

PUBLIC HEALTH AND MUNICIPAL ENGINEERING DEPARTMENT

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Name of Work: Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.

Tender Notice No: **01/TPT/RRR/DB/ATO/2015, Dt:01-05-2015**

**OFFICE OF THE SUPERINTENDING ENGINEER
Public Health Engineering Department
Nellore**

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PUBLIC HEALTH AND MUNICIPAL ENGINEERING DEPARTMENT

NOTICE INVITING TENDERS

'e' Procurement Notice

NIT No. 01/TPT/RRR/DB/ATO/2015, Dt:01-05-2015

Name of Work: Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.

SCOPE OF THE PROJECT : Investigation, Survey, Design, Preparation of Detailed Estimates and Execution of Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source - Consisting of centrifugal pump sets with suitable motors and DI Valves to pump raw water, at KP canal Pumping Station with discharge of 637 LPS and Head of 32 mts – 3 nos, discharge of 325 LPS with the head of 32 mts, 1 No. at MD Puttur Pumping Station with discharge of 410 LPS with Head 53 mts, 1 no., at Mangalam pumping station with Discharge of 410 LPS with head of 55 mts 1 No. vertical turbine pump with suitable motor to pump raw water with Discharge of 420 LPS with Head of 41 mts 2 Nos. Manufacture, Supply, Erection and Commissioning of Double Chamber Y Pattern Pump Control Valve, 450 mm PN 1.0 at KP Canal 3 Nos, Ramapuram 3 Nos, 350 mm PN 1.0 at M.D. Puttur 3 Nos, at Mangalam 3 Nos, at Leela Mahal, towards Palani 150 mm PN 1.0 2 Nos, towards Municipal Park, 300 mm PN 1.0 2 Nos. Supply, Erection and Commissioning of Bladder Vessel with Load Cell at KP canal PN 1.0, 10 cum 2 Nos, at Ramapuram Pumping Station PN 1.6, 15 cum 1 No, M.D. Puttur PN 1.0, 40 cum 2 Nos, at Mangalam Pumping Station PN 1.0, 5 cum 1 No, at Municipal Park Pumping Station PN 1.0 5 cum 1No, Surge Suppression Valve with body of ductile iron, float of polycarbonate at KP Canal 150mm PN 1.0, 4 Nos at Ramapuram 150 mm PN 1.0 4 Nos, at M.D. Puttur 150 MM PN 1.0, 4 Nos, at Mangalam 150 mm PN 1.0, 2 Nos, at Municipal Park 150 mm PN 1.0, 3 Nos. Air Management system, Supply, Erection and Commissioning of Suitable Air Management system, Yanadula Sump to MD Puttur 18 Nos, MD Puttur to Mangalam 10 Nos, Mangalam to WTP 4 Nos, Municipal part to Medical College 5 Nos. Reservoir Management System, Supply Erection and Commissioning of Reservoir Management system to control the flow as per the demand to facilitate uniform distribution of water to the ELSRs, from Leelamahahal to palani ELSR side (3 ELSR's) for 70 LPS 3 Nos, RMS from Leelamahahal to Municipal Park (1 GLSR) for 225 LPS 1 No, RMS from Municipal Park to Medical College GLSR side (1 GLSR) for 225 LPS 1 No. Water Management District Supply Erection and commissioning of WMD system which should be able to control the flow as per demand to facilitate uniform. Distribution of water to the consumer irrespective of its location – 7 Nos (places). Instrumentation

and SCADA for the pumping system for centralized monitoring and control of essential, parameters such as Levels, flow, Pressure, Temperature, Electrical parameters etc., confirming to relevant codes. All the SCADA systems providing at the individual stations should be able to be integrated and all the required data shall be displayed at a selected centralized monitoring stations for effective maintenance of the entire system and each in following pumping stations at KP Canal, Ramapuram, MD Puttur, Mangalam & Municipal Park. Civil works for replacement of pump sets, Errection Bladder Vessel, Surge Suppression Valve, Air Management system, District etc and supply of 4 wheeled, 2 nos of vehicles for a period of 10 months and maintenance of the scheme for the defect liability period of 24 months. The Entire System Should be Designed as per CPHEEO Manual and Relevant IS Codes.

Public Health and Municipal Engineering Department under the control of Municipal Administration and Urban Development Department (MA & UD), Government of Andhra Pradesh (G.O.A.P) invites proposals from eligible bidders for the above work under Engineering, Procurement, Construction (EPC) turnkey system.

a) Salient components of the Scheme :

Sl. No	Qty	Description of Item
1	2	3
I		PUMPS & MOTARS
1		Supply, delivery, erection of Centrifugal pump sets with suitable motors and DI valves to pump raw water, Suitable transformers, Instrument control pannel and power & control cables etc., complete as per the Standard specifications including all taxes and duties.
i)		KP CANAL PUMPING STATION
A)	3	i) Discharge :- 637 LPS ii) Head : 32 Mts
B)	1	i) Discharge :- 325 LPS ii) Head : 32 Mts
ii)		MD Puttur Pumping Station
A)	1	i) Discharge :- 410 LPS ii) Head : 53 Mts
iii)		MANGALAM PUMPING STATION
	1	i) Discharge :- 410 LPS ii) Head : 55 Mts

2)		Supply, delivery, erection of vertical turbine pump with suitable motor to pump raw water from Kailasagiri reservoir to sump at Yanadula colony including cost of supply of required size of MS/DI pipe fittings, DI valves, suction & Delivery piping up to manifold, erection and hoisting system (Crane), MCC panels, Suitable transformers, Instrument control panel and power & control cables etc., complete as per the Standard specifications including all taxes and duties.
	2	Pumps, Motors and other related works in Ramapuram pumping station i) Discharge :- 420 LPS ii) Head : 41 Mts
3)		Design, Manufacture, Supply, Erection and Commissioning of Double Chamber Y Pattern Pump Control Valve Alongwith Wafer Type butterfly valve suitable for Isolation of Pump Control valve as per Standard Specification
A)	3	450 mm PN 1.0 at KP Canal
B)	3	450 mm PN 1.0 at Ramapuram
C)	3	350 mm PN 1.0 at M.D. Puttur
D)	3	350 mm PN 1.0 at Mangalam
E)		Leela Mahal
	2	i. Towards Palani 150 mm PN 1.0
	2	ii. Towards Municipal Park 300mm PN 1.0
4		Design, Manufacture, Supply, Erection and Commissioning of Surge Protection System
A)		Design, Supply, Erection and Commissioning of Bladder Vessel with Load Cell and Surge Monitoring System comprises of Data Logger, Pressure Transmitter including all taxes and duties
i)	2	10 cum PN 1.0 at KP CANAL Pumping Station
ii)	1	15 cum PN 1.6 at Ramapuram Pumping Station
iii)	2	40 cum PN 1.0 at M.D. Puttur Pumping Station
iv)	1	5 cum PN 1.0 at Mangalam Pumping Station
V	1	5 cum PN 1.0 at Municipal Park Pumping Station
B)		Surge Suppression Valve with Body of Ductile Iron, Float of Polycarbonate and Surge Suppression Disc of Steel with Rolling Seal of EPDM with Switching pressure of 2.2 Kpa having features efficient air release valves, Tamperproof Enclosure system with Auto Vandalized Alert , Burst Monitoring by pressure monitoring at Air valve locations with following material of construction of Air valve including all taxes and duties
i)	4	150 MM PN 1.0 @ KP CANAL
ii)	4	150 MM PN 1.0 @ Ramapuram

