes as per detailed specifications will be used for new distribution pipelines and MDPE pipe as per specifications will be used for consumer service pipe lines.

73. The Contractor has to plan and implement its pipe laying works in a detailed and strict manner as per approved SIP plan. The planning has to be coordinated with the Engineer and SMC. The expected date of decommissioning of the existing pipeline and the commissioning of the new pipeline together with the exact location of the old and new pipeline have to be properly documented.
74. Pipe laying and decommissioning of old pipes should be done in the following way:
- 74.1. Preparation of skilled labor, tools, fittings, dewatering pump, chlorine water solution (10 ppm), hoses, electric source, grinder, welding machine (where required) etc.
 - 74.2. Excavation around the pipe at the pre-determined location of disconnection. It has to be ensured that there is enough working space according to the pipe diameter and the method of disconnection.
 - 74.3. Marking on the pipe, showing the length of the existing pipe to be cut out. The length to be removed piece shall generally be of at least 1.5 meters.
 - 74.4. Cutting the pipe perpendicular to the pipe centre line, using grinder, metal saw or cutter according to the pipe material. Extreme care is to be taken to avoid any dirt or foreign material entering the existing (and remaining) pipe.
 - 74.5. Installation of the required fittings to plug the existing (and remaining) pipe. All new parts are to be submerged completely in the chlorine solution (10 ppm) for at least 15 minutes directly before being installed.
 - 74.6. Installation of thrust block, where required.
 - 74.7. Repair of any possibly damaged protection layer.
 - 74.8. Greasing of bolts and washers and installing of the protective coat.
 - 74.9. After the one week period, described hereafter, all temporary parts are to be removed.
 - 74.10. The excavation shall be left open for about one week. During such time the pipe end has to be observed very frequently in order to ensure immediate recognition of a possible flow of water.
 - 74.11. After the one week period and with the consent of the Engineer and his approval on the appropriate form, the excavation shall be backfilled and the surface brought back to former condition.
 - 74.12. If, at certain points or situations, public safety does not allow for leaving the pipe ends open for the mentioned time, other means shall be found to control the appearance of water at the pipe ends. Possible solutions, to be decided on from case to case could be the following:
 - o Plug the end where there are restrictions in a temporary form and leave only one end of the decommissioned pipe open.
 - o A pipe connection in a side street can be used for observation.
 - o A temporary pipe could be laid to the shoulder of the road to bring the possible water flow to the open.
 - o Former house-connections could be prepared for observation, after the pipe ends are plugged temporarily.

6.9.8 Consumer Service Connections requirements

75. The scope includes providing / replacing of 27000 Connections in project area. The actual number of connections may vary which may include many unauthorized ones. All existing service connections shall be replaced and new connections provided.
76. SMC will provide information about the existing authorized consumers. Contractor will use this information for verification of the same during consumer survey and also for identifying unauthorized service connections in existence during the Consumer Connection surveys. The results of such verification of authorized connections and identified unauthorized connections will be submitted to the Engineer and SMC for further needful action.
77. Existing authorized Connections: Contractor will replace the existing service pipe lines from distribution main pipe lines to the consumer premises with new saddles, ferrule, stop cock, MDPE pipe, GI pipe above ground etc. as per detailed specifications for the authorized consumers from the newly laid distribution pipe lines under a DMA. The work shall include excavation and cutting of road surface as required, making connection with distribution line under pressure, installation of service pipe and accessories including water meter and refilling the ground and bringing the road surface to original condition. This work will be done DMA wise on completion and commissioning of transmission main feeding the DMA. A water meter with a meter box will be provided at the end of the consumer service pipe line securely inside premises of the Consumer as per detailed specifications.
78. New Service Connections: Contractor will provide new service pipe lines from distribution lines to the consumer premises with new saddles, ferrule, MDPE pipe, stop cock etc. as per detailed specifications for the unauthorized consumers from the newly laid distribution pipe lines under a DMA on receiving approval from SMC. This work will also be done DMA wise on completion and commissioning of transmission main feeding a particular DMA. A water meter with a meter box will be provided at the end of the consumer service pipe line securely inside the premises of the consumer as per detailed specifications. The work shall include excavation and cutting of road surface as required, making connection with distribution line under pressure, installation of service pipe and accessories including water meter and refilling the ground and bringing the road surface to original condition. Contractor will also be responsible for providing new consumer service connections from time to time on receiving approval from SMC for the same. This will be an ongoing work during the entire contract period. The work of new service connections will be done as per detailed specifications within 3 days of receipt of approval from SMC.
79. Services to the Urban Poor: In the case of urban poor areas in the Service Area, the Contractor, in accordance to the approved connections policy, shall undertake provision of individual. Such water connections shall also be provided with same specifications and procedures as mentioned above for regular consumer connections. However, the water meter

and meter box shall be installed at a safe place as agreed with the Consumer and approved by SMC.

80. Public Stand Posts: All public stand post shall be removed after providing individual connection or if SMC instruct to install public stand post. All permitted public stand posts as per list to be provided by SMC shall be rehabilitated and constructed with sturdy plumbing and good quality stopcocks and shall be provided with a Consumer meter for the purpose of accounting the consumption from the respective tap. The location and operation arrangement of each stand post will be determined in coordination with the future tap users. The Contractor is required to participate in the coordination process.
81. Bulk Water Supply Connections: In the case of bulk water supply connections of sizes equivalent or higher than 25mm dia. to bulk consumers such as apartments, housing societies or private layouts within the Service Area, the Contractor shall install a suitably sized, accurate consumption meter.
82. Illegal Connections: The Contractor based on the findings from the Consumer Connection survey, and in accordance to the approved connections policy, shall identify the illegal or unauthorized connections and inform SMC for regularization / disconnections of the connections. On approval and after payment of prescribed charges by the Consumer, the Contractor shall then rehabilitate the connection with good plumbing material and a Consumer meter. Final decision on regularisation or disconnection of such Consumers shall solely be the responsibility of SMC and Contractor shall be more particular in bringing to the notice of SMC such connections.
83. The responsibility of the Contractor will be limited to providing service pipe line up to the water meter, water meter, stopcock and meter box in the consumer premises. All works beyond the water meter will be the responsibility of the Consumer, except for the public stand posts.
84. The Contractor shall set up and operate temporary Customer service points in those DMAs where Works are ongoing and Consumer Service Connections are being provided, to facilitate easy communication with Consumers.

6.9.9 Testing and commissioning

85. Testing of all materials, equipment and instrumentation shall be done as specified in the Technical Specifications. Installation of all electro-mechanical equipment shall be carried out strictly as per recommendations of the manufacturers. Pre-commissioning and trial run shall be undertaken as specified in Technical Specifications and detailed technical specifications covered under section 6.21, 6.22 & 6.23 of this document.

86. Supplying for the first time water to the DMA, the Contractor has to check that none of the replaced pipelines is still supplied with water via another pipeline inside or outside the DMA. In case of water flowing from the replaced pipeline, the Contractor has to take all necessary measures to stop the supply of water to the replaced pipeline. The measures at least include:
- 86.1. Valves in the immediate vicinity of the decommissioned pipe shall be closed to assess the location of the connection.
 - 86.2. Start digging out the decommissioned pipe from both ends until the unknown connection is found. The found pipe has to be followed until at least the border of the DMA, in order to isolate the DMA properly.
 - 86.3. Gather latest information from SMC on valve settings and pump operations. If it becomes evident that the water comes through a connection from outside the district, it will be necessary to examine jointly with the Engineer what changes in pump- or valve settings has been done recently.
87. Testing for commissioning of a completed DMA shall consist of flow measurements at DMA inlet and at all service connections to determine whether the target level of water loss, as specified in Schedule 7 of PCC [*Target Performance & Standards*], Parameter has been met.
- 87.1. Simultaneous flow measurements shall be undertaken during a 24-hour period.
 - 87.2. In case the actual water loss thus measured is more than twice the target level, the Contractor shall propose a work method, to be approved by the Engineer, to determine the cause(s) of water loss.
 - 87.3. The Contractor shall investigate the cause(s) of water loss accordingly and shall make the necessary rectifications.
 - 87.4. The testing for commissioning shall then be repeated till the requirements are met & 24x7 water supply achieved in the project area.
 - 87.5. Contractor shall be responsible to conduct the internal water audit / leak test at consumer premises. Contractor shall prepare and record the list of high water consumption consumers and perform the test.

6.9.10 Meter Reading, water billing and Management requirements

88. Meter reading & water billing of consumer meters and associated software development is covered under the scope of Contractor. All Meter to be provided by SMC under this Contract Are AMR meters and hence Operator shall develop the system to read water meter readings and issue the water bills on a periodic basis through latest technology available. The individual readings shall be downloaded at a central terminal of SMC at regular intervals to create a billing schedule. Contractor shall be responsible to verify the volumetric consumption readings of DMA consumers during DMA / baseline study and also be responsible for spot / random checking as and when desired by SMC.

The Water Billing Solutions systems shall be a comprehensive commercial management system equipped with functionality to cover all operational areas of revenue management and customer information as well as to manage commercial data quality. The proposed system shall perform following functions :-

- Billing, revenue collection, statement delivery, debt management, customer services,

enquiries, new accounts, pricing & consumer analysis, meter reading & control, meter & connection maintenance and reporting.

- Dealing with customer complaints and enquiries, and efficiently administer and process applications for new services.
- System shall be online, semi-offline with batch updating of a central server, and stand alone (offline).
- The systems shall be integrated with geographical information systems (GIS) to enable optimized walk route management and property/connection reconciliation and should be able to interface with existing system.

89. The Contractor shall:

- i. Develop and implement: (i) meter reading procedures and arrangements; (ii) Digital record of meter readings (iii) meter reading and billing control, and (iv) efficient and accurate meter reading system & technology; (v) Development water billing software with web enabled GIS application module
- ii. During DMA study, read all consumer water meters of selected DMA consumers in accordance with requirements laid down under this contract.
- iii. develop a monitoring program of random spot-checks to ensure the accuracy of the - meter calibration and the meter reading process and provide written reports to the SMC on the results of the monitoring programme;
- iv. read all Consumer Meters in accordance with the general instructions of the SMC;
- v. register all Consumer Revenue Meters readings in the appropriate computer data base as desired by SMC
- vi. Develop and implement a plan, the intent of which is to ensure that:
 - a. All consumer meters are in working condition
 - b. All consumer meters are accurate,
 - c. All consumer meters are read,
 - d. All consumer meters are in suitable and easily approachable locations,
 - e. Problems related to unprotected and unsealed consumer meters are resolved,
 - f. Develop and implement a program to estimate consumption in circumstances where metering problems exist, and
 - g. Provide advice as to methods to improve the meter reading process to ensure greater accuracy;
- vii. Identify consumer meters which have not been read; and
- viii. Respond to reports of malfunctioning consumer revenue meters from Consumers.

6.9.11 Water Loss reduction & management Services

90. The Contractor has to take all necessary action, provide all required services and materials and equipment and carry out all works required to achieve the main objective of the Contract and

reduce water loss for total number of 27000 connections in selected DMA's of operational zones. The following (non-exhaustive) list summarizes the activities the Contractor is normally expected to carry out (without limiting the Contractor's obligations and the scope of work):

- a. no water loss reduction works shall be carried out prior to the 7-day inflow and pressure measurement baseline measurement to be carried out by the Contractor, jointly with and supervised by the Engineer;
- b. leak detection surveys (using all kind of equipment and technologies, from simple sounding with a listening stick to leak noise correlators and leak noise loggers as appropriate, helium gas), note that all required leak detection equipment has to be provided by the Contractor (but will not revert to the Employer at the end of the Contract).
- c. Pressure management: stabilizing, managing and reducing average DMA pressure using PRVs and controllers and various techniques as appropriate; when doing pressure reduction, the Contractor has to ensure that all the volume of water supplied to consumers in the DMA is the same or better than the baseline levels at the start of the project. Level of minimum pressure will depend on the type of housing and the general availability of tanks. Pressure management has to be done in close co-operation with the consumers in the DMA to reduce the risk of complaints. All required customer information and education is part of the Contractor's duties and cost for these activities covered under scope of services envisaged in this contract.
- d. Service connection replacement: it is anticipated that most of the service connections are leaking or are in bad condition and must be replaced. Detailed design, supply and installation complete with all fittings and road and sidewalk reinstatement are included. The Contractor shall decide which connections shall be replaced but in any case, if a leak is found on any part of the service connection, the entire connection including the pipe saddle shall be replaced
- e. Leak detection surveys, repairs and pressure fine-tuning shall be repeated and/or shall continue until an acceptable level of leakage is achieved. The acceptable level of leakage might vary from one DMA to the other, it is up to the Contractor to decide at which point the effort for further leakage reduction becomes prohibitively high;
- f. continuous flow and pressure data logging and data transfer to the central server establishment of the Target Night Flow Level (TNFL) in m³/h after completion of all water loss reduction activities in a DMA and continuous monitoring of inflow, pressure and minimum night flow to become aware of new leaks; and
- g. Repeating of leak detection and repair should the minimum night flow exceed the tolerance limits .
- h. Detecting illegal connections: Should the Contractor find illegal connections he shall report them to the Employer.