iii)	5	150 MM PN 1.0 @ M.D. puttur
iv)	2	150 MM PN 1.0 @ Mangalam
v)	3	150 MM PN 1.0 @ Municipal Park
		Air Management System
5)		Design, Supply, Erection and Commissioning of Suitable Air Management System to avoid the Air Lock Problems and increase the Efficiency of pipeline with Burst Monitoring and Enclosure Box with Vandalism Alert with following equipment 1. Dynamic Air Valve 2. Pressure Transmitter 3. Field Controller 4. Enclosure System with made up of Reinforced Polyester having vandalism alert
i)	18	Yanadula Sump to MD Puttur
ii)	10	MD Puttur to Mangalam
iii)	4	Mangalam to WTP
iv)	5	Municipal Park to Medical College
6)		Reservoir Management System
		Supply, Erection and Commissioning of Reservoir Management System (RMS) which should be able to control the flow as per demand to facilitate Uniform Distribution of Water to the Elevated Reservoir irrespective of its location, elevation and distance from the Pumping Station.
i)	3	RMS from Leelamahal tro Palani ELSR Side (3 ELSR's) for 70 LPS
ii)	1	RMS from Leelamahal to Municipal Park (1 GLSR) for 225 LPS
iii)	1	RMS from Municipal Park to Medical College GLSR Side (1 GLSR) for 225 LPS
7)		Water Management District
	7	Supply , Erection and commissioning of WMD system which should be able to control the flow as per demand to facilitate uniform Distribution of water to the consumer irrespective of its location, elevation and distance from the water source and the system should be able to record monitor and control the cumulative quantity delivered to the consumer without any external Electrical Energy and with minimum recurring cost for communication with GSM / GPRS / RADIO Etc., including all taxes and duties and following specifications.
8)		Instrumentation and SCADA for the pumping system for centralised monitoring and control of essential parameters such as Levels, Flow, Pressure, Temperature, Electrical parameters etc. including all taxes and duties

		with following scope and confirming to relevant codes.
		All the SCADA systems providing at the individual stations should be able to be integrated and all the required data shall be displayed at a selected centralized monitoring station for effective maintenance of the entire system.
i)	1 Job	AT KP CANAL
ii)	1 Job	AT RAMAPURAM-
iii)	1 Job	AT MD Puttur
iv)	1 Job	AT Mangalam
v)	1 Job	AT Municipal Park
9	1 Job	Civil works for replacement of pump sets, Errection Bladder Vessel, Surge Suppression Valve, Air Management System, District Metering, including Earth Work Excavation, Concrete Platform & Foundation for above all equipment etc., Complete
10	1 Job	Hiring of vehicles for supervision and maintenance 2 Nos x 24000x 9 Months
		Part - II Schedule - A
		VAT @ 5 %
		Labour Cess @ 1 %

The interested bidders may down load the tender schedules documents from the 'e' procurement web site www.eprocurement.gov.in from **02-05-2015 @ 11.00 AM**. The field data can be had from the office of the Superintending Engineer (PH), Nellore on any working day before bid submission closing date i.e., **20-05-2015 @ 5.00 PM**.

II) NIT DETAILS :

1.	Department Name	P.H & ME Department
2.	Circle / Division Name	Public Health Circle, Nellore
3.	Tender Number	01/TPT/RRR/DB/ATO/2015, Dt:01-05-2015
4.	Tender Subject	Tirupati - Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.
5.	Estimated Contact Value	Rs. 1416.78 Lakhs

	(Internal Bench Mark)	
6.	Period of Contract	9 (Nine) Months
7.	Form of Contract	EPC – Turnkey system.
8.	Tender Type	Open
9.	Tender Category	Works
10.	EMD / Bid Security	Rs.14,16,800/-
11.	EMD / Bid Security Payable to	In the shape of unconditional & irrevocable Bank Guarantee in the standard format in favour of Superintending Engineer, Public Health Circle, Nellore to be obtained from any Government owned Public Sector Bank or any scheduled commercial bank (OR) in the shape of Demand Draft in favour of PAO TGP, TIRUPATI to be valid for a period of 3 months from the date of bid notice.
12.	Tender Fee	(0) INR
13.	Tender Fee Payable to	Not Applicable
14.	Process Fee	Rs.11,236/- (INR) (Inclusive of Service Tax @12.36 %)
15.	Process Fee Payable to	M/S Vayam Technologies., Hyderabad through Electronic gate way payment system.
16.	Schedule Sale Opening Date	02-05-2015 @ 11.00 AM
17.	Schedule Sale closing Date	19-05-2015 up to 05.00 PM
18.	Pre-Bid Meeting Date	11-05-2015 @ 11.00 AM to 5.00 PM
19.	Bid submission closing Date(online)	20-05-2015 up to 05.00 PM
20.	Pre-Qualification / Technical bid opening date (Qualification and Eligibility stage)	20-05-2015 @ 05.30 PM
21.	Price Bid Opening Date (Financial Bid Stage)	26-05-2015 @ 11.00 AM
22.	Place of Price Bid Opening	Superintending Engineer (PH), Nellore.
23.	Officer Inviting Bids/ Contact Person	Superintending Engineer (PH), Nellore.
24.	Address / E-mail ID	Superintending Engineer (PH), Nellore. seph_nlr@yahoo.co.in
25.	Contact Details/Telephone, Fax	Sri T.MOHAN, Superintending Engineer, Public Health Circle, Mulapet, Nellore. PH No: 0861 – 2328649 Cell No.:9849905737 Fax. No: 0861 – 2328649

26.	Eligibility Criterion :	
	<p>Period of Completion : 9 months.</p> <p>1. Civil Contractors/Contracting firm having registration with Government of Andhra Pradesh in appropriate eligible class as per the G.Os specified. (i) G.O.Ms.No.178, I&CAD (PW-COD) Dept., dt: 27.9.1997. (ii) G.O.Ms.No.132, TR&B (R.1) Dept., dt: 11.8.1998. (iii) G.O.Ms.No.8, TR&B (R1) Dept., dt: 8.1.2003. (iv) G.O.Ms.No.94, I & CAD (PW-COD) Dept., dt: 1.7.2003 are only eligible.</p> <p>2(a). The bidder should furnish 'U' form obtained from the Principal manufacturers, double chamber Y pattern valves, DI air valves, control valves and as per the above deliverables where ever required and ISO 9001 Certification for pumping machinery. (b). Bidder should have MOU with manufactures/provided of surge protection system with bladder vessel technology. (c). In case of Manufacturers who participate in tenders, supposed to furnish / upload manufacturing license from the authority concerned.</p> <p>3 The bids are limited to those individuals, firms, companies who meet the following qualification and the eligibility requirements and here in after referred to as bidder.</p> <p>4. Joint ventures is allowed not exceeding maximum of 2 partners.</p> <p>5. Bidder / joint ventures partners should have experience of supply, erection and commissioning in any water supply scheme of amount not less than Rs.945.00 Lakhs as per the deliverables.</p> <p>4. Technical Requirement:</p> <p>a) The Bidder as a Prime Contractor should have executed the following minimum quantities in any one financial year during the last ten Financial Years ending with 31-03-2015.</p> <p>1. Pumping Machinery</p> <p style="text-align: center;">Centrifugal pumps/ Vertical Turbines:</p> <p style="text-align: center;">Should have supplied erected and commissioned Centrifugal / Vertical Turbine pumps with suitable motor of not less than 2 Nos having discharge 637 LPS, Head 32 mts, 2 no of 410 LPS with head of 55 mts or equivalent KW Pumps / Mortors.</p>	

2. Bladder Vessels

Should have supplied, erected and commissioned Bladder vessel(s) for surge protection with necessary accessories of total capacity of 50 cum, each of capacity not less than 10 cum

3. SCADA & Automation-

Should have supplied and installed the required SCADA system with all required components at minimum of 3 places / locations in any of the similar projects.

Note: - Proportionate Quantities will be considered, if the project is executed spanning over more than one financial year.

b) The bidder should enclose experience certificates in support of technical criteria issued

by the Engineer – In - charge of the State / Central Government departments / Undertakings not below the rank of Executive Engineer or Equivalent and countersigned by the next higher authority not below the rank of Superintending Engineer or equivalent.

5. Financial Requirement:

a. The bidder as a prime contractor should have executed similar type of project costing not less than **Rs. 945.00 Lakhs** in any one financial year during the last ten financial years updated by giving 10% simple weight age per year to bring them to 2014-15 price level.

b. The bidder should produce liquid asset / credit facilities / Solvency certificates from any Indian Nationalized / Scheduled Banks of value not less than **Rs.473.00 Lakhs**.

c. Assessed available Bid capacity as per formula (2AN-B) should be greater than internal Bench mark value assessed by the Department.

A= Maximum Value of Civil Engineering works executed in any one financial year during the last ten financial years (updated 2014-15 price level) taking into account the completed as well as works in progress.

N= Number of years prescribed for completion of the works for which tenders are invited.

B=Value of existing commitments and ongoing works to be completed during the period of completion of the project for which tenders are invited.

	<p>d. The bidder should furnish the availability (either owned or leased) of following key and critical equipment required for the work.</p> <ol style="list-style-type: none"> 1. Cranes for erection of equipment pumping machinery, valves and vessels – 3 Nos. 2. JCB / Hitachi - 2 Nos. 3. Water Tanker – 2 Nos. 4. Tractor / Tippers – 3 Nos. 5. Concrete Hopper miller – 1 No. <p>e. The bidder should furnish the availability of following key personnel.</p> <ol style="list-style-type: none"> 1. Graduate Engineers – 2 Nos. 2. Diploma Engineers – 2 Nos. <p>f. The bidders should furnish the particulars of quality control testing Lab owned, or tie up with established quality control testing laboratories.</p> <p>g. The bidder should furnish the Income Tax Pan and submission of latest Income Tax return along with proof of receipt.</p> <p>h. The bidder should furnish the VAT Registration Certificate and Latest VAT Clearance certificate.</p> <p>Note: - The Internal Bench Mark (IBM) is arrived based on the probable quantities indicated in the deliverables.</p> <p>The Scope, Deliverables, IBM Value and Eligibility Criteria for the NIT are submitted before the committee for approval and committee approved the same.</p> <p>Technical evaluation will be done only based on the documents uploaded on the e-procurement platform as per G.O.M.S.No.94, I&CAD, Dt::01-07-2003 and subsequent G.O.s issued from time to time by the Government.</p>
	<p>General Terms & Conditions :</p>
	<p>1. The details and certificates are to be furnished as per the pro-forma available in the tender schedules.</p>
	<p>2. The bidder should have the key and critical equipment (either owned or leased as mentioned in the tender document).</p>
	<p>3. The bidder is subjected to be disqualified and liable for black listing and forfeiture of EMD, if he is found to have misled or furnished false information in the forms statements / certificates submitted in proof of qualification requirements.</p>

	4. Even while execution of the work, if found that the contractor had produced false / fake certificates of experience he will be liable for black listing and the contract will be liable for termination and liable for forfeiture of EMD and all the amounts due to him.
	5. Bidders shall submit a declaration without any reservation what so ever that the submitted eligibility and qualification details, technical and financial bid are without any deviations and are strictly in conformity with the documents issued by the employer.
	6. Declaration should be given for the credentials submitted by the bidder.
	7. The employer reserves the right to relax the conditions and required for eligibility of the bidders in the public interest. The Bidder(s) shall not have any right to question the decision taken by the employer in this regard.
	8. The bidder(s) shall submit a written power of attorney authorizing the signatory of the bid to commit for the bidder.
	9. The bidder should furnish the Income Tax Pan and submission of latest Income Tax return along with proof of receipt.
	10. The bidder should furnish the VAT Registration Certificate and Latest VAT Clearance certificate.
	Special Conditions :
	1) Tenders with an excess of more than 5% over the internal benchmark value arrived by the department shall be summarily rejected.
	2) In respect of tenders beyond 25% less than internal benchmark arrived by the department, a Bank Guarantee or Demand Draft for the difference between the tendered amount and 75% of internal benchmark value should be furnished at the time of agreement as additional security deposit.
	3) Government reserves the right to cancel/alter the bid conditions at any time.

III) Procedure for Submission of Bids:-

a. Intending bidders can contact office of the Superintending Engineer, Public Health Circle,

Nellore for any clarifications, information on any working day during working hours

b) The bidder would be required to register on the e-procurement market place www.eprocurement.gov.in or <https://tender.eprocurement.gov.in> and submit their bids online. The department will not accept any bid submitted in the paper form. Bidders are requested to submit the bid in two stages

Stage – I :Eligibility and Technical Bid Stage.

Stage – II : Financial Bid Stage.

- c) The first stage will cover the qualifications eligibility details and the technical bid. The bidder shall upload documents in support of the above. The bidder shall submit price bid online under second stage which may include proposals for financing to cover part of the scope of the work as per bid documents before the bid submission closing date.
- d) The detail procedure for bid submission is described in the bid documents
- e) Bidders shall submit a declaration without any reservation whatsoever that the submitted eligibility and qualification details, Techno-Commercial bid and financial bid are without any deviations and are strictly in conformity with the documents issued by the Employer.
- f. Declaration should be given by the bidder for the correctness of the credentials submitted by him.
- g. The Bidders shall sign on the documents (such as EMD, transaction fee payable at Vayam Technologies) uploaded by him, owing responsibility for their correctness/authenticity. The documents without signature of the bidder will be considered as invalid documents and the same will not be considered in evaluation of the bid.
1. For registration and online bid submission bidders may contract HELPDESK of M/s. Vayam Technologies., on <https://tender.eprocurement.gov.in>

I. Submission of Hard copies The following orders are applicable as per G.O. Ms. No. 174 I & CAD (PW Reforms) Dept., Dt : 01-09-2008.