91. The fixed and performance fee together cover all fixed cost, overheads, profit and all manpower, machinery, equipment, transport as well as all materials and works required to carry out all activities that might become necessary to achieve the objective of the Contract.

92. Water Audit for Consumer Connections:- Contractor shall identify the consumers with very high consumption of water and prepare the list and maintain the record of such consumers. While Establishment of DMA's, the list of such consumers shall be submitted to Engineer for internal water audits within consumer premises. Contractor shall be responsible to carry out Internal water audit for such identified consumers and submit the Internal Water Audit Report to Engineer with the consent of Consumer. Payments for this activity shall be as per Schedule-B.

6.10 Road cutting & Restoration

93. The Contractor shall take a timely action in accordance to the Approved Implementation Plan for obtaining the necessary permissions for road cutting from SMC/ PWD / CPWD. A comprehensive list of locations with respective time schedules shall be provided to SMC who intern shall assist the Contractor in obtaining the permissions.

94. The Operator shall adhere to the standards, specifications and all requirements in compliance to the prevailing Dig and Restore Protocols prescribed by SMC / PWD / CPWD from time to time. On completion of work on pipelines, the Operator shall ensure standard refilling of the trench and inform SMC for timely restoration of the road for minimizing inconvenience to the users and residents.

95. While Road restoration Following guidelines should be followed:

1. The contractor shall have to restore the road up to WMM stage including refilling trench in layers, watering, rolling and compacting to within 10days after trenching is completed in a particular street/reach. The contractor shall ensure that total uncovered length of WBM does not exceed 5.0KM at any stage of work and will complete the bituminous work regularly.
2. Contractor shall erect informatory board at his own cost showing type of work, inconvenience expected and timeline for various construction activities going to take place in a particular street or a particular reach of road as per direction of Employer's Representative in charge.
3. Contractor shall deploy a community outreach team headed by a qualified social expert (post graduate in sociology) having minimum 3 years' experience of social activity work with government recognized NGO or other government institutes to make strong relation with public prior to start of work in a particular area.
4. The contractor shall have to do the sequencing of activities as per direction of Employer's Representative in charge to synchronize sewer work and water pipe line work to minimize the road excavation and restoration in the street which will have both pipe lines.
5. The cutting of existing C.C. pavement shall be done by using mechanical cutter to ensure cutting in regular line and the laying of C.C pavement shall be done below 30 degree ambient temperature.

6.11 O&M Requirements

6.11.1 Operations and Maintenance of Water Supply Services

96. After completion of Design Construction DMA Establishment works in selected service area, the Contractor shall take over the management responsibilities of the Operations and Maintenance (O&M) of the water supply facilities of that respective area. The O&M tasks essentially comprise but not limited to the following.
- a. Providing & maintain water supply to the Consumers at the minimum service levels as per Schedule-7 without further deterioration
 - b. Water Demand Management
 - c. Emergency water supply
 - d. Network Operations and Management
 - e. Flow and pressure, SCADA monitoring
 - f. Repair of leaks and bursts and valves
 - g. New Connections as per directives and approval by SMC
 - h. Consumer Services including attending to complaints received through SMC and their resolution
 - i. SCADA Information management and reporting
 - j. Valve Operations through actuator control

6.11.2 O&M Period

97. During this period, the Contractor shall continue to provide water supply services to the legal Consumers in the Service Area at the prescribed Minimum Service Levels. This shall include but not limited to all the tasks, operations, maintenance activities as listed above including attending to any new requirements for new connections, extended boundaries of Service Area etc complete.
98. The Contractor shall ensure continuous, pressurized water supply to all the Consumers and any interruptions shall be within the permissible limits as specified in the Schedule 7 Performance Standards.
99. The Contractor shall also implement all rehabilitation or service improvement works required in any extended area of the Service Area depending upon bulk water supply feasibility and hydraulic modeling or as necessary as mutually agreed between the Parties at same terms & conditions upto 25% of additional project area.

6.11.3 General

requirements:-

Operating Functions

110. Basic Operating Functions shall be as following;

Area of Operations	Key Operating Functions
Storage and Distribution	<ul style="list-style-type: none"> ▪ Conduct routine O&M ▪ Valve inspection ▪ Compliance monitoring for pressure and quality ▪ Flow measurement & monitoring ▪ Leak detection and repair
	<ul style="list-style-type: none"> ▪ Storage tank inspection ▪ Repairs, rehabilitation, expansion of networks ▪ Replacement of assets as per maintenance schedule
Consumer services	<ul style="list-style-type: none"> ▪ Install new connections ▪ Conduct meter installations ▪ Checking of Meter reading ▪ Consumer complaints redressal, and monitor Consumer satisfaction as per instructions given by SMC

Area of Operations	Key Operating Functions
Water Safety	<ul style="list-style-type: none"> ▪ Water safety plan ▪ Monitoring water quality
Administration	<ul style="list-style-type: none"> ▪ Planning and coordination with other authorities ▪ Procurement of materials, works and services ▪ Project Management and supervision ▪ Accounts and financial management, and training ▪ Information recording and management ▪ Regulatory reporting ▪ Stores and Inventory Management

In the above table, the key basic operating functions are only listed and there are many more routine O&M functions which the Contractor has to undertake at different time frequencies.

6.11.4 Preventive Maintenance

111. The preventive maintenance tasks generally required in O&M of distribution systems are given in the following Table.

Chart Indicating Preventive Maintenance Schedule

Component	Daily Maintenance Tasks
WDS and ESR	Routine Maintenance Site maintenance and house keeping in good and neat conditions. Provide regular repairs to keep all in working conditions. Site maintenance including upkeeping of landscaped area.
Pipelines	Routine Maintenance Check residual chlorine - weekly Surveillance for leakage – pipe breaks and leaks - Daily Pipe flushing once in 6 months Swabbing and scraping once in three years
Mechanical / Electrical / Instrumentation	
Chlorination	Routine Maintenance <ul style="list-style-type: none"> ▪ Check leakage of Chlorine ▪ Cleaning of chemical deposits
	<ul style="list-style-type: none"> ▪ Check fuses and contacts ▪ Check dosing pumps Check condition of safety equipment
Valves Actuators	Routine Maintenance (A) Sluice valve and Knife gate valve <ul style="list-style-type: none"> ▪ Check gland packing of the valve at least once in a month. ▪ Ensure that packings inside the stuffing box are in good trim and impregnated with grease.

	<ul style="list-style-type: none"> ▪ If necessary change the packing as often as necessary to ensure that the leakage is within limit. ▪ Grease should be applied to reduction gears and grease lubricated thrust bearing once in three months. ▪ Check tight closure of the valve once in 3 months. ▪ A valve normally kept open or closed should be operated once every three months to full travel of gate and any jamming developed due to long disuse shall be freed. ▪ Inspect the valve thoroughly for flaws in guide channel, guide lugs, spindle, spindle nut, stuffing box etc. once in a year. ▪ Do not operate with oversize hand wheel or cap or spanner. ▪ Do not operate under throttled i.e. partially open condition <p>(B) Reflux (non-return) valve</p> <ul style="list-style-type: none"> ▪ Check proper operation of hinged door and tight closure under no-flow condition once in 3 months. ▪ The valve shall be thoroughly inspected annually. ▪ Condition of dampening arrangement should be thoroughly examined once in year ▪ In case of dampening arrangement, check for oil leakage and replace oil once in a year. <p>(C) Butterfly Valve</p> <ul style="list-style-type: none"> ▪ Check seal ring and tight shut-off once in 3 months. ▪ Lubricate gearing arrangement and bearing once in 3 months. ▪ Inspect the valve thoroughly including complete operations once in a year. ▪ Change oil or grease in gearing arrangement once in a year.
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Component	Daily Maintenance Tasks
Connections	Routine Maintenance
SCADA System	Routine tests , System PLC's , Calibration of instrumentation etc. complete
Water Meters	Routine Maintenance <ul style="list-style-type: none"> ▪ Check for bulk meter accuracy – once in 6 months or as per requirement ▪ Replace Consumer meters – once in 7 years ▪ Replace bulk meters – once in 10 years ▪ Calibration check from NABL labs once in 2 years

6.11.5 General Obligations

112. The Contractor shall have the following general obligations as they may be applicable during the term of the Contract.
- (a) The Contractor shall perform the Services in accordance with this Contract, and carry out its obligations with all due diligence, efficiency, and economy, in accordance with generally accepted professional techniques and international best practices, and shall observe sound management principles, and employ appropriate advanced technology and safe methods. The Contractor shall always act in good faith, in respect of any matter relating to this Contract or to the Services, to the SMC and shall at all times support and safeguard the SMC's legitimate interest in any dealings with the Customers, sub-contractors or third parties;
 - (b) The Contractor shall ensure that all materials and workmanship used in the course of the Contract shall be in accordance with the standard specifications. In absence of and appropriate specification, in accordance with the Indian National Standards or the International Standards Organisation as the case may be.
 - (c) The Contractor shall develop, install, commission and maintain efficient and effective Integrated Information Management System (IIMS) comprising of all management needs including customer contact management, new connections, disconnections, reconnections, consumption and flow monitoring, demand management, asset management, inventory management, human resources management, monitoring .of operating efficiency etc complete as' required for efficient and effective operations and management of the water supply services.
 - (d) The Contractor shall establish and operate a 24-hour customer service centre to be managed by SMC to carry out the functions of customer relations, support and complaints in terms of this Contract including but not limited to response and redressal of complaints concerning leakages in the distribution system, water reduction, water quality, low pressure, and provide assistance in imparting education concerning use of

water supply, installation of new connection, water usage and plumbing. The customer service centre should be operational during all times of year round the clock with appropriate staff.

The support staff to manage the centre shall be provided by Contractor.

- (e) The Contractor shall install Customer metering on all points of Customer supply and randomly check the calibration of meters installed for accurate reading to establish accurate water balance and monitor water losses;

The Contractor shall supply water to SMC properties with metered connection

- (f) The Contractor shall permit the persons appointed and / or authorised by the SMC to conduct. time to time audit of accounts and records of the Contractor relating to performance of the Contractor under the Contract after the Appointed Date subject to receipt of prior written intimation from the SMC in this regard and shall fully co-operate with such auditors in the conduct of audit and review exercises and checks and shall provide all requested information to the auditors;
- (g) The Contractor shall on a periodical basis update the record of Facilities.
- (h) Neither the Contractor nor its employees shall indulge, either directly or indirectly, in any of the following activities:
 - (i) during the term of this Contract, any business or professional which would conflict with the activities assigned to them under this Contract;
 - (ii) NA
- (i) The Contractor shall undertake the measures as agreed under the Emergency Procedures as per para 6.11.9 herein in times of operational exigencies.
- (j) Any complaints received from the consumer through customer service centre shall be recorded and the appropriate remedial measures shall be effectively implemented to the satisfaction of the SMC duly documented.
- (k) Any leakages observed in the distribution main shall be attended immediately and water supply restored within 12 Hours of the receipt of complaint for leakage.
- (l) The Contractor shall be responsible to maintain required quantities of spares for preventive maintenance, periodical maintenance and breakdown maintenance as enlisted hereafter in this document. The Contractor must also keep the minimum stock of spares for emergency repairs as required for prudent operational practices.

6.11.6 Specific Obligations of the Contractor for Operations & Maintenance

113. The Contractor shall have the following obligations:

- a) Prepare & implement operating and maintenance manuals, spare parts lists, recommended spares , warranty period from equipment suppliers and connected matters;
- b) Identifying and procuring workshop equipment and capital spares for repairs as may be required, at his cost.
- c) Select suitably qualified Suppliers of Spares, Consumables, and the external Contractors required during Operations.
- d) Set up a fully functional office with computers, personnel, equipment, furniture and communications and 24-hour customer service desk at locations / space provided or suggested by SMC/ engineer. Customer service front office shall be managed by SMC, while support staff for resolving the complaints or repairs shall be provided by Contractor.
- e) Contractor shall collect water sample for water quality check at ESR level, within distribution system as well as consumer end and submit it to SMC laboratory for monitoring and reporting ,
- f) The Contractor shall assist the SMC in evaluating and verifying the reasonableness of the Operations and Maintenance Plan and answer all queries, explain the assumptions, projections, calculations etc. and shall make available all the concerned staff who had prepared the respective plans.

114. Notwithstanding the above obligations the Contractor shall have the following obligations during Operation & Maintenance

- (a) Provide prudent management, operation and maintenance services as per the prescribed-standards of performance for existing as well as new assets created under this contract;
- (b) Undertake efficient demand management and meet the entire demand for water as required during the time of operation;
- (c) Co-ordinate with SMC for ensured Bulk Supply volume at WDS inlet
- (d) Contract management;
- (e) Connections, reporting defaulters, reconnecting as per the general conditions of contract.

- (f) Manage and maintain the Integrated Management Information System (IMIS) to ensure efficient and transparent information, record keeping, and decision making. Under IMIS, set up a robust integrated information system comprising of the following areas:
 - (i) technical services such as service levels of NRW, water quality, consumption, pressure, losses, monthly real time water balance, SCADA etc.;
 - (ii) business services comprising, procurement, inventory management and human resource management;
 - (iii) Hydraulic network Modeling:- A hydraulic network model representing the water supply system for selected area of SMC shall be developed using suitable software such as Water GEMS. The model shall be calibrated, reconciled and established and fully functional for continuous updating for management of the system;
 - (iv) Asset Management Program including covering each type and category of asset, its servicing schedule, replacement frequency, etc. for all assets in water system including but not limited to:-
 - (A) Valve inspections
 - (B) Tank inspections
 - (C) Pipeline inspections
 - (D) Leak detection process.
 - (E) Leak repairs
 - (E) SCADA & Preventive maintenance of all existing and new mechanical, electrical and instrumentation equipment
 - (v) Set up operating and maintenance procedures for each of the unit operation including Standard Operating Procedures, Standard Maintenance Procedures, Emergency Procedures, Health and Safety Procedures etc incorporating Original Construction Contractor's Operating and Maintenance Manuals;
- (g) Maintain effective and efficient customer complaints redressal system, the prescribed performance standards including awareness program, campaigns, trainings etc.;
- (h) Undertake timely and cost effective asset management program;
- (i) Maintain the automated water quality surveillance system;
- (j) Operate and maintain all mechanical, electrical, instrumentation , SCADA Server & Monitoring and information technology installations, equipment, machinery etc as per the respective standard operating and maintenance procedures;
- (k) Undertake preventive and breakdown maintenance for all pipelines, valves, appurtenances, mechanical, electrical and instrumentation equipment in relation to the above referred Facilities, along with appropriate documentation to facilitate warranty and insurance claims, if required;

- (l) Ensure effective and efficient planning, procurement and inventory management for all spares, equipments, consumables, instrumentations and PLC/SCADA system etc;
- (m) Provide robust security arrangements for all the facilities within the scope of this project, including restriction of entry of unauthorised persons;
- (n) Manage and maintain the water distribution management system (WDMS) for the water supply in the project area, including all, water storage facilities, flow measurement, pressure measurement and quality surveillance systems etc. complete;
- (o) Comply with all relevant local laws including environmental, industrial and labour laws;
- (p) Maintain healthy working relations with all stakeholders including the Water resources department, SMC, NHAI, PWD, State Pollution Control Board, and power utilities; etc.
- (q) Maintain detailed documentation and prepare periodical reports including monthly, quarterly and yearly reports for submission to SMC including data on water balance, leakage levels, flow and pressure of water at designated check points, Import / Export point flow details, water loss / NRW level, service level, etc. complete as set out in.
- (r) Training of the operating personnel from SMC or any other designated authority for taking over the system at the end of Contract Term;
- (s) To undertake emergency chlorination measures at times of outbreak of epidemics and any such emergency situations on behalf of SMC;
- (t) Rectify all defects attributable to the Contractor and notify the SMC of defects, developed within defect liability period of the commissioned components or equipments of Water supply system;
- (u) Follow all reporting requirements as specified by Engineer;
- (v) Maintain the Performance Indicators, Quality Assurance, Standard & Safe Operation Procedures (SOPs);
- (w) To summarize, the services provided by the Contractor shall include the following:
 - Operation of Facilities from inlet of service reservoir upto consumer end;
 - Provision for 24 hours a day operation and emergency cover;
 - Maintenance of the Facilities from inlet of service reservoir upto consumer end;
 - Ground and buildings maintenance;
 - Unscheduled and emergency maintenance;
 - New service connection surveys and estimates as per instructions of SMC;
 - Making new service connections as per instructions of SMC;

- Investigation of illegal connections, install meter & measure and necessary reporting as per instructions of SMC;
 - Quality surveillance programme;
 - Data collection and reporting;
 - Holding emergency exercises;
 - Incident management;
 - Safety inspections;
 - Supervision of subcontractors ,enforcement of specifications;
 - Operational liaison;
 - Updating of the IMIS/ Computerized water management software system;
 - SCADA system operations / cloud facility
 - Preparation of all plans, procedures and budgets relating to operational matters, as required within the Contract.
 - Consumer awareness program, campaign, training, meetings, media interaction etc.
 - Any other work necessary to ensure the continued operation and availability of the system.
- (x) All instruments shall be maintained, checked, calibrated and serviced periodically and will always be kept in operating condition. The calibration shall be checked whenever necessary and corrected. Calibration data shall be submitted to the SMC for approval. As a minimum, all instruments shall be calibrated once per year.
- (y) For the purpose of complying with the requirements of this contract, the Contractor will need to provide.:
- i) An adequate and skilled workforce, supervisors, managers and technical support staff;
 - ii) Administrative and financial support staff and computer and business support systems;
 - iii) All necessary mobile plant and equipment, vehicles and incidental equipment;
 - iv) Health and Safety equipment and staff protective clothing as well as traffic and footpath barriers and signs;
 - v) Necessary chemicals and fuel;
 - vi) Stores suitably stocked with adequate spare parts and replenished within a store policy that recognizes frequency of use and delivery periods;
 - vii) Suitable depot and office premises.
- (z) The Contractor shall carry out the complete cleaning & disinfection of service reservoirs, master balancing reservoirs etc. once in a year.
- (aa) All SCADA and monitoring data shall be maintained and available on internet through application software.

6.11.7 Standard Operating Procedures (SOP)

115. Operating Instructions and Standard & Safe Operating Procedures (SOP) shall be formulated for each Site comprising of process equipment schedules, operation & maintenance data, sampling and analysis with frequencies etc. The operating parameters shall be optimised based on the data collected on commissioning of the facilities. All the activities in the preventive maintenance schedule shall be followed without any lapse. Indicative functions that are expected to be performed at each site are given below:

Water Supply Network

- (a) Take all relevant meter, flow and pressure readings
- (b) Check operation of all equipment
- (c) Periodically check water meters and cross check readings
- (d) Check for Chlorine residual, flow and pressure at the Critical Measurement Points (CMPs)
- (e) Checking SCADA operations & monitoring

Water pumping stations/ and transmission main

- (a) Check operation of all pumps
- (b) Take all relevant meter readings
- (c) To ensure compliance with agreed withdrawals and to bring to notice of the DMA any excess or short withdrawal
- (d) Check operation of all valves along the transmission main
- (e) Flow and pressure measurement
- (f) Checking operations of electrical & mechanical equipment
- (g) Check the power factor and power consumption

Feeder main pumping Stations

- (a) Inspect the overflow devices
- (b) Check operation of all pumps
- (c) Take all meter readings at such times of the day, as agreed with the SMC
- (d) Check distribution of flows to feeder mains
- (e) Checking operations of electrical & mechanical equipment

6.11.8 Maintenance and Repairs (Mechanical, Electrical and Instrumentation)

A] Management and Maintenance Plan

116. A properly designed water system shall be capable of delivering desired output at all times. Considering that every mechanical system shall have to be given a downtime for maintenance purposes, the Contractor shall schedule a downtime of one hundred twenty hours, on a

cumulative basis in a year for the water components or project facilities in consultation with the SMC so as to minimise disruption in services.

- (A) Routine inspection and maintenance of all equipment;
- (B) Planned and scheduled maintenance (preventive);
- (C) Unscheduled maintenance (breakdown);

B]Routine Inspection and Maintenance of Equipment

The Contractor shall carry out routine monitoring of the equipment and ensure that the equipment is properly maintained to meet the desired output. Typical tasks that shall be undertaken are:

- (A) Mechanical
 - (a) Checking the lubrication and necessary follow-up
 - (b) Replacing of glands that are leaking
 - (c) Servicing as per supplier's instructions
 - (d) Checking for unusual vibrations and noise

- (B) Electrical
 - (a) Checking electrical contacts and wiring
 - (b) Assessing efficiency of electrical equipment

- (C) Instrumentation
 - (a) Cleaning and calibration of probe /sensors
 - (b) Fault diagnosis
 - (c) SCADA, PLC, RTU, Cables, Display Unit etc.

These maintenance tasks shall be issued on a weekly basis through computer aided management system and the Contractor shall incorporate it in operating work schedule. All observations shall be recorded in the properly designed record system and would be analysed for initiating corrective actions, if any.

C] Planned and Scheduled Maintenance (Preventive)

A work schedule chart listing identification of critical equipment, work assignment, timing shall be prepared. Critical equipment is defined as those items where failure would adversely affect the quality and quantity of output or those that risk the safety of employees or customers. The schedule shall identify the responsible person / agency who shall be intended to complete the task e.g. in - house technician or specialist contractor etc.

The overall yearly plan schedule shall be issued to all parties to enable forward planning of anticipated manpower requirement and equipment down time. The indicative maintenance schedule is provided further in the following table. This shall be finalised during the preparation of the Operation and Maintenance Plan.

D] Breakdown Maintenance

The aim of routine and preventive maintenance is to keep breakdown to minimum for items of critical equipment which shall directly affect the performance of treatment processes. However certain breakdown may occur in spite of proper maintenance. The Contractor shall take the breakdown maintenance on top priority to keep disruption to the systems at a minimum level.

The Contractor shall have an option to call other available staff and also the services of the local skilled contractors should the breakdown occur.

E] Spare Parts

The Contractor shall store spares of all the critical equipment on respective sites and the inventory shall be assessed according to anticipated usage and in conformity with Annual Operating and Maintenance Plan.

The Contractor shall obtain consumable items required for maintenance e.g. grease, gaskets etc. from local suppliers, as and when required.

F] Maintenance Report

As part smart management of the maintenance activities, a Computer Aided Maintenance Management (CMM) shall be implemented by the Contractor which shall be integrated with the IMIS system i.e. WDMS with the help of GIS. Appropriate proprietary CMM packages shall be utilised by the Contractor for maintenance purposes. This package shall incorporate features such as Facility details, maintenance history records, and scheduling of maintenance activities and updated regularly in GIS database. The use of such package shall allow the Contractor to predict when the maintenance activities need to be carried out.

Record of maintenance jobs carried out shall be reported in the record system, which shall provide the SMC the past history, time and cost involved for each category.

6.11.9 SCADA & Instrumentation system

General Activities

117. Within the framework of the Contractor's responsibilities given in this document, 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 fulfil 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) Providing the Centralized monitoring system & SCADA for SMC including pure water Pumping station with all OHT's& or as directed by SMC engineer-in charge.
 - b) Providing the required staff, but not less than the minimum as specified in this document
 - c) Providing all required consumables and spare parts/ instruments required for functioning of plant and equipment.
 - d) Maintenance of instrumentation (all field instruments) & control system, software's, PCs, control room, radio telemetry system, UPS, A.C. etc. and all other works constructed in this Contract.
 - e) Periodic calibration check of all supplied instrumentation and controls from reputed agencies and submitting the same document to SMC engineers during the period of operation and maintenance.
 - f) Reporting;
 - Repair history of all mechanical, electrical and instrumentation control equipment in and pure water pumping stations, water transmission mains;
 - Daily log of operations of all the important instrumentation & equipment
 - Daily start-stop operation of pumps with every hour readings for operating voltage, amperage and power factor;
 - Hourly readings of pressure, flow rate and integrated quantity of water;
 - Hourly levels of sumps;
 - 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 SMC;
 - Last periodic maintenance done for all equipment/buildings of the system;
 - g) Providing required instrument spares and maintaining adequate inventory of required accessories or equipment itself for repair of system so that the all instrumentation and control equipments, software and communication system can work efficiently for the proper functioning of Central Monitoring System as per the guarantees given or minimum required efficiencies asked under this Contract, without any additional costs to department.
 - h) Prior approval to the changes required to be carried out during O&M shall be obtained by the contractor from the SMC engineer. The required changes shall be reported to SMC well in time necessary drawing and literature for any changes shall be submitted to the employer's representative.

- i) 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.
- j) Daily patrolling of each location, to identify and report the damages / defects if any.
- k) Periodic routine maintenance of structures/control room / chambers of each location of pumping station, OHT's etc. and others built in the Contract. 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 / room pleasant.
- l) Providing adequate manpower for monitoring / watch and ward of each location of, pumping stations, OHT's etc.
- m) Providing four wheeler vehicle as specified & as approved by engineer-in-charge for transportation facilities between various locations.
- n) 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.
- o) Submission of Daily report (Water audit / Energy Audit / Water Balance).
- p) Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities, insure;
 - The work together with material and plant for incorporation therein, to the full replacement cost (term "cost" in this context shall include profit).
 - 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.
 - 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.
 - Any amount not insured or not recovered from the insurer shall be borne by the Contractor

6.11.10 Emergency Action Plan

118. The Contractor shall provide Emergency Plan of Action, as per the following:

- (i) The SMC may, at its election, intercede and take, or direct the Contractor to take, any and all actions reasonably necessary to respond to an Emergency.
- (ii) The Contractor shall, upon learning of an Emergency or the probable occurrence of an Emergency, (1) immediately provide oral notice to the SMC or its Authorized Representative of the same and (2) as soon as possible, but no later than twelve (12) hours, provide Notice to the SMC or its Authorized Representative of such event or

probable event; provided however, if Applicable Law shall provide for a more expeditious oral or written notice of any Emergency to the SMC, the Contractor shall so comply by providing such notice to the SMC or its Authorized Representative.