- i. Submission of original hard copies of the uploaded scan copies of DD / BG towards EMD by participating bidders to the tender inviting authority before opening of the price bid is dispensed forthwith.
- ii. All the bidders shall invariably upload the scanned copies of DD / BG in the e-procurement system and this will be the primary requirement to consider the bid as responsive.
- iii. The department will carry out the technical bid evaluation solely based on the uploaded certificates / documents, DD / BG towards EMD in the e-procurement system and open the price bids of the responsive bidders.
- iv. The Department will notify the successful bidder for submission of original hard copies of all uploaded documents, DD / BG towards EMD prior to entering into agreement.
- v. The successful bidder shall invariably furnish the original DD / BG certificates / documents of the uploaded scanned copies to the tender Inviting Authority before entering into agreement either personally or through courier or post and the receipt of the same with in the stipulated

date shall be the responsibility of the successful bidder. The department will not take any responsibility for any delay in receipt/non-receipt of original DD/BG towards EMD, certificates / Documents, from the successful bidder before the stipulated time. On receipt of the documents, the Department will ensure the genuinity of the DD/ BG towards EMD and all other certificates/documents uploaded by the bidder in e-procurement system in support of the qualification criteria before concluding the agreement.

- vi.** If any successful bidder fails to submit the original hard copies of the uploaded certificates / Documents, DD / BG towards EMD with in the stipulated time or if any variation is noticed between the uploaded documents and the hard copies submitted by the bidder, the successful bidder will be suspended from participating in the tender on e-procurement platform for a period of 3 (three) years. The e-procurement system would de-active the use ID of such defaulting successful bidder based on the trigger/recommendation by the Tender Inviting Authority in the system. Besides this, the department shall invoke all processes of law including criminal prosecution of such defaulting bidder as an act of extreme deterrence to avoid delay in the tender process for execution of all development schemes taken up by the Government. The information to this extent will be displayed in the e-procurement platform website.

j. Deactivation of Bidders:

The bidder (L1) found defaulting in submission of hard copies of original DD/BG for EMD /Transaction fee to the Tender Inviting Authority on or before the tender stipulated time before concluding the agreement will be suspended / disqualified from participating in tenders on eProcurement platform for a period of 12 months from date of bid submission as per G.O Ms No 245 I&CAD Dept. dated 30-12-2005 and GO Ms No 155 I&CAD Dept. dated 23-08-2006 besides forfeiture of EMD. Other conditions as per tender document are applicable.

k. Payment Of Transaction Fee and EMD:

It is mandatory for all the participating bidders to pay electronically the Transaction fee to M/s Vayam Technologies through "Payment Gateway Service on E-Procurement platform ". The Electronic Payment Gateway accepts all Master and Visa cards issued by any bank and Direct Debit facility / Net Banking of ICICI Bank, HDFC to facilitate the transaction. This is in compliance as per G.O Ms No 13 IT & C Dept, dated 5-7-2006. A service tax of 12.36 % + Bank Charges for Credit Card Transaction of 1.85% on the transaction Amount payable to Vayam Technologies Shall be applicable.

l. Tender Document:

The bidder is requested to download the tender document and read all the terms and conditions mentioned in the tender Document and seek clarification if in

doubt from the Tender Inviting Authority. Any offline bid submission clause in the tender document shall not be considered.

The bidder has to keep track of any changes by viewing the addendum / Corrigendum's issued by the Tender Inviting Authority on time-to- time basis in the E-Procurement platform. The Department calling for tenders shall not be responsible for any claims/problems arising out of this.

m. Bid Submission Acknowledgement:

The user should complete all the processes and steps required for bid submission. The successful bid submission can be ascertained once acknowledgement is given by the system through bid submission number after completing all the process and steps. GOAP and M/s. Vayam Technologies is not responsible for incomplete bid submission by users. Users may also note that the incomplete bids will not be saved by the system and are not available for the Tender Inviting Authority for processing.

Deliverables of the Scheme:

Sl. No	Description of Item	Qty
1	2	3
	Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.	
	The bidder should design, supply, delivery, erection, trial run, commission, complete and maintain for a period of 2 years after completion of the work with the following parameters:	
I	PUMPS & MOTORS	
1	Supply, delivery, erection of Centrifugal pump sets with suitable motors and DI valves to pump raw water, supply and fixing of panel board with suitable bus bar arrangements and connections with suitable copper cable from panel to motor and starter, supply and erection of suitable DI /MS pipes IS 8329 – 20000 and its amendments time to time for DI, IS 3589 : 2001 and its amendments time to time for MS standard sluice valves, non-return valves etc., with soft starter complete including making hole to the existing sump including cost of suitable DI / MS pipes or specials for manifold, suction, delivery pipes ,connecting to existing pumping main. The pumps are to be erected in the existing pump house duly connecting to the existing system including cost of supply of required size of MS/DI pipe	

	fittings, DI valves Confirming to IS / DIN / ASTN / BIS specifications and its amendments time to time, suction & Delivery piping up to manifold, erection and hoisting system (Crane), MCC panels, Suitable transformers, Instrument control panel and power & control cables etc., complete as per the Standard specifications including all taxes and duties	
i)	KP CANAL PUMPING STATION	
A)	i) Discharge :- 637 LPS ii) Head : 32 Mts	3
B)	i) Discharge :- 325 LPS ii) Head : 32 Mts	1
ii)	MD Puttur Pumping Station	
A)	i) Discharge :- 410 LPS ii) Head : 53 Mts	1
iii)	MANGALAM PUMPING STATION	
	i) Discharge :- 410 LPS ii) Head : 55 Mts	1
2)	Supply, delivery, erection of vertical turbine pump with suitable motor to pump raw water from Kailasagiri reservoir to sump at Yanadula colony including supply and fixing of panel board with suitable bus bar arrangements and connections with suitable copper cable from panel to motor and starter, supply and erection of suitable DI IS 8329 – 2000 and its amendments time to time for DI, IS 3589 : 2001 and its amendments time to time for MS standard sluice valves, non-return valves etc., with soft starter complete including making hole to the existing sump including cost of suitable DI / MS pipes or specials for manifold, suction, delivery pipes ,connecting to existing pumping main for the designed discharge.. The pumps are to be erected in the existing pump house duly connecting to the existing system including cost of supply of required size of MS/DI pipe fittings, DI valves Confirming to IS / DIN / ASTN / BIS specifications and its amendments time to time, suction & Delivery piping up to manifold, erection and hoisting system (Crane), MCC panels, Suitable transformers, Instrument control panel and power & control cables etc., complete as per the Standard specifications including all taxes and duties.	
	Pumps, Motors and other related works in Ramapuram pumping station i) Discharge :- 420 LPS ii) Head : 41 Mts	2

3)	<p>Design, Manufacture, Supply, Erection and Commissioning of Double Chamber Y Pattern Pump Control Valve Along with Wafer Type butterfly valve suitable for Isolation of Pump Control valve as per Standard Specification and confirming to relevant codes including all taxes and duties with following technical specification of pump control valve and consisting of following :</p> <p>Main Valve: The main valve shall be a center guided, diaphragm actuated globe valve of oblique (Y) pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.</p>	
	<p>Actuator: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit. The stainless steel valve shaft shall be center guided by a bearing in the separating partition.</p> <p>Control System: The control system shall consist of a 3-Way solenoid pilot (for 8" and larger valves, an accelerator shall be added to the solenoid), two check valves (for 12" and larger valves, an additional check valve), a limit switch, and a filter. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested. Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.</p>	
	<p>Material Construction: Body & Actuator: Ductile Iron ASTM A 536/EN 1563 Diaphragm: Nylon Fabric reinforced natural rubber. Stem & Seat: Stainless Steel. Seal: NBR Control Tubing & Fitting: Stainless Steel. Pilot: Brass/Bronze. Pressure rating : 16 Bar Large Control Filter with Body of Epoxy Coated Steel, Cover of Brass and Disc of Polypropylene</p>	
A)	450 mm PN 1.0 at KP Canal	3
B)	450 mm PN 1.0 at Ramapuram	3
C)	350 mm PN 1.0 at M.D. Puttur	3
D)	350 mm PN 1.0 at Mangalam	3
E)	Leela Mahal	

	i. Towards Palani 150 mm PN 1.0	2
	ii. Towards Municipal Park 300mm PN 1.0	2
4	Design, Manufacture, Supply, Erection and Commissioning of Surge Protection System	
A)	Design, Supply, Erection and Commissioning of Bladder Vessel with Load Cell and Surge Monitoring System comprises of Data Logger, Pressure Transmitter to be supplied to enable to study the surge effect of make Carbon Steel SA 516 Gr 70 with Elliptic cap of Carbon Steel SA 516 Gr 70, BUTYL type of Bladder with Sand blasting SA 2.5 1 Coat Food Epoxy Thickness 100 Microns in side of the bladder vessel, Sand Blasting SA 2.5, Zinc Epoxy Dressing LACQUER RAL 2002 of total thickness of 110 Microns outside of the vessel with lifting of Carbon Steel SA 516 Gr 70 and out let of Carbon Steel SA 516 Gr 70 to sustain 60 degree temperature, positioned in vertical, having load cell HYDROCONTROL LEVEL GAUGE EQUIPMENT WITH OUTPUT 4/20 MA etc., Complete with following technical specifications. including all taxes and duties	
	SHELL : Carbon Steel P265GH/SA 516 Gr 70/Equivalent	
	ELLIPTIC CAP : Carbon Steel P265 GH / SA 516 Gr 70/ Equivalent	
	Bladder : BUTYL	
	Coating Inside : Sand Blasting SA 2.51 Coat Food Epoxy Thickness 100 Micron	
	Coating Outside : Sand Blasting SA 2.5 Zinc Epoxy Dressing, Lacquer RAL 2002 Total thickness 110 microns.	
	Lifting Pad : Carbon steel P265 GH / SA 516 Gr 70 / Equivalent	
	Outlet : Carbon steel S/ENS or Equivalent	
	Design Temp : 60° P	
	Position : Vertical	
	Load Cell : Hydro control level Gauge equipment with output 4 / 20 MA.	
i)	10 cum PN 1.0 at KP CANAL Pumping Station	2
ii)	15 cum PN 1.6 at Ramapuram Pumping Station	1
iii)	40 cum PN 1.0 at M.D. Puttur Pumping Station	2
iv)	5 cum PN 1.0 at Mangalam Pumping Station	1
V	5 cum PN 1.0 at Municipal Park Pumping Station	1
B)	Surge Suppression Valve with Body of Ductile Iron, Float of Polycarbonate and Surge Suppression Disc of Steel with Rolling Seal of EPDM with Switching pressure of 2.2 Kpa having features efficient air release valves, Tamperproof Enclosure system with Auto Vandalized Alert , Burst Monitoring by pressure monitoring at Air valve locations with	

	following material of construction of Air valve including all taxes and duties	
	Model : Surge Suppression combination air valve	
	Body and Cover : Ductile Iron ASTM A 536 / EN 1563	
	Float : Polycarbonate	
	Nozzle Seat : Bronze ASTM B - 62, B- 271	
	Nozzle seal : Rubber E.P.D.M	
	O- Ring : Buna - N	
	Screen Cover : Ductile Iron ASTM A 536/ EN 1563	
	Screen : Stainless Steel SAE 304	
	Bolt and Nut : Galvanized Steel	
	Working Pressure : 16 Kg / Cm ²	
i)	150 MM PN 1.0 @ KP CANAL	4
ii)	150 MM PN 1.0 @ Ramapuram	4
iii)	150 MM PN 1.0 @ M.D. puttur	5
iv)	150 MM PN 1.0 @ Mangalam	2
v)	150 MM PN 1.0 @ Municipal Park	3
	Air Management System	
5)	Design, Supply, Erection and Commissioning of Suitable Air Management System to avoid the Air Lock Problems and increase the Efficiency of pipeline with Burst Monitoring and Enclosure Box with Vandalism Alert with following equipment 1. Dynamic Air Valve 2. Pressure Transmitter 3. Field Controller 4. Enclosure System with made up of Reinforced Polyester having vandalism alert	
	The Dynamic Air Valves should able to release air from the water system in a controlled and gradual manner, preventing slam and local up-surges. The Dynamic Air Valves should be designed to draw in large volumes of air into the water system, impeding down surges and, consequently, all pressure surges in the line. The Dynamic Air valves should be Normally Closed when the line is not operating, which will prevent the infiltration of foreign particles e.g. insects, dirt etc. into the water system. Main Valve Body and Cover should be of Ductile Iron ASTM A 536 Operating Valve Assembly Should be with Rolling Seal of EPDM for continuous removal of Entrapped Air in pipeline. Operating Valve Body should be made of Reinforced Nylon. Operating Valve Assembly should be capable for discharges Entrapped Air up to 160 m ³ /hr.	

	MATERIAL of CONSTRUCTION 1. Operating Valve Body : Reinforced Nylon 2. Drainage Elbow : Polypropylene 3. Rolling Seal E.P.D.M. Rubber 4. Operating Ass. : Elastomer + Stainless Steel 5. Clamping Stem : Reinforced Nylon 6. O-ring seal : BUNA-N 7. Bolt and nut : Steel Coated 8. Cover : Ductile Iron ASTM A 536/ EN 15639. 9. Kinetic Sealing Ass. : Reinforced Nylon + E.D.P.M. Rubber 10. Nozzle : Stainless Steel 11. Body (80mm and above) : Ductile Iron ASTM A 536	
i)	Yanadula Sump to MD Puttur	18
ii)	MD Puttur to Mangalam	10
iii)	Mangalam to WTP	4
iv)	Municipal Park to Medical College	5
6)	Reservoir Management System	
	Supply, Erection and Commissioning of Reservoir Management System (RMS) which should be able to control the flow as per demand to facilitate Uniform Distribution of Water to the Elevated Reservoir irrespective of its location, elevation and distance from the Pumping Station. The system should be able to record, monitor and control the cumulative quantity without any external Electric Energy and with minimum recurring cost for Communication with GSM/GPRS/RADIO etc. including all taxes and duties with following technical specifications.	
	<ul style="list-style-type: none"> • The System should be able to operate without any External Electric Energy. • The System should be capable to achieve the Uniform Distribution of Water to all the reservoirs/Sumps in the Network irrespective its Elevation and Distance from the Source of Supply. • The System should be capable to avoid the overflow of Reservoirs/Sumps in the Networks. • The System should be able to Operate/Isolate remotely without any Electrical Energy. • The System should be able to record and generate the report of the instantaneous and Cumulative Flow Delivered to Every Reservoirs/Sumps in the Network. • The System should be able to allow the flow to Reservoirs/ Sumps as per the Demand. • The System should be able to Operate, Monitor, Control and Manage the Water to Reservoirs/ Sumps in Complete Distribution Network without any External Electric Energy. • The System should not have any high recurring cost for Energy/Communication Cost such as GSM/GPRS/RADIO etc. 	
	<ul style="list-style-type: none"> • The System should be kept in Protective Cover Box capable of giving Vandalism Alert messages such as door open and site GPS co-ordinates. • The System should update battery status and atmospheric 	