- (iii) The SMC and Contractor or their Authorized Representatives shall coordinate with each another prior to, during and after the occurrence of an Emergency including 1) the planning and implementation of actions designed to prevent or mitigate damage to the System and the environment and (2) the attendance of all meetings related to such planning and implementation.
- (iv) The Contractor shall **interact / liaison** and cooperate with appropriate departments of the public entities comprising the SMC and other jurisdictions.
- (v) The Contractor shall supply standby employees from normal system staff ready to address an Emergency in an expeditious manner.
- (vi) Response Times and Emergencies:-

The Contractor commits itself to a high standard of effective response. To indicate commitment, the Contractor shall establish 'Standards of Service' which shall define the Contractor's response to any emergency with the intention of minimizing the possible impact of an emergency or failure on the output of the Facilities. These standards shall be agreed with the SMC and would typically include:

Situation	Response	Target Time
To any alarm or non-conformity during normal work time, or when the Facilities are being manned.	Any threat to public or personal health.	Immediate
	To attend to and assess the required action and the resources needed to effect remedial action. Effect first call repairs where possible	Immediate
	If the problem requires further resources, to have remedial work on site rectifying the problem	2 Hours
To any alarm Or non-conformity occurring outside normal Operating hours or when Facilities are unmanned	Any threat to public or personal health.	Immediate
	To attend to and assess the required action and the resources needed to effect remedial action.	1 Hours

	Effect first call repairs where possible	
	If the problem requires further resources, to have remedial work on site rectifying the problem	2 Hours

119. A dedicated problem solving team shall be appointed by the Contractor and this team shall have the responsibility of tracking problems through to a satisfactory outcome.

Major events that threaten public, employee or process safety or security shall be managed directly by an Contractor’s Representative, who shall have full authority to utilise whatever resources he considers fit to rectify any emergency situations. In performing these duties, this manager shall have full responsibility for ensuring proper and adequate communications with the SMC and other relevant bodies.

6.11.11Permits

120. Both the SMC and the Contractor will be responsible for obtaining various permits, authorizations and consents to enable them to carry out their duties. These will include, but not be limited to the following:

1. Permits to be obtained by SMC
 - a) Abstraction licences from various departments
 - b) Planning permissions
 - c) Public way-leaves that may be required from time to time
 - d) Discharge consents
 - e) Disposal licenses
 - f) Permissions to enter public and industrial properties

2. Permits to be obtained by the Contractor
 - a) Vehicle and plant licenses
 - b) Licenses to store
 - c) Health and Safety certificates
 - d) Fire certificate
 - e) Approval from Labour Inspector
 - f) Approval from District Health Officer
 - g) Insurance as appropriate
 - h) Licenses to carry out water operations

6.11.12 Integrated Management Information System (IMIS)

121. The Contractor shall establish, develop and maintain all Integrated Management Information System (IMIS) related to water Supply & distribution management (WDMS) & monitoring

system. The IMIS shall be integrated with GIS and have capabilities for facility management, inventory management, water billing management, complaint redressal system, citizen charter, operational job management and records and data management as well as all capabilities necessary for safe and efficient management, operation and maintenance of the Facilities.

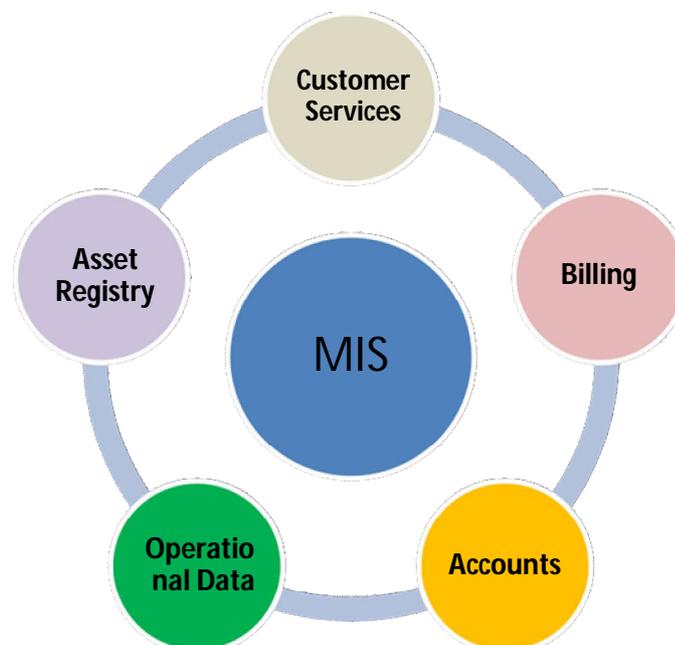
This can be improved through implementing proper customer management system (CMS) and integration of the same with web based database for successful operation of IMIS. Hence GIS based softwares with various customised applications module shall be implemented for SMC.

122. The key objectives are:

- i. **Capability:** The proposed MIS shall be capable of handling at least 60,000 customer records with ability to expand to 80,000 to record, monitor and report on all core business activities of the Contractor in connection with the services and obligations under this Contract.
- ii. **Modules:** The MIS shall have integrated modules for (1) record and monitoring the customer complaints, redressal (2) billing and collection system, (3) keep an accurate asset registry of the existing water supply infrastructure, (4) manage all accounts related to the water services and (5) record all operational data for monitoring efficacy and efficiency of the water services.

A pictorial representation of the MIS structure is shown below.

Figure: MIS – Conceptual Design



123. Scope of Work and services includes;

- A. **Customer Services** – shall be a database management system for recording customer complaints like no water, less water, low pressure, poor quality water, leakage, sewage

overspill, manhole covers lost, wrong bills, no bills etc and facilitating monitoring the complaint until its redressal by the Contractor and closing the loop when the complaint is resolved or upgrading the status of complaint to higher authorities etc;

- B. **Billing and Collection** – a comprehensive billing system capable of managing the existing customer records, cumulative metered consumption details, prevailing tariffs and process and generate a bill on volumetric tariff (for water supply) or on flat tariff basis (for sewerage) and shall be capable of recording collection of revenue and suitably accounting the same towards to current bill or arrears as per local accounting practice and generate triggers and reports for monitoring the efficiency of billing and collection including new connection management system etc.;
- C. **Accounts:** shall be a simple accounting system confirming to Applicable Laws and accounting standards for recording all transactions of expenditure accounts, revenue accounts and capital accounts including debt service if any.
- D. **Operational Data** – address all facets of the operation, maintenance and work order management, stores and inventory. Continuous logging of operational data like consumption of energy, chemicals and spares; volume of water input, water consumption, treated water quality, repairs and bursts etc;
- E. **Asset Registry** – shall be capable of recording all assets installed in the water supply scheme including the asset rehabilitation and replacements executed from time to time;
- F. Record of units operated; power consumption and power factor at WS pumping stations, SPS on daily basis and monthly basis etc
- G. Report Generation: Besides acting as a powerful standalone, report-creating application, reports shall provide a report-writing module that can add to applications. The report shall be generated in English. A multitude of ready-made reports for users to execute shall be incorporated. Users can modify and customize these reports or add new ones by using relevant reports. The Report Engine enables printing to a printer or a preview window or the files can be exported through e-mail, directly to disk. The report can be exported in any of several word processing, spreadsheet, database file, or data exchange formats including HTML.
- H. GIS Platform & Server:- A Latest Geographical Information System is proposed for SMC water supply distribution network with integrated server to deal with all geographical data/database. The systems should enhance corporate GIS, effectively dealing with the capturing, structuring, maintenance and management of network data and assets.

The proposed IMIS systems shall address the entire spectrum of network data management and perform following functions:

- network data acquisition,
- network data analysis,

- network data management,
- mapping, network data modeling,
- customer complaint identification
- and should support asset management functions

Proposed IMIS shall interface with water billing and customer information systems to achieve following;

- work order and maintenance management,
 - interfacing with demand management and
 - network analysis applications enabling functions such as consumption analysis, demand-forecasting, design standards evaluation and non-revenue water (UFW) analysis and operational audits.
- I. Citizen Charter:- Citizens' Charter represents the commitment of the Organisation towards standard, quality and time frame of service delivery, grievance redressal system which shall be developed and maintained by the Contractor. The proposed system shall have the online citizen charter service so that Citizens can also submit the service applications and track the same. As part of citizen charter SMC / Contractor will deliver the services within time as specified in the citizen charter. Citizens shall receive an SMS on their mobile/E-Mail with Service Application No, Date of Submission and Date of Delivery of Service. The system shall have the facility to link with existing Right to Service (RTS) web portal of SMC.

6.11.13 The Contractor's and the SMC Responsibilities.

124. Responsibilities are as following

- (a) The Contractor shall be establishing, keeping and maintaining the computerized water management system in consultation with the SMC while integrating all water supply components under the scope of this contract. The Contractor shall collect and keep up to date information on the facilities, both above and below ground.
- (b) All Facilities taken over by the Contractor shall be entered into the computerized water management system for integration to further set up IMIS and further monitoring.
- (c) The Contractor shall verify all information in accordance with procedures agreed with the SMC.
- (d) The Facility Register based on condition grade system shall be supported by operational information on compliance with Performance Standards, part wise.
- (e) The Contractor shall be responsible for operating the Facilities and the Conveyance System in the correct manner and for maintaining them in a professional manner.
- (f) The Contractor shall use the data to plan the Annual O&M Plan in consultation with the SMC.
- (h) SMC may use the information to gain an overall view of the Facility's value, performance and condition grades.

6.11.14 Facility Register

125. The Facility Register shall be a schedule (a computerized database, but also available on paper for ease of inspection) of the Conveyance System to be maintained under the responsibility of the Contractor as agreed with the SMC. The Facility Register shall be used to perform, or support, the Services carried out by the Contractor

The format of the Facility Register shall be designed in consultation with the SMC.

The SMC shall have the right to verify the Facility Register and Contractor's procedures for keeping it up to date.

6.11.15 Facility Numbering

126. Each above ground Facility shall be given a unique number within the Facility register. Numbering system shall be designed in consultation with the SMC. The number shall refer to the site and the type of Facility.

Records to be Produced and Maintained

The scope of the Facilities to be included are summarised in following Table

Scope of the Facilities

Type	Facilities
Management and General	Workshops Stocks Computers and associated equipment Land Vehicles Plant & machinery Service reservoir SCADA components Softwares

6.11.16 Operational Job Management

127. The Contractor shall establish and maintain a suitable job management system, in consultation with the SMC. This job management system shall provide detailed information on Facilities such as the type and make of motors, maintenance schedules etc.

6.11.17 Record Drawings

Data on Facilities shall be mentioned on Record Drawings.

128. The SMC shall ensure that the Contractor is given available Drawings of all Facilities. The Contractor shall accept the As-Built Drawings as per the scales and standards utilised by the Original Construction Contractor(s). The data can then be extracted and summarised on the IMIS. The Contractor shall establish and maintain up to date Record Drawings for both above ground and below ground Facilities.

129. The Contractor shall update the Record Drawings and Facility Register to include the Facilities taken over, together with any works that are subsequently undertaken. The Record Drawings shall be updated by the Contractor within 3 months of any modifications being carried out in the Facilities.

6.11.18 Accuracy of Data.

130. The Contractor shall assign 'Confidence Grades' to the data to validate its accuracy. The Contractor shall develop the definitions of these grades and how they are to be used in consultation with the SMC.

6.11.19 Inventory Management

131. The Contractor shall operationalise a computer based inventory management system to enable effective control of spares and consumables on the commencement of the Operations Period. This system shall use standard proprietary software and shall be linked by the Contractor to computerised water supply management software integrated with SCADA server. The Contractor shall provide monthly reports from this system to the SMC.

6.11.20 Customer Service Management System

132. Customer service encompasses a broad range of activities. The Customer Service Management System shall have an interface with the Customer's premises to ensure required performance are met (e.g. water pressure and flow) and proper response are given to customer enquiries. The following provisions shall be integrated into the customer service management system:

- i. Advance warning of planned supply shut off for repairs and renewals
- ii. Advice Customers during emergencies
- iii. Billing Customers
- iv. Dealing with billing queries
- v. Recording and Responding to Customer Complaints

6.11.21 Systems and Procedures for Creating and Updating Customer Database

133. Within one year from the contract commencement date, Contractor shall operationalise the Customer Database, with all customer contacts with respect to billing and provision of services can be controlled. Information held shall include the Customer name, reference number, mailing address, telephone number and account history information.

6.11.22 Water Quality

134. The SMC shall supply treated water that complies with the CPHEEO norms, presented in Schedules of Section 8 [Particular Conditions of Contract].

135. The Contractor shall collect all water samples relative to the system within the selected DMA's required by Applicable Law for physical-chemical and bacteriological analysis at SMC laboratory and provide and submit in a timely manner all such test results to the Engineer.

136. The Contractor shall propose its water sampling and analysis program as part of the Operations and Maintenance Plan. The program shall allow adequate monitoring of water quality and shall meet the minimum sampling and analysis frequencies as specified in CPHEEO manual or as per frequency interval below;

location	Physical & chemical parameters	bacteriological parameters	Heavy metals & pesticides	residual chlorine
at all Bulk Water supply points	monthly	weekly	annually	online
at all reservoirs	not applicable	weekly	-	online

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at service delivery points, randomly taken from Service Area, two per DMA.	monthly	daily	-	online
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137. During the Contract Period, i.e. upon completion and commissioning of selected DMA's for continuous (24 x7) pressurised water supply, SMC will start supplying Bulk Water to specific Supply Points (ESR inlet) in the water supply system. If the quality of the supplied Bulk Water is not as per the CPHEEO norms, the Contractor shall immediately report to SMC and the Engineer. The Contractor shall in this regard take two spot samples of the water supplied to it by SMC. These samples are to be taken every day till such date that the Engineer issues a notice to discontinue the sampling. One of the samples should be analyzed on site for chlorine residual. The other sample, taken in accordance with the sterile requirements for bacterial analysis, shall be analyzed at a laboratory of SMC or any other laboratory approved by SMC for the test parameters as CPHEEO norms. A representative of SMC and the Engineer shall be present, if they wish to, at the sampling and the sample for bacterial analysis should be divided in two for separate analysis at different approved laboratories, one portion for the Contractor and the other for SMC.
138. Based on the results of the analyses, SMC may advise the Engineer to instruct the Contractor to temporarily discontinue the supply of Bulk Water.
139. The Contractor shall assist and advise the SMC in all matters related to water and quality including, but not limited to, providing advice and assistance during the SMC's discussions with the regulators and public health officials on water quality matters.

6.11.23 Customer Service Management System

140. Customer service encompasses a broad range of activities. The Customer Service Management System shall include redressal of complaints reported by SMC and required performance parameters are met (e.g. water pressure and flow, NRW, SCADA) and proper response are given to customer enquiries. The following provisions shall be integrated into the customer service management system:
- i) At least 24 hours advance warning of planned supply shut off for repairs and renewals
 - ii) Advice Customers during emergencies
 - iii) Recording and Responding to Customer Complaints received from SMC.

- (iv) The strategy prepared by the Contractor shall include, but not be limited to, a comprehensive strategy to establish a Customer Service Centre,
- (vi) The SMC's personnel at front office at customer service centre shall receive and handle all customer queries and complaints, including, but not limited to, queries and complaints related to
 - water bills;
 - Customer Information System : Rates and Fees Management
 - Billing Management
 - Customer Information System: Payment Processing and Cash Receipt
 - Customer Information System : Credit and Collection Management
 - Consumer / Customer Management
 - Customer Information System : Account Management
 - Customer Information System : Premise Management
 - Customer Information System : Customer Contact Management
 - Customer Information System : Customer Grievance Redressal
 - Customer Information System : Services
 - Integration with SCADA/GIS Software
 - Meter Data Management
 - malfunctioning or inaccurate meters;
 - meter readings;
 - water quality;
 - water pressure;
 - leakage and damaged pipes;
 - change in meter location;
 - changes in customer names; .
 - cancellation of connection by the customer
 - System Interface

6.11.24 Establishment of Customer Service Centers

141. The Contractor shall develop and set up Customer Service Centres (CSC) at SMC zonal offices that will be used to manage consumers related services. The number of CSC's will increase with the number of DMAs completed and number of service connections provided. Ultimately there shall at least be one CSC for every 5000 to 7000 connections to facilitate receiving and resolving consumer requests received through SMC in the areas of new connections, service deficiencies, etc. Space of establishing the CSC shall be provided by SMC. Contractors scope shall be responsible for development of customer service centre with all furnishing etc. complete and deployment of staff for operating the same shall be responsibility of SMC. Contractors shall provide the required O & M Staff to perform the duties and responsibilities specified under this contract. Contractors shall be responsible to provide manpower and resources in attending, resolving and closing the consumer complaints received and forwarded by SMC to Contractor.
- 141.1. The CSCs shall function between 8am to 8pm during all working days and between 8am to 1pm during public holidays including Sundays.
- 141.2. The CSC shall be equipped hardware and software to facilitate continuous record of SMCs forwarded complaints, monitoring the resolution, and reporting completion of necessary actions and tasks.
- 141.3. Cost of operation of the CSC shall be included in the Contractor's Operation fees.

142. The first CSC shall be operational from the Operation Service Commencement Date., adequate space will be provided by the Employer.

143. The design of the CSCs will be approved by the Employer.

6.11.25 Consumer Billing and Revenue Collection

144. The revenue collection system shall support Employer standard payment methods at the minimum and would be designed to incorporate additions. In addition it will cover the following:

- i. Preparation and issue of a debtor statement
- ii. Timetable for the issue of reminders and recovery notices shall be established and issued to consumers at the regular intervals based on the Employer's inputs.
- iii. Notice to the Employer of continued debtor for the Employer's action (like disconnection etc.)
- iv. Additional charges such as disconnection/reconnection fees, damage cost and late payment penalties shall be billed.

The Contractor shall:

- i. Collect all amounts due to the Employer as Revenues related to the Services.
 - through the billing offices;
 - through banks, electronic transfer;
 - by other means as may be agreed to by the Employer;
- ii. identify and record all outstanding accounts and take all necessary measures to collect outstanding accounts;
- iii. submit to the Employer a summary and analysis of unpaid accounts [every month];
- iv. Manage all aspects of customer services with the Customers.

145. The activity of meter reading and proper maintenance and use thereof shall vest with the Contractor. This shall be used for issuing water bills to the consumers by the Contractor. Such reading are subject to random spot checking by the SMC / Contractor, for verification or as the case may be.

With reference to 6.23.36 billing software requirement /functions/obligations/ maintenance of all services, hardware, software, data generation, training to SMC staff for operation, use and maintenance of software and hardware, data collection, and data protection including all data connection charges , website creation & maintenance , mobile app creation & maintenance with up gradation charges and other all inclusive charges to better running for the system required for the contract period .

6.11.26 Meter Replacements / Refurbishment / Calibration by Contractor

146. Scope includes following

- i) Failed equipments / instruments / meters shall be replaced by Contractor under defect liability period.
- ii) Contractor shall be responsible for calibration testing of Flow meters after every 2 years from NABL accredited labs or CWPRS or as specified by Engineer-in-charge
- iii) Complaints related to faulty water meters or inaccurate meter shall be notified to Contractor by SMC. Contractor shall be responsible to un-install such meters and provide it to meters testing bench facility of SMC as per the instruction of Engineer-in-charge.

6.11.27 Customer Service Help Desk

147. A 24 hour customer service desk shall be established by the Contractor and managed by SMC. The customer service desk will be integrated with the computerised water supply management software. All enquiries and customer complaints shall be recorded into the system along with resolution mechanism, time of resolution, action taken and feedback procedures. Space for establishing the office shall be provided by SMC for created DMA's under the scope of this contract within project area.

6.11.28 Environmental Management Plan

148. It shall be as per following table

Environmental Management Plan
Environmental Management Plan for Selected Area of SMC Project

Project Activity	Environmental Impacts	Mitigation Measures	Primary Responsibility
Bursts	Flooding and leakage of water in the influence Area during implementation	Appropriate shut off or bypass and leak control arrangements shall be ensured	Contractor
Replacing the valves	Temporary disruption of water supply to the consumer	Alternative supply arrangements such as supply through tankers shall be provided.	Contractor
Leak repair and replacement of mains	Disruption of water supply to the consumers during execution	-Alternative supply arrangements such as supply through tankers shall be provided.	Contractor
New pipelines or extensions	Disruption of traffic during execution	-Appropriate traffic diversion plans shall be prepared and implemented during construction	Contractor
Working in roads or restrictive places	Safety hazards to labour	-Adequate safety precautions such as helmets, safety shoes, gloves, etc. shall be provided to the labours	Contractor
Repair of pipelines	Disturbance to other utilities such as telephone cables and sewer lines etc.	-Scheduling activities in consultation with the other utility agencies and ensuring minimum disturbance to the utilities	Contractor
Construction or installation of new structures or equipments	Increased noise levels during construction	-Use of low noise generating equipment for all the activities, provision of personal protective equipment, ear muffs, etc. for the construction labour and avoiding construction activities during nights	Contractor
Replacement of service connection	Temporary disruption of water supply	Alternative supply arrangements such as supply through tankers shall be Provided.	Contractor
Provision of appropriate water meters & taps	Temporary disruption of water supply	Alternative supply arrangements such as supply through tankers shall be Provided.	Contractor

6.12Key -Personal requirements (Mandatory Provisions)

149. In general, staffing levels and qualifications are to be decided by the Contractor apart from minimum and mandatory personnel requirements specified in in this section. However, in order to make bids comparable, the following minimum number of experienced key-personnel for has to be available for entire project period for the scope of services under this assignment. The number of man-months for each position is to be understood as the absolute minimum requirement. Evidence of the physical presence of these listed staff members have to be provided in the quarterly Progress Reports. Non availability of key persons shall result into imposition of penalty as per contract agreement.
150. It has to be understood that it might be necessary to bring significantly more specialists to the Site in order to achieve the objectives of the Contract. All costs of such additional personnel have to be included in the Contract Price.
151. Team Leader cum O & M specialist- having a minimum of 84 man-months of a person meeting the following minimum experience criteria shall be required during entire project duration:
- (a) 15 years experience with water distribution networks
 - (b) Technical University degree, for example Water and Sanitary Engineering, Civil Engineering or Mechanical Engineering
 - (c) Project Management & operation Experience
 - (d) 10 years of experience
 - (e) Experience of 1 project with 24 x 7 water supply operations is mandatory

6.13Consumer Awareness requirements

152. Contractor shall undertake at his own cost, all measures which shall promote the benefits of project and create public awareness about 24x 7 water supplies. Contractor shall also appoint a Public Relation team for such programmes. Contractor shall ensure cordial communication between Contractor, SMC, public representatives, NGOs, consumer forum, Media, other Government Authorities etc.
153. The public campaign for the project & water conservation while conversing DMA's in to 24x7 Water Supply shall be responsibility of Contractor
154. Contractor shall conduct internal water audit or leak test for consumers those having history of high consumption. Contractor shall maintain the list of such consumers and identify them. Contractor shall identify all visible leakages while closing all known taps during supply hrs for period of 1 or 2 hrs. at consumer premises. Contractors shall

submit report to Engineer after certification of same from consumer. Consumer shall be solely responsible for rectification of leakages within the premises of customer beyond consumer meter.

155. Contractor shall provide the checklist of probable leak points to consumers of DMA's as part of awareness programme.
156. Digging within the consumer premises shall be completed in a day time. Contractor shall provide advance notice & time table for his work within the premises / colony / societies.
157. Residents Welfare Association (RWA) / notified societies shall be informed about time table for digging & restoration work within the colony. The failure of Contractor to maintain the time table will attract penalty as decided by the Engineer. The penalty shall not exceed Rs. 5000 per day per RWA colony / Society.

6.14 Training Requirements

158. Contractor will provide on the job training during operation services to the staff of Employer. Such trainings will be commenced 30 days prior to commissioning the first DMA. Also that in the last year of O&M period and before 180days from the date of handing over the assets back to the Employer, the Contractor shall organize detailed training to the identified staff in technical, commercial and financial aspects of water services provision to enable the Employer to build sufficient capacity and skills to manage the water services after the Contract Completion Date. Commencing from 120days before the Contract Completion Date, the staff either from Employer or from a future Contractor will overlap and co-manage the operations to ensure continuity in service delivery.

6.15 Maintaining Performance Standards

159. The performance standards for the Design construction works during the SIP implementation shall consist of i) quality of work as per specifications and ii) The time line for completion as per the milestones defined in under this contract. The liquidated damages will be levied for non achievement of these milestones in time, as per the provisions in Section 8: Particular Conditions of Contract.
160. The measurement of the quality of work will be as per the tests laid down in the specifications of various items while the measurement of the achievement of milestones is based on the defined works and defined dates under this contract.
161. All works / services and materials, instrumentation to be provided/ required under this contract shall comply to 6.21 & 6.22: Standard Technical Specifications and 6.23: Detailed Technical Specifications specified under this contract. Contractor shall be responsible for replacement of equipment's under defect liability period during the contract period.

162. Payment of operation services will be in accordance to the procedures in Schedule –5 Contractor Payments attached to Section 8: Particular Conditions of Contract. Operation service contract will be governed by Performance Standards provided in Schedule 7– Performance Targets and Measurement attached to Section 8: Particular Conditions of Contract.