	temp to control centre. Low battery & High temp Alert messages shall be generated to avoid the faults.	
	<p>COMPONENTS OF RESERVOIR MANAGEMENT SYSTEM (RMS):</p> <p>1. Pressure Flow Control Metering Device (PFCMD)</p> <p>The Pressure & Flow Control and Metering Device (PFCMD) shall integrate a flow meter with a diaphragm actuated hydraulic control valve equipped with suitable pilots. The PFCMD automatically performs one, two or more independent functions as per the requirements, such as Anti Draining of System, Reducing higher upstream pressure to a constant maximal downstream pressure or sustaining maximum set Flow. All functions are performed irrespective of change in upstream pressure and/or demand. Functions can easily be added or removed in a modular way. The meter accuracy is independent and not affected by the action of the valve. An adjusting screw on each pilot allows setting of the desired set-point for Pressure and Flow. The valve shall be compatible with Automation System.</p>	
	<p>I. Main Valve</p> <p>1.1 The main valve shall integrate a flow meter with a diaphragm actuated hydraulic control valve.</p> <p>1.2 The valve shall be of a Globe or Angle pattern design.</p> <p>1.3 The valve should be designed for both horizontal and vertical installation</p> <p>1.4 The valve pressure rating shall be PN16.</p> <p>1.5 Valve body shall be with flats for vertical support.</p> <p>1.6 Valve flanges shall accommodate for drilling according to various standards, such as ISO 7005-2 and ANSI B16.42.</p> <p>II. Construction Materials</p> <p>2.1. Body and cover: Cast Ductile Iron to EN 1563 or ASTM A-536.</p> <p>2.2. Diaphragm and seals: EPDM & NBR.</p> <p>2.3. Bolts and nuts: Steel.</p>	
	<p>III. Coating</p> <p>3.1 Valve body, cover and separating partition shall have a protective fusion bonded epoxy coating OR Polyester Coating.</p> <p>IV. Metering</p> <p>4.1. The metering accuracy shall not be affected by varying pressure or flow conditions.</p> <p>4.2. The integrated metering device shall have a visual flow rate indicator and flow totalling counter.</p> <p>4.3. The integrated metering device shall be equipped with, or accommodate for an electric pulse output option.</p>	

	<p>V. Control System</p> <p>5.1. The valve shall be self-contained hydraulic controlled and shall not require any Electric Power.</p> <p>5.2. The complete valve shall function normally when fully submerged.</p> <p>5.3. The control shall consist of one, two or more 2-Way adjustable pilots with a single setting spring.</p> <p>5.4. Isolating cock valves shall be installed on upstream, downstream and control chamber ports.</p> <p>5.5. The control system shall be equipped with an external "Y" shape filter. Washing the filter shall not require isolating the main valve.</p> <p>5.6. Commissioning, setting and on-site readjusting of the valve shall be simple, according to IOM directions supplied with the valve, and shall not require a manufacturer specialist.</p> <p>5.7. The valve shall be compatible with Automation System.</p> <p>VI. Service</p> <p>6.1. All valve components shall be accessible and serviceable without removing the valve from the pipeline.</p>	
	<p>6.2. The valve cover shall be removable via unfastening bolts for quick in-line inspection and service.</p> <p>VII. Testing</p> <p>7.1 Prior to shipment the valve shall be tested a complete functional test performed under dynamic conditions similar to the project specification.</p> <p>7.2. Valve will be Tested for Low Pressure Sealing of 0.8 Kg/cm².</p> <p>7.3. Valve will be Tested for High Pressure Sealing of 16 Kg/cm².</p> <p>VIII. Approvals And Certifications</p> <p>8.1. The valve manufacturer quality system shall be certified to ISO 9001-2000</p>	
i)	RMS from Leelamahal to Palani ELSR Side (3 ELSR's) for 70 LPS	3
ii)	RMS from Leelamahal to Municipal Park (1 GLSR) for 225 LPS	1
iii)	RMS from Municipal Park to Medical College GLSR Side (1 GLSR) for 225 LPS	1
7)	Water Management District	
	<p>Supply, Errection and commissioning of VMD system which should be able to control the flow as per demand to facilitate uniform Distribution of water to the consumer irrespective of its location, elevation and distance from the water source and the system should be able to record monitor and control the cumulative quantity delivered to the consumer without any external Electrical Energy and with minimum recurring cost for communication with GSM / GPRS / RADIO Etc., including all taxes and duties and following specifications.</p>	7

	<ul style="list-style-type: none"> • The System should be able to Operate, Monitor, Control and Manage the Water to Consumers in Complete Distribution Network without any External Electric Energy. • The System should be capable to achieve the Uniform Distribution of Water to all the Consumers in the Network irrespective of its Elevation and Distance from the Source of Supply. • The System should be able to record and generate the report of the Cumulative Quantity delivered to every Consumers in the Network. • The System should be able to allow the quantity to Consumers as per the Demand / Quota. • The System should have minimum recurring cost for Communication by using GSM/GPRS/RADIO etc. • The System should be kept in Protective Enclosure capable of giving Vandalism Alert 	
	<ul style="list-style-type: none"> • WMD SYSTEM should consist of PFCMD, Air valve, inlet and outlet isolation valves, pressure transmitter, solar power panel of suitable capacity with 12 V battery having 5 days back up capacity for communication, protective enclosure of IP 65 standard. <p>also following devices materials and their functions and testing.</p>	
	<p>1. Pressure Flow Control Metering Device (PFCMD) The Pressure & Flow Control and Metering Device (PFCMD) shall integrate a flow meter with a diaphragm actuated hydraulic control valve equipped with suitable pilots. The PFCMD automatically performs one, two or more independent functions as per the requirements, such as Anti Draining of System, Reducing higher upstream pressure to a constant maximal downstream pressure or sustaining maximum set Flow. All functions are performed irrespective of change in upstream pressure and/or demand. Functions can easily be added or removed in a modular way. The meter accuracy is independent and not affected by the action of the valve. An adjusting screw on each pilot allows setting of the desired set-point for Pressure and Flow. The valve shall be compatible with Automation System.</p>	
	<p>1. Main Valve</p> <p>1.1. The main valve shall integrate a flow meter with a diaphragm actuated hydraulic control valve.</p> <p>1.2. The valve shall be of a Globe or Angle pattern design.</p> <p>1.3. The valve should be designed for both horizontal and vertical installation</p> <p>1.4 The valve pressure rating shall be PN16.</p> <p>1.5 Valve body shall be with flats for vertical support.</p> <p>1.6 Valve flanges shall accommodate for drilling according to various standards, such as ISO7005-2 and ANSI B16.42.3.</p> <p>Construction Materials</p> <p>2.1. Body and cover: Cast Ductile Iron</p>	