6.16 Customer Services Requirements

163. The Contractor shall start providing basic Customer services through Employer from the Operation Service Commencement Date. Contractor shall act as back office support to SMC and shall provide services to consumers on behalf of SMC. Contractor shall not exclusively interact with consumer or directly give any services to consumers. The Customer Service Management System shall have an interface with the Customer’s premises to ensure required performance are met (e.g. water pressure and flow, NRW) and proper response are given to customer enquiries. The following provisions shall be integrated into the customer service management system:
- Advance warning of planned supply shut off for repairs and renewals
 - Advice Consumers during emergencies
 - Meter reading queries of Consumers
 - Recording and Responding to Customer Complaints through SMC only.
164. The Contractor shall receive and handle all customer queries and complaints forwarded by SMC, including, but not limited to, queries and complaints related to:
- i. Water meter queries;
 - ii. Malfunctioning or inaccurate meters;
 - iii. meter readings;
 - iv. Water Billing
 - v. Water quality;
 - vi. Water pressure / availability of water;
 - vii. Leakage and damaged pipes;
 - viii. change in meter location;
 - ix. changes in customer names;
 - x. cancellation of connection by the customer

6.16.1 Customer Service Centers

165. The Contractor shall develop and set up Customer Service Centres (CSC) that will be used to manage consumers related services. The number of CSC’s will increase with the number of DMAs completed and number of service connections provided. Ultimately there shall at least be one CSC for every 15000 to 20,000 connections to facilitate receiving and resolving consumer requests received through SMC in the areas of new connections, service deficiencies, etc. Contractors scope shall be limited to development of customer service centre and deployment of staff for operating the

same shall be responsibility of SMC. Contractors shall provide the required O & M Staff to perform the duties and responsibilities specified under this contract. Contractors shall be responsible to provide manpower and resources in attending, resolving and closing the consumer complaints received and forwarded by SMC to Contractor.

165.1. The CSCs shall function between 8am to 8pm during all working days and between 8am to 1pm during public holidays including Sundays.

165.2. The CSC shall be equipped hardware and software to facilitate continuous record of SMCs forwarded complaints, monitoring the resolution, and reporting completion of necessary actions and tasks.

165.3. Cost of operation of the CSC shall be included in the Contractor's Operation fees.

166. The first CSC shall be operational from the Operation Service Commencement Date., adequate space will be provided by the Employer.

167. The design of the CSCs will be approved by the Employer.

6.16 SCADA System, Monitoring and Control System Design Requirements

6.17.1 Proposed System objective

168. Water distribution network management of DMA's & monitoring is possible using the subsystem referred as water distribution management system WDMS shall be implemented for the SMC water supply system covered under project area for 14625 connections (DMA wise) by providing a central monitoring station located at SMC office or any other location specified by SMC within the project area. The intention is to measure, record and monitor the parameters like flow, level, pressure, residual chlorine of Water distribution network at specific locations like distribution trunk mains, DMA Inlet and outlets points, ESR/UGR etc. along with valve actuator control facility for which necessary input & output signals, sensors and transmitters etc. Shall be provided along with wireless Telemetry system / GPRS system to communicate the data/information with Central Monitoring System. The proposed system shall have real time data retrieving, monitoring, recording and web enabled facility through application software.

169. All the relevant data, graphs, trends shall be made available online to SMC executives and field personnel using cloud services and apps developed for Android and IOS devices. Relevant Data to be made available to the citizen's at large using website and apps. Dashboards to be developed along with minimum service standard for monitoring and information and variance, if any these parameters shall be notified to SMC personnel automatically by SMS, email alerts.

170. The proposed system is broadly divided into following sub-works;
- i) Instrumentation for parameters like Pressure, Flow, Level, Residual Chlorine
 - ii) Control Elements like Electrical Actuators
 - iii) Data loggers at key locations or remote locations
 - iv) New PLC Based control Panels
 - v) Integration with existing PLC based Panels
 - vi) New SCADA Server Software
 - vii) Integration with existing SCADA
 - viii) Report Generation and Alert Notifications
 - ix) User Interface like Dashboards, Cloud Application, Apps
171. The scope of the works includes design, manufacture, testing at works (FAT), supply at site, storage at site, installation / erection, testing, commissioning, programming, integrating with existing systems, providing, field testing (SAT) and development of integrated SCADA server and Monitoring system consisting of Central SCADA with cloud server facility, PLCs at various locations with HMIs, flow meters, pressure transmitters, chlorine analysers, data loggers and automation of valves through actuator control within project area for water supply distribution network of SMC project area.
172. The locations covered under the scope of proposed system for Integration and monitoring at Central Server locations are as following
- At feeder mains:
 - Flow at delivery pipe
 - At storage reservoirs (tentative 23 nos.) (both ground level reservoirs and overhead tanks):
 - Flow, pressure, residual chlorine in incoming mains;
 - Flow, Pressure, residual chlorine in outgoing mains;
 - Water level.
 - Residual Chlorine level
 - At DMAs (Tentative 26 Nos.):
 - Flow at the inlet point(s) (i.e. IMPORT) of each DMA;
 - Flow at the Outlet point(s) (i.e. EXPORT) of each DMA;
 - Flow meters within DMA
 - Pressure at 5 Critical Measuring Points in each DMA.
 - At remote valve locations
 - Valve actuators within all DMA's
 - Data loggers at remote locations
 - At Central Server Monitoring System

Note:- 1. Pumping station or BPS locations SCADA is not covered in present scope of works

2. Above locations may include many instrumentations, PLC's etc. which are being operated under separate SCADA service contract. Contractor shall be responsible to interface & integrate above instruments with the Proposed SCADA system for further monitoring and proper functioning of the system. Contractor is expected to visit the locations covered in the scope of work shall do his own assessment before tendering.

6.17.2 Functional requirements of Instrumentation interfacing and Integration

173. All existing and new instrumentation like flow meter, pressure sensor, residual chlorine, etc. (installed at various ESR locations) or existing PLC panels will be integrated and interfaced with proposed SCADA system through GPRS communication. These instruments can be monitored/operated either from the SCADA in the central control room or from local control panel.
174. Instrumentation Interfacing and integration includes commissioning, required development & programming for PLC or SCADA software as per the requirement of SMC with actuator control facility and level, flow, pressure, residual chlorine for integration with central monitoring system.

6.17.3 Functional Requirements of Monitoring System

175. Contractor shall responsible to fulfil following minimum functional requirements of proposed monitoring system
1. The proposed system includes the central monitoring station, the local PLC panels for the valve actuator operation and/or data acquisition from existing/new instrumentation.
 2. To provide continuous real time data monitoring of water inventory & inflows/ outflow at each ESR & DMA.
 3. To create mathematical model for each ESR/DMA & use the same along with past data to derive demand curve for each ESR/DMA.
 4. To provide levels data of each ESR / DMA continuously for 24 Hrs.
 5. Daily flow, Pressure data for all ESR/DMA with flow meter location by graphics display.
 6. Residual chlorine at the outlet of ESR
 7. A graphical trending diagram of water balance (Pie Chart) of all ESR /DMA's within project area.
 8. Water Audit charts & LPCD for each zone/DMA-Bar chart
 9. To provide alerts, in case of emergency, to the appropriate authorities to quickly initiate actions for disaster management.
 10. Sending alarm SMS messages to SMC engineers and authorities to connect them with the system on 24x7 basis.
 11. To generate, store historical data and print valuable data regarding water distribution network in, easy to analyze, digital form which can be used for distribution chain optimization.
 12. Generation of bulk water audit report or any other as specified by SMC (hourly/daily basis)
 13. Water management system shall be web enabled with application software including all internet facility.

14. All the relevant data to be linked online on the cloud, link to which should then be made available on the SMC website.
15. The relevant data on the cloud server shall also be accessible to users and citizens using Android and IOS apps.
176. The functions and features specified here with are the minimum acceptable requirements for the successful implementation of proposed Monitoring System. The provided system shall equal or exceed each requirement as specified by Engineer or mentioned elsewhere in the contract. Contractor shall refer to Section 6.23 ; Detailed Technical Specifications of the instrumentation and specifications mentioned for proposed SCADA system

6.17.4 Functional Requirements of SCADA/PLC Operation and control

Local: PLC Control

177. All the logic for automatic operation of the valves using data from local instrumentation shall be programmed in the local PLC based panel and shall work irrespective of the connectivity with the central monitoring station. The status of each actuator and instrumentation shall be communicated online to the SCADA using GPRS. If there is a break in the GPRS/Broadband connectivity at the ESR side or SCADA side the working of the system should not get hampered in any way.

Local Modes of operation

Auto Control

It shall be executed as per the logic in the local PLC based on timings and or pressure, level and flow, residual chlorine settings

Manual Control

Manual control shall be executed using control elements like push buttons and selector switched to be provided on the control panel.

Remote: SCADA Control

178. The SCADA software shall have the facility to remotely carry out manual operation and control of Valve Actuators for changing/ controlling the delivery pressure at the inlet and outlet of ESR.
The ESR / GSR inlet / outlet Valve actuator operation will be integrated with SCADA System and timing / level based automatic filling system can be developed as per the requirements of SMC. Valve Actuator operations within distribution system of DMA's shall also be integrated with SCADA system.

6.17.5 Proposed System Architecture

179. The system shall be implemented using following Four levels of information system.
First level shall consist of primary sensors such as pressure, flow, level sensors, residual chlorine etc. Field instruments which are located at various local stations

within DMA's and ESRs/GSR will acquire each ESR & DMA information and will communicate the information to the next level of information processing system using standard 4-20 mA current signal.

180. Second level shall consist of Analog / Discrete Input Module which will communicate with the PLC located at local stations / remote locations within the DMA.
181. Third level shall consist of SCADA monitoring software running on PC located at central office within project area. The system will communicate with all the existing ESRs/ UGRs & MBRs and vice versa. During each communication Telemetry system will get status of different parameters from the above Input modules. The telemetry/ GPRS system will transfer information with main central SCADA system server. Whenever required it should be possible to start communication with specific above Input modules. The whole system can be monitored and controlled from single location. The operator can give the instructions to the local site through voice or SMS for taking corrective action from other end. In addition to that any alarming condition at local station is generated, is also displayed / informed immediately at Central station without through GPRS/telemetry system.
182. Fourth level shall consist of WDM software system which will run in typical client-server mode. Data acquired from ESR / GSR / Valve locations using level one hardware as well as data acquired by operator data entry shall be used as centralized water distribution system information data. MSSQL database or any other equivalent or higher technology data base server shall be used for information storage. It will consist of one server PC & one client PC, which includes PC used by GPRS. It is under the scope of this contract to provide all required latest software, configurations all other peripherals and licenses (unlimited) & the same shall be registered in the name of SMC.

Important Note:-

- 1) For detailed specification of the instrumentation refer Section 6.23: Detailed Technical specifications for the instrumentation.
- 2) The functions and features specified herewith are the minimum acceptable requirements for the instrumentation & proposed Monitoring System. The provided system shall equal or exceed each requirement. Contractor shall visit to all locations covered in scope of work before and do his own assessment before tendering.
- 3) The extent of the instrumentation is indicated but not limited to that specified instruments and in the subsequent clauses mentioned elsewhere in the contract. Additional instrumentation as appropriate to the requirements of specification shall be included. Consent letter from SMC is necessary before the actual supply of instruments.

6.17.6 PLC System

183. PLC shall be provided as a Hot-Standby configuration to perform combinational and sequential logic functions, status monitoring and reporting functions with counter and timer facilities.

PLC Panel interrogation power supply should be fully redundant.

PLC shall comprise of necessary processors, input/output (I/O) modules, communication interface modules and man-machine interface (MMI) or HMI required to perform the desired functions with.

Adequate PLC handling capacity is need to be envisaged by Contractor considering the need to support Communication ports like serial RS 485, RS 232, Ethernet port and GSM cards and Ethernet connectivity, must be able to reprogram the external device connected to it and also support future add-ons cards, the memory (USB) and speed requirement.

PLC should be capable of the following

- Integrated Colour Graphic display with Touch/viewer screen and all specified memory units Built-in.
- Complete automation of valve operations.
- Accurate recording of all events
- Effective alarm management for the personnel concerned
- Complete remote surveillance.

The data generated at the PLC shall be transmitted on continuous basis to the Master PLC. The data from the PLC shall be transmitted over wireless network using GPRS communication technology from the ESR / GSR locations within DMA.

184. Each PLC shall have memory protected built in historical archiving/data logging of system alarms & events and process variables. Data logger shall be able to log data based on time or an event PLC shall have enough memory allocated to allow 200,000 time and data stamped discrete and /or analog values to be archived. The historical archive shall allow the oldest data to roll off the system as memory is used keeping the 200,000 most current data points available. Process point time stamping frequency shall be selectable within the configuration software. It shall be possible for the archived data to be exported in CSV format allowing use with standard spreadsheet and data software applications

PLC shall have the following attributes as a Hot-Standby configuration.

- carry out sequential logic implementation for operations of plant;
- carry out computation and interfacing for data acquisition, data storage and retrieval;
- it shall accept downloaded program from a programmer;
- it shall have different functional modules to perform the desired functions;

- it shall scan the inputs in time cycles and update the status of its outputs.

Every PLC at ESR / GSR to be connected via an intelligent switch to GPRS/ wireless telemetry (from any service provider available locally) to be connected to the communication Modem.

The wireless communication shall enable seamless data transfer from each PLC to a centralized reception at the Central Control Room, wherein the data are stored in a suitable high-density storage data server.

The communication technology services require a service provider who shall set up and maintain necessary transmission devices at each location within DMA. The transmission set up at each station shall include necessary equipments like firewall, routers, etc. for network security. The data transmission over the entire wireless network shall be secured and same shall be envisaged by setting up required equipments at each transmission/reception points.