	<p>to EN 1563 or ASTM A-536.2.2. Diaphragm and seals: EPDM & NBR.2.3. Bolts and nuts: Steel.3. Coating3.1 Valve body, cover and separating partition shall have a protective fusion bonded epoxy coating OR Polyester Coating.</p>	
	<p>4. Metering 4.1. The metering accuracy shall not be affected by varying pressure or flow conditions. 4.2. The integrated metering device shall have a visual flow rate indicator and flow totalling counter. 4.3. The integrated metering device shall be equipped with, or accommodate for, an electric pulse output option.</p>	
	<p>5. Control System 5.1. The valve shall be self-contained hydraulic controlled and shall not require any Electric Power. 5.2. The complete valve shall function normally when fully submerged. 5.3. The control shall consist of one, two or more 2-Way adjustable pilots with a single setting spring. 5.4. Isolating cock valves shall be installed on upstream, downstream and control chamber ports. 5.5. The control system shall be equipped with an external "Y" shape filter. Washing the filter shall not require isolating the main valve. 5.6. Commissioning, setting and on-site readjusting of the valve shall be simple, according to IOM directions supplied with the valve, and shall not require a manufacturer specialist. 5.7. The valve shall be compatible with Automation System.</p>	
	<p>6. Service 6.1. All valve components shall be accessible and serviceable without removing the valve from the pipeline. 6.2. The valve cover shall be removable via unfastening bolts for quick in-line inspection and service. 8. Testing 9. 7.1. Prior to shipment the valve shall be tested a complete functional test performed under dynamic conditions similar to the project specification. 7.2. Valve will be Tested for Low Pressure Sealing of 0.8 Kg/cm². 7.3. Valve will be Tested for High Pressure Sealing of 16 Kg/cm². 8. Approvals And Certifications 8.1. The valve manufacturer quality system shall be certified to ISO 9001-2000</p>	

8)	<p>Instrumentation and SCADA for the pumping system for centralised monitoring and control of essential parameters such as Levels, Flow, Pressure, Temperature, Electrical parameters etc. including all taxes and duties with following scope and confirming to relevant codes.</p> <p>1 Complete set of design and engineering documents and drawings.</p> <p>2 Field instruments with field cabling and hook-up to the field instruments, motor operated valves and control. system, inclusive of supply and installation of enclosures, housings, junction boxes and accessories.</p> <p>3 All power cables and interconnecting wiring to all items of equipment.</p> <p>4 Adequate power supply distribution and earthing cabling with lightning protection for all I&C equipment.</p> <p>5 Auto Operation of Raw Water pumps, water treatment plant and Product water pumps using PLC & HMI</p>	
	<p>6 Flow metering.</p> <p>7 Cabling between I/O cards & individual field instruments & valves.</p> <p>8 Provision for connection of the new instrumentation, flow meter and control valve signals with adequate spare I/Os</p> <p>9 Power supply is required for all the instruments and flow meters.</p> <p>10 Site Acceptance Tests (SAT).</p> <p>11 Supply of manufacturer's test certificates and tests on completion certificate.</p> <p>12 Supply of operations and maintenance manuals.</p> <p>13 Supply of as-built drawings.</p> <p>14 Supply of all documentation.</p> <p>15 Supply of spares.</p> <p>16 Supply of all specialist test equipment (if applicable).</p> <p>17 Training of Operation and Maintenance personnel.</p> <p>18 Final System Testing.</p>	
	<p>Pump House field instruments Pump house field instruments</p> <p>The field instruments and system parameters shall be monitored and controlled. They are as follows :</p> <p>1. Level transmitter for sensing the level in the pump.</p> <p>2. Pressure switches at discharge of each pump.</p> <p>3. Pump REMOTE / RUN / TRIP status and Emergency Stop.</p> <p>4. Motorized valves on discharge line of pumps and valves status indication for open / close position. (Limit switches mounted on valves not in scope of Automation system Supplier).</p> <p>5. Bladder Vessel load cell sensor weight.</p> <p>6. Pressure transmitter at discharge.</p> <p>7. Flow transmitter at discharge.</p> <p>8. Non return valve at discharge.</p> <p>9. Pumps Start / Stop commands for all the Main Pumps</p> <p>10. Valves Open / Close commands for all the motorized valves.</p> <p>11. Cooling water system Start & Stop commands.</p> <p>12.</p>	

	Main Incomer Breaker OPEN / CLOSE command.	
	<p>Following parameters shall be made available on the system.</p> <ol style="list-style-type: none"> 1. DC and AC supply OK. 2. Open / Close indication of MOV. 3. Trip circuit healthy indication. 4. Winding and Bearing Temperature of motor is fine 5. Discharge pressure is OK at delivery side of each pump. 6. Level of the sump. 7. Motor voltage, current, frequency, KWH. 8. Overall incoming voltage, current. 9. "Breaker tripped on fault" indication from each breaker. 	
	<p>Alarms</p> <ol style="list-style-type: none"> 1. Circulating with respect to pressure is not OK. 2. Hi / Low water sump level. 3. Winding and bearing temperature of motor is high if given 4. B.F.V (MOV) is not opened. 5. "Breaker tripped on fault". 6. Trip circuit unhealthy. 7. Alarms related to power supply system of the control system such as rack power supply. 8. Communication related alarms. <p>INSTRUMENTS - FIELD MOUNTED</p> <p>All outdoor instruments with LCD display shall be protected as follows:</p> <ol style="list-style-type: none"> a. The housing shall be at least triple of the transmitter size. b. The GRP box shall have a small window for meter reading and its orientation shall be to the north to minimize the effect of direct sunlight. c. Include one opening with mesh to prevent the increase of temperature inside the box. The box shall also be protected by relatively large sunshade for extra protection if needed 	
	<p>Ultrasonic Flow Meters:</p> <p>Clamp-on Sensors - Standard Type</p> <p>Temperature Range -20 +80 °C Range: DN15.. .100 Working Frequency 1. 5 MHz Range: DN50... 1000 Working Frequency 1 MHz Range: DN300... 6000 Working Frequency 0.6 MHz</p> <p>Pressure Transmitters</p> <p>Pressure transmitters shall conform to Standard Specification with the following additions or exceptions specific for this project:</p>	
	<p>Pressure Transducer Level Measuring Equipment</p> <p>Pressure Transducer Installation</p> <p>Float Switches</p> <p>Pressure Switches</p> <p>Control and Interposing Relays</p>	