The communication network requires statutory requirements like licensing, structural design, lightning arrestor, aviation lamp etc. shall be considered. The communication network should be sufficient enough to handle the required traffic.

6.17.7 SCADA System

185. The SCADA shall be a fully dual redundant server integrated microprocessor based control and data acquisition system which will monitor, control, display, record and trend all assigned plant and water supply network inputs and outputs. The main process monitoring and control shall be by means of Visual Display Unit (min. 50 inch. LED monitor) based process operator workstations that shall be located in the central control room.
186. SCADA/HMI system shall be designed and implemented such that the failure of a central processor or HMI console does not inhibit continuous automatic control of the system. In the event of such a failure, historical data shall be recoverable to a condition where a worst-case maximum of 15 minutes of historical data is lost.

Integration with the existing System

PLC Panel Integration

187. The existing PLC based panels have to be used to import data of the existing instrumentation into the new PLC based panel. This can be done by installing additional hardware like communication modules with required wiring modification in the existing panel and collect data over a standard protocol like MODBUS. All the additional hardware/software/interfacing devices/cabling/licenses required to achieve this connectivity shall be in the scope of the contractor.

188. The contractor shall ensure that while carrying out the integration part the existing system should not get damaged or hampered in any way.

189. All the logic shall be in the new PLC based panel and the existing system shall be used only to retrieve data of the existing sensors/instrumentation.

SCADA Integration

190. The new SCADA software shall be required to connect to the existing SCADA system to retrieve relevant data of the existing system. The required hardware/software/interfacing devices/cabling/licenses required for establishing a seamless channel for communication shall be provided by Contractor.

191. Any requirement related to the above including database integration and utilities/query functions to be developed for the same shall be in the scope of the Contractor.

End User Interface

192. There shall be three levels of End user Interface

i) Central Monitoring Station

The Central Monitoring Station shall have the following main components

1. Screens to display the layout schematic of the system as per actual configuration on the field
2. Online and historical trends plotted with respect to benchmark graphs. The benchmarks are to be arrived at using practical data over a reasonable period of time
3. Settings screen for important parameters like timing, pressure and flow, residual chlorine
4. User login and authentication screens
5. Dashboards of important KPIs as specified by the Engineer in Charge
6. Bar graphs as per Engineer-in-charge to be plotted against Benchmark levels

ii) Cloud based web Pages

1. Important Data to be uploaded to the cloud using state of the art protocols like IOT drivers etc. and viewed using Http protocol. Any software/hardware/drivers required for the same shall be provided by Contractor
2. This shall be only in view mode and no changes shall be possible in this method

3. It should be possible to add a link to these web pages on the SMC website. The link to be added by the customer using the services of the service provider/agency maintaining the website of SMC
- iii) Apps
1. Apps for IOS and android devices to be developed by the contractor
 2. Apps to be downloadable by users/citizens if required
 3. Screens of the apps to be developed as per Engineer in Charge
 4. The system shall also have online payment gateway facility for online payment of water bills using Web API / Web Service, and IVR.

6.17.8 Instruments and general requirements

193. Under the Works component of the Contract, EMF Flow meters, bulk flow and pressure measurement devices, level measurement devices, chlorine analysers, data loggers etc. Shall be installed to monitor water distribution in addition, temporary pressure loggers shall be installed at 30 locations in the existing system. These pressure loggers can subsequently be used as permanent pressure loggers in the DMAs.
194. Most DMAs will have one single inlet point. In case of multiple inlet points, each point shall have a flow meter.
195. The Contractor shall design and install a Supervisory Control and Data Acquisition (SCADA) system that shall meet the following objectives:
- 195.1. Data acquisition at all bulk flow meters installed storage reservoirs and DMAs, at all water level indicators installed at storage reservoirs and at all pressure loggers installed in all completed DMAs.
 - 195.2. Data acquisition at pressure loggers, temporarily installed in the existing distribution system, is recommended.
 - 195.3. Data acquisition at customer service connections shall not be included
 - 195.4. A telemetry / GPRS system to send the acquiring data to a centrally located supervisory system, including adequate security systems.
 - 195.5. A supervisory (computer) system with adequate back-up facilities to gather the acquiring data, and to feed a Historian (Database Management System).
 - 195.6. The SCADA system shall be expandable to include the bulk flow meters to be installed in future, if any.
 - 195.7. SCADA system shall be web enabled with application software so that other users can view, print and monitor.
 - 195.8. The SCADA system shall allow for upgrading to include remote control in the future.

196. The Contractor shall provide computer hardware and develop software for SCADA data analysis and reporting that shall meet the following objectives:
 - 196.1. Daily and monthly water balance for each water production, transmission and storage sub-system. Each sub-system typically consists of one storage reservoir
 - 196.2. Hourly and daily water balance of each storage reservoir, presenting inflow, water level fluctuations and outflow at each reservoir.
 - 196.3. Daily and monthly water delivery at each DMA, at clusters of DMAs served from a single reservoir, and total water delivery to all selected DMAs.
 - 196.4. Daily and monthly water delivery to the existing distribution network.
 - 196.5. Hourly pressure logs at Critical Measuring Points in the DMAs.
 - 196.6. Water Balance of DMA with water audit report of each DMA
 - 196.7. Graphic presentation of all the above.
197. Further requirements and detailed technical specifications are provided in Vol-2of this document. The Contractor shall submit its proposed SCADA system as part of its Operations and Maintenance Plan for approval by the Engineer.
198. The SCADA system shall be implemented step-wise following the completion of the relevant components of the Works. The SCADA system shall be fully operational at the completion of the entire Works.
199. The Contractor shall train SMC staff in operating the SCADA system and related software.

6.17.9 GPRS enabled data loggers for remote locations

200. The Data logger shall be a dual channel device capable of taking inputs for pressure as well as flow. It shall be a battery based instrument with a minimum battery life of 3 years with data transfer frequency of every 30 mins. The minimum frequency of data logging shall be atleast 5 mins. To achieve a data transfer frequency of every 30 mins, an external battery pack of suitable size shall be used with the data logger. All the logged data should be transferred over GPRS using the data sim card to be provided by the contractor. It shall include all other charges to be paid to the manufacturer like cloud subscription charges, data usage charges to be paid to the service provider etc to ensure the working of the data loggers.
201. Channel1 – Pressure :The pressure input shall be a direct input from a tapping point on the pipe line. It shall not need any additional pressure transducer to be mounted on the pipeline. The transducer shall be built in the logger and only a capillary to be connected form the tapping point to the data logger.

202. Channel 2 4-20mA/pulse input: The second channel may be used to connect to a flow/level sensor with 4-20mA output. This can be used as instantaneous flow rate/ level of water. Alternatively it may be used to connect to the pulse output of a flow meter to totalize the flow of water.

6.17.10 Instrumentation System

203. Instrumentation system shall fulfill to following requirements
- a. Electronic instruments shall utilize solid state electronic components, integrated circuits, microprocessors, etc., and shall be of proven design.
 - b. all instruments shall be suitable for continuous operation;
 - c. all digital outputs shall be volt free;
 - d. all instrumentation systems for use out of doors shall be protected to IP 65 for sensors and transmitters, while enclosures under submersible conditions shall be protected to IP68;
 - e. all analogue displays shall be of the digital type with no moving parts utilizing back lit liquid crystal diode technology;
 - f. For transmitting instruments, output signal shall be 4-20 mA DC linear having two wire system.
 - g. Unless otherwise stated, overall accuracy of all measurement systems shall be $\pm 0.5\%$ of measured value, and repeatability shall be $\pm 0.5\%$.
 - h. After a power failure, when power supply resumes, the instruments and associated equipment shall start working automatically.
 - i. The instruments shall be designed to permit maximum interchangeability of parts and ease of access during inspection and maintenance.
 - j. The instruments shall be designed to work at extremes of the ambient conditions of temperature, humidity, and chlorine contamination that may prevail. The instruments shall be given enough protection against corrosion.
 - k. Lockable enclosure shall be provided for the field mounted instruments wherever required.
 - l. All field instruments, and cabinets / panel-mounted instruments shall have tag plates / name plates permanently attached to them.
 - m. The performance of all instruments shall be unaffected for the $\pm 10\%$ variation in power supply voltage and $\pm 5\%$ variation in frequency simultaneously.
 - n. All wetted parts of sensors shall be made out of non-corrosive material capable of working with chlorine content of 5 ppm.
 - o. For all instruments (transmitting analogue signals) installed in the field, surge protection devices (SPDs) shall be provided at both ends of the connecting cable for the protection against static discharges / lightning and electromagnetic interference.
 - p. Pressure transmitters shall be provided with two valve manifold and a test port, so that in situ calibration can be carried out.

- q. Two wire transmitters shall be provided with on-line test terminals.
- r. The ranges of all instruments shall be suitable for the application in the process.
- s. Instruments of similar type shall be of same make for appropriate inventory of spares, ease of maintenance and training.
- t. The Indian agents of imported equipment shall have establishment to provide after sales maintenance facilities.

6.18 Reporting Requirements

- 204. The Contractor shall prepare and submit for approval, plans and periodic reports on those plans, progress of Works and Services, performance standards etc., including exceptional reports on emergencies if any. The reporting requirements shall be as instructed by Engineer time to time. The Contractor shall as part of the Baseline System Improvement / Construction Plan, the Operations and Maintenance Plan and the Training Plan, develop the required formats for the periodic reports and also identify any critical reporting requirements in order to enable timely decision making by the Employer.
- 205. The Contractor shall prepare and submit for approval a System Improvement plan, Construction Plan defining and scheduling all Improvement Works. The Construction Plan shall be finalized and approved within 6 months from the Commencement Date. The Construction Plan shall include:
 - 205.1. The results of the review and verification of the proposed water supply system of service area and transmission mains works & establishment works for DMAs covered under scope of work;
 - 205.2. Condition Assessment, Survey & Investigation Report, Consumer Survey report, Hydraulic Modeling (all DMA's), frozen boundary map and proposed SCADA & web enabled system facility
 - 205.3. The results of the review and verification of the designs for DPR prepared by the Employer;
 - 205.4. The results of the review and verification of DMA boundaries including priority DMAs;
 - 205.5. Proposed construction schedule along with resource planning & SCADA Report/ Architecture;
 - 205.5.1. Cash flow requirements;
 - 205.5.2. Format for periodic construction reporting;
- 206. The Contractor shall prepare and submit for approval an Operations and Maintenance Plan, defining all operational services to be provided under the Contract. The Operations and Maintenance Plan shall be finalized and approved within 6 months from the Commencement Date. The Operations and Maintenance Plan shall include:

- 206.1. The Hydraulic Network Model developed by the Contractor
 - 206.2. The results of water quality survey sampling
 - 206.3. Results of Assets of water supply
 - 206.4. The results of consumer connection surveys
 - 206.5. Emergency Response Plan
 - 206.6. Energy Optimization Program
 - 206.7. Standard Operating Procedures for routine operations and emergency responses
 - 206.8. Format for periodic operation and maintenance reporting.
 - 206.9. First year plan Annual Operating Plan, covering specific water supply operations requirements and scheduled maintenance activities.
207. The Contractor shall prepare and submit for approval a Training Plan, defining all on-the job and class room training of SMC staff to be conducted during the Project. The Training Plan shall be finalized and approved within 6 months from the Commencement Date.
208. Operation and Maintenance Manuals shall provide the details of the regular and periodic maintenance of Works, and shall ensure that at all times during the Operation Service Period, the Project Facilities are maintained in a manner that it complies with the Performance Standards. Such Operation and Maintenance Manuals shall include but not be limited to the following:
- 208.1. Intervals and procedures for the carrying out of inspection of all elements of the Section;
 - 208.2. Criteria to be adopted for deciding maintenance needs;
 - 208.3. Preventive maintenance schedule;
 - 208.4. Intervals at which the Contractor shall carry out periodic maintenance;
 - 208.5. Intervals for major maintenance and the scope thereof;
 - 208.6. Leakage management system;
209. Monthly Operating Performance Report (MOPR); Performance targets and standards report as per Schedule 7 of PCC. The MOPR shall also include: a detailed progress report on the implementation of the Operation and Maintenance Plan; monthly water account with details of water measured at bulk supply points, distribution and Performance Standards achieved or maintained during the month; exceptional reports on emergencies; financial information on project cash flows, etc.
210. Quarterly Operating Performance Report (QOPR). Performance report as per schedule 7 of PCC. The QOPR shall also include a brief summary of the relevant issues detailed in the Monthly Performance Reports including a summary analysis of the quality of water supplied, the number of Consumer connections, the performance of water meters, consumer complaint recording and handling on behalf of SMC.

6.18.1 Performance Standards & Measuring Framework

211. The Contract distinguishes two sets of Performance Standards:
- 211.1. Target Performance Standards are performance standards that the Contractor shall aim to achieve in order to provide improved levels of water supply services.
 - 211.2. Minimum Service Levels are the performance standards the Contractor is required to maintain at all times;

The performance standards and measuring framework shall be applicable as per Schedule 7 of PCC

6.19 QUALITY ASSURANCE& CONTROL

212. Contractor shall prepare detailed plan for this Contract for Quality Assurance and Quality Control and get it approved from the Employer's Representative or Engineer. The Contractor shall deploy adequate number of suitable experts whose sole responsibility shall be to strictly implement the QA/QC plan and conduct necessary tests to ensure highest quality standard. All other measures that the Contractor may feel necessary or as may be directed by the Employer's Representative or Engineer or his representative shall be followed.

6.19.1 Shop Drawings for equipment's / works

213. The Contractor shall prepare shop drawings before manufacturing, ordering, installing any equipment, materials etc. The shop drawings shall follow the design and detailed requirements as indicated by the Engineer's specifications and shall incorporate the fabrication details. Six copies of these shop drawings shall be submitted by the Contractor i.e. two copies to the Engineer and Four copies to Consultants/ PMC. After due checking, the consultant will forward three copies to SMC with his comments within seven days. The Engineer shall, at his earliest convenience scrutinize these comments from consultant and return one copy to the Contractor with his comments/approval. Only on receipt of the approval of the shop drawings, further work shall be proceeded with by the Contractor. The Contractor shall submit these shop drawings to the Engineer at the earliest, but within 30 days from the award of work considering the overall time schedule, to allow the Engineer reasonable time to scrutinize. Any plea of delay on this aspect, shall not be entertained, as per the Contractor's request.

6.19.2 Drawings, Maintenance Manual etc. for works

214. All the drawings, documents and data sheets as detailed below shall be delivered after checking & verifications from the consultants to the Engineer for his approval. The approval of the drawings/data sheets/documents/ QAP by the engineer shall in no way relieve the Contractor from his obligations to get the drawings approved from the statutory bodies before execution of the work and provide a complete and satisfactory plant and installation as per intent and purpose as laid down in the specifications. Any omission and/or errors shall be made good or rectified whether or not the drawings were approved or not, at no extra cost to SMC.

6.19.3 PRE-DISPATCH INSPECTIONS OUTSIDE THE EMPLOYER'S CITY

215. In the event the Contractor proposes to procure material which requires pre-dispatch inspection of the Employer's Representative from outside of the Employer's city, the Contractor will have to arrange and provide for the cost the travel to the Manufacturer's place, accommodation, local transport and food for the representatives of the Employer. Such costs will be incorporated in the tendered cost of such items and no separate payment will be made for the same.

6.19.4 Material

216. All material used shall be new and conform to the relevant specifications or standards or as per approved Quality Assurance Plan. Reconditioned parts/Equipments shall not be accepted.

6.19.5 Working Conditions

217. It will be the Contractor's responsibility to acquaint himself with the local prevailing conditions of temperature, humidity, rainfall, dust and other conditions. All the equipments supplied shall be suitable for satisfactory operation under such abnormal conditions as prevalent.

6.19.6 Conformity to Specification

218. The work is to be executed in accordance to the specifications (mentioned under this contract) and the relevant I.S. Codes.

6.19.7 Approval of Materials

219. All materials used on the work shall be new and of the best quality available, conforming to the relevant specifications specified under this contract and as per the good Engineering practices. Prior approval should be obtained in writing from the Engineer or Employer's representative while approving the Quality Assurance Plan (QAP) for all materials proposed to be used.

6.19.8 Shop Inspection and Testing

220. Contractor shall depute the Third Party Inspecting Agency (TPIA) for the shop Inspection & Testing at his own cost for the items specified under this contract. TPIA shall be as per approved list of SMC or as Specified in PCC.
221. The Engineer or his appointed inspecting agent shall be entitled at all reasonable times during manufacture to inspect, examine and test in the Contractor's premises, the material and workmanship, of all plant to be supplied under the contract and if part of the said plant is being manufactured on other premises, the Contractor shall obtain permission to inspect, examine and test the same at such premises for the Engineer. Such inspection, examination and testing or waiving of the same shall not relieve the Contractor from any obligation under the contract. The Contractor shall give the Engineer minimum 30 days' notice in writing of the date and the place at which any Plant will be ready for testing.
222. All instruments used for such tests shall be calibrated and certified by an approved testing authority and the calibration certificate shall be valid at the time of tests. The calibration certificate shall be produced by the Contractor, at the time of carrying out every test, showing the readings obtained, all calculations and full details of the calibration.
223. The expenses for shop inspection of finished equipment and witnessing of performance tests at manufacture's work as specified shall be borne by the Contractor. The charges towards to & fro travel, boarding, lodging etc for third party agency including their inspection fee shall be borne by Contractor. The expenses incurred for above shall be deemed to be included in the prices quoted for the equipment. The above arrangements shall be made in advance and intimated to the department before any inspection has to be carried out at the manufacture's works. The delay in the inspection due to any reasons whatsoever shall be attributable to the Contractor.

6.19.9 Test Certificate

224. All manufacturer's certificates of test proof sheets, etc. showing that the equipment, material also have been tested in accordance with the requirements of the SMC, appropriate Indian Standard, Statutory requirement, other relevant standard specification or this specification are to be supplied free of charge on request. In case of dispute, SMC or Employer shall have the right to get the material tested at the cost of the Contractor as per the specification. Materials, which are not supported by the test certificates or for which test results do not tally with relevant standard specifications, shall not be used.

6.19.10 Quality Certificate of Equipment/ Material

225. The Contractor shall be required to produce a manufacturer's quality certificates for the equipment and materials supplied by the Contractor. Notwithstanding the manufacturer's certificates, the engineer may ask for testing of materials in approved test houses. The test result shall satisfy the requirements of the relevant Indian Standards/ SMC.

6.19.11 Records & Usage of Equipment/ Material

226. The Contractor shall maintain a detailed report of all equipment/materials received at the site in his stores or storage and working areas in the vicinity of the site and shall make such records available to the Engineer at such times as the latter may reasonably require.

6.19.12 FAILURE TO PASS TESTS AFTER COMPLETION

227. The performance criteria, as specified in the tender are the minimum acceptable criteria, below which the works failing to pass tests after completion shall be rejected.

6.19.13 SAFETY ASSURANCE

228. The Contractor will take all measures required to maintain highest safety standards on the site. The measures taken will include all but will not be limited to the relevant provisions of the Indian Standards. The Contractor will prepare a safety plan for the project and have it approved from the Employer's Representative. The Contractor shall deploy a safety officer on each important site to ensure compliance.

6.19.14 OPERATION AND MAINTENANCE MANUAL

229. The Contractor, before commencement of the Tests on Completion, shall submit 6 (six) copies of the operation and maintenance manuals for the pipe line, Water Supply System (continuous), overhead service reservoirs, SCADA, Instrumentation, Consumer Services etc. covering all the project components in English language, containing descriptions, illustrations, sketches, drawings, sectional drawings, sectional arrangement view and manufacturer's parts numbers to enable the connections, functions, operation and maintenance of all components of the complete System to be easily followed and for all parts to be easily identified to facilitate ordering of the replacement parts.

The Contractor shall also submit the following information while handing over water supply system / Equipments / SCADA / software's:

- a) A write up about the system, sufficient in detail to enable the staff of SMC to operate the water supply in smooth & trouble free manner and to maintain, and continue the services.
- b) Six sets of detailed drawings and specifications in respect of wearing parts and parts likely to be damaged. For parts where submission of detailed drawings & specifications will be possible, parts catalogue of equipment's will be acceptable.
- c) Six sets of List of control components giving their type, designation.
- d) Six sets of manufacture's catalogues of the main equipment and accessories.
- e) Schedule in quadruplicate, of the items of which the Contractor is not manufacturer or manufacturer's authorized dealer. This should contain the specifications of each item and the agency from which these items are purchased.
- f) Maintenance/instruction manual furnished by the manufacturer.

6.20 DETAILED TECHNICAL SPECIFICATIONS

Provided in Volume-2

Note : The Detailed Technical Specifications provided in Volume-2 under Section 6.20 separately.

6.21 Supplementary Information

The following list is not exhaustive but shows some of the main reports that are available in SMC office. Participating Bidders can obtain the information by seeking the necessary permission from the Employers representative.

- a) Detailed Project report on 24 X 7 Water Supply System in TP-7, TP-8, TP-33, TP-34 and TP-64(P) Under Smart City Project
- b) Detailed Project report on Refurbishment for existing 24 x 7 water supply system in TP-19, TP-64(P) and TP-53(P) under smart city project
- c) Detailed Project report on Water Supply Scheme of New East Zone of SMC
- d) Detailed Project report on Water Supply Scheme of remaining part of new South East zone of SMC

6.22 Drawings

230. Employer's Drawings. The List of drawings is provided as a guideline of the specifications and work of the Bidding Document. All data and information furnished in the drawings by the Employer is given in good faith as a part of approved Detailed Project Report for the service area. The drawings shall be verified and corrected by the Contractor before submitting the System Improvement Plan to SMC.

The list of drawings enclosed with the document is as follows :

1	LOCATION MAP OF SURAT IN INDIA,GUJARAT	WS/SMC-SMART/WTP/01
2	MAP SHOWING PROPOSED PROJECT AREA	WS/SMC-SMART/TRANS. MAP/01A
3	LAYOUT PLAN OF WDS-1 F.P.NO.-157,T.P.NO-7 (ANJANA)	WS/SMC-SMART/WDS-1/LAYOUT-02
4	GENERAL ARRANGEMENT OF SUMP & PUMP HOUSE IN PLAN & SECTION F.P.NO.- 157,T.P.NO-7 (ANJANA)	WS/SMC-SMART/WDS-1/GAD-02
5	LAYOUT PLAN OF WDS-2 FP NO.-107, TP NO- 7 (ANJANA)	WS/SMC-SMART/WDS-2/LAYOUT-03
6	GENERAL ARRANGEMENT OF SUMP & PUMP HOUSE IN PLAN & SECTION F.P.NO.- 107,T.P.NO-7 (ANJANA)	WS/SMC-SMART/WDS-2/GAD-03
7	LAYOUT PLAN OF WDS-3 F.P.NO.-R13,T.P.NO-53 (KRISHNA CIRCLE)	WS/SMC-SMART/WDS-3/LAYOUT-04
8	GENERAL ARRANGEMENT OF SUMP & PUMP HOUSE IN PLAN & SECTION F.P.NO.- R13,T.P.NO-53 (MAGOB,DUMBHAL)	WS/SMC-SMART/WDS-3/GAD-04
9	GENERAL ARRANGEMENT OF 15 LACS LIT.CAPACITY ESR	WS/SMC-SMART/ESR-15 LACS/GAD-05, SHEETS – 2 NO.
10	GENERAL ARRANGEMENT OF 21 LACS LIT.CAPACITY ESR	WS/SMC-SMART/ESR-21 LACS/GAD-06, SHEETS – 2 NO.
11	GENERAL ARRANGEMENT OF 24 LACS LIT.CAPACITY ESR	WS/SMC-SMART/ESR-24 LACS/GAD-07, SHEETS – 2 NO.
12	MAP SHOWING EX. WATER SUPPLY DISTRUBITION NETWORK FOR ALREADY IMPLIMENTED AREA FOR 24X7 WSS (REFURBISHMENT AREA) – PART-1	SMC/WS/DIST.NETWORK/PART-01

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13	MAP SHOWING OF PROP. DISTRIBUTION NETWORK FOR NEWLY PROPOSED AREA FOR SMART CITY	WS/SMC-SMART/TDIST.NET.- PART-2
14.	HT ELECTRICAL SINGLE LINE DIAGRAM (SHEET 1 OF 2)	STC/SMC/WDS-S/E-02A
15.	HT ELECTRICAL SINGLE LINE DIAGRAM (SHEET 2 OF 2)	STC/SMC/WDS-S/E-02A
16.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 1 OF 4)	STC/SMC/WDS-1-S/E-02B
17.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 2 OF 4)	STC/SMC/WDS-1-S/E-02B
18.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 3 OF 4)	STC/SMC/WDS-1-S/E-02B
19.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 4 OF 4)	STC/SMC/WDS-1-S/E-02B
20.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 1 OF 4)	STC/SMC/WDS-2-A/E-02B
21.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 2 OF 4)	STC/SMC/WDS-2-A/E-02B
22.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 3 OF 4)	STC/SMC/WDS-2-A/E-02B
23.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 4 OF 4)	STC/SMC/WDS-2-A/E-02B
24.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 1 OF 4)	STC/SMC/WDS-3-A/E-02B
25.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 2 OF 4)	STC/SMC/WDS-3-A/E-02B
26.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 3 OF 4)	STC/SMC/WDS-3-A/E-02B
27.	LT ELECTRICAL SINGLE LINE DIAGRAM NOTES (SHEET 4 OF 4)	STC/SMC/WDS-3-A/E-02B
28.	TYP. G.A. DRG. OF TRANSFORMER YARD & FOUNDATION DETAILS	STC/SMC/WDS-1-A/E-05A
29.	TYPICAL OUTDOOR LIGHTING POLE DETAILS	STC/SMC/WDS-1-A/E-10
30.	TYPICAL EARTHING DETAILS	STC/SMC/WDS-2-S/E-11