	<p>SPECIFICATIONS OF FIELD CONTROL UNIT FOR REMOTE CONTROL AND MONITORING:</p> <p>The field control unit shall be able to control and monitor the required parameters from Control Centre with the help of licence free radio frequency or GPRS system.</p> <p>Remote Control Centre</p> <p>The remote Control Centre shall provide a management tool for controlling all the reservoirs, outlets, VTC and WMD in the water network. Remote control station will have developed application so that user can monitor and control each outlet from any place.</p> <p>System configuration:</p> <ul style="list-style-type: none"> • The Remote Control Centre shall be able to configure system's parameters for optimal operation. • The user shall be able to define all field Units and their associated configurations, 	
	<p>The user shall be able to define all software application functionality and download (send) the data to the field units, in order for them to perform the on-site function.</p> <ul style="list-style-type: none"> • The user will be able to upload the existing data from the field units in order to monitor the entire system. • The Control Centre shall provide the ability to analyze every level of single element characteristics (i.e. Input/Sensor, Output/Pump etc.) at each site. 	
	<ul style="list-style-type: none"> • The user will be able to monitor site conditions like inside panel temperature, Battery Voltages, GSM/Radio signal strength. • The user will be able to monitor the Panel door status at centralManagement tools: • Historical trends views and Events/Alarms logging. • Interface to third party database , SCADA and communication systems such as SMS, paging alarms and weather stations • Time based and/or Volume based Weekly Auto schedule will be stored into the controllers / HMI • Onsite Critical alarms and events are sent by email /SMS to user given email ID or mobile nos. 	
	<p>Part of the Remote Control Centre a Zonal Field Control Unit (ZFCU).</p> <ul style="list-style-type: none"> • The ZFCU shall provide communication capabilities and interface between the Remote Control Center and Field Control unit which is on the site. • The ZFCU shall have the ability to perform "regular" Field Control Unit's functionalities, such as monitoring sensors or activating pumps, in addition to its ZFCU functionalities. • As part of the Control Center a front end (FEP) is requested (HW and/or SW) enabling the communication between the Control Center and the Field Control Units. • The Control Centre shall be able to interface with various software applications (third party), such as weather stations, and other management SW packages. 	

	<p>The Remote Control Centre shall be able to execute and support the following features :</p> <ul style="list-style-type: none"> • Displaying the entire data of Field Control Unit such as, flow rate/accumulated flow, and total time of operation, balance time in the form of tables and graphical screens • Displaying Field Control Unit's events and alarms and ability to report them utilizing SMS technology. 	
	<p>Display the communication healthiness of field units.</p> <ul style="list-style-type: none"> • The user shall be able to change valve operation timings, from the graphical screens • The user shall be able to operate valve from the graphical screens • Shall be able to call the Downloading and Uploading data from the Field Control Units • Shall allow the quantity of water as per the Demand set by the operator. • Shall have a program to design and display an event report for each outlet in the water network. • Shall have a program to calculate the predicted flow load, over the hydraulic system. • Shall have a program for displaying sensors data historical trends and alarms. • Shall have an Off-Line program for the Field Units in addition to the current run time unit's program. 	
	<p>Radio / GPRS communication Network</p> <p>The Radio/GPRS communication network shall be able to make the communication link between the remote control Centre and outlets/ Reservoir with conventional (865-867MHz licenses free) frequency or using GPRS network.</p> <p>The communication protocol shall be able to support multiple logical channels per physical port, enabling simultaneous Central-to-Field Control Unit and Field Control Unit -to-Field Control Unit sessions.</p> <p>The communication protocol shall be able to support the following messaging methods: Burst (also known as Contention) - this is transmission upon change of state. Polling (also known as Interrogation) - automatically or manually request for data updating. Report by Exception - the unit shall only report data that have changed since the last poll.</p>	
	<p>HMI CUM PLC Controllers</p> <p>GENERAL FEATURES:</p> <ol style="list-style-type: none"> 1. The PLC CPU shall collect data, perform process control functions, communicate with other PLCs, and distribute process information along the local area network. 2. The PLC & HMI shall be able to have its program downloaded from a remote workstation over the local area network, and be locally programmed from a portable laptop 	

	<p>computer.</p> <p>3. The executive firmware of all intelligent modules shall be stored in Flash memory and can be updated in the field using standard programming tools</p> <p>4. The PLC shall have provisions for communicating unsolicited messages (report by exception) to an operator interface to reduce network traffic.</p> <p>5. The PLC shall be field expandable to allow for the expansion of the system by the simple addition and configuration of hardware.</p> <p>6. All cables and connectors shall be as specified by the manufacturer. Cables shall be assembled and installed as per the manufacturer's recommendations.</p>	
	<p>7. The PLC shall utilize Ethernet protocols that meet the following:</p> <p>a) Protocols that are assigned to port 502 of the TCP/IP stack by the IANA (Internet Assigned Numbers Authority).</p> <p>b) Devices must be able to utilize embedded web pages, or a physical means such as DIP switches, to be recognized and properly addressed on the network. Ethernet protocols that require network management software, or utilize configuration files.</p>	
	<p>Other than that system shall have following features:</p> <ul style="list-style-type: none"> • Access Level Password protection. • Maintenance Routine using Calendar function - RTC. • Energy log & Energy management. • Alarm Logging. • Back of program & reinstallation of program using SD Card. • Frequency control via MODBUS RTU protocol. • Data access by SCADA using OPC server. • Web server in built for web monitoring. • Data export to PC using DATA EXPORT software. • Customized screen & logo during boot-up & programming. • ActiveX & .Net communication driver. 	
	<p>Testing and Commissioning:</p> <p>All equipment, including panels, consoles, pillars and all separate items shall be subject to inspection and full function test at the manufacturer's works. All equipment, sequences, programs and the like shall be proved and demonstrated to the Engineer as being in accordance with the application requirements.</p> <p>Test certificate including characteristics covering the full operating range of measured variable against output signal, shall be provided for all instruments or sets of equipment measuring primary quantities.</p> <p>Site testing shall include demonstration of the satisfactory operation of each system individually and the complete</p>	

	<p>system as a whole, before the start-up of main plant commissioning.</p> <p>The Contractor shall ensure and demonstrate that all items of equipment incorporating any form of variable setting (level electrodes, float switches, transmitters, trip amplifiers, meter relays, controllers, timer etc) have been adjusted to achieve optimum control of the process or plant operation.</p>	
	<p>INSPECTION & TESTING</p> <p>All factory tests will be witnessed by the department.</p> <p>The department shall have free entry and access at all phases of the project to all parts of contractor's facilities associated with manufacturing and testing of system. The equipment will not be shipped before they have been officially released in the form of release notes by department. The contractor shall provide the department with all reasonable facilities necessary to determine compliance to the system specification.</p> <p>The contractor shall note that acceptance of the equipment's and the system by department or exemption of inspection & testing shall in no way absolve the contractor of his responsibility to deliver the system meeting all the requirements specified in the specification. Contractor shall be responsible till the completion of the warranty, for any corrections/ modifications including supply and implementation of hardware & software to fulfil the requirements of the contract/ up gradation including supply and implementation of hardware & software to meet the functionality and performance of the contract. Contractor personnel shall be actively involved during factory acceptance and site acceptance testing.</p>	
	<p>Testing shall concern HMI Panel equipment's at all stations including PLC. The tests shall consist of:</p> <ul style="list-style-type: none"> • Factory Acceptance Testing (FAT) • Site Acceptance Testing (SAT) • Test Run <p>The contractor shall submit to department detailed test plans and procedures, one month prior to actual testing for all factory and site acceptance tests for review.</p>	
	<p>Factory Acceptance Testing (FAT): On line testing, Commissioning: Prior to SAT, all PLC shall be tested online by contractor, when all the MCS hardware & software w.r.t. SCADA system have been successfully tested, with regard to correctness of complete database using plant simulator, remote diagnostics, proper representation of all PLC data on</p>	

	<p>graphics, alarms, trending, reports etc., checking of operation of various control commands i.e. valves open/close and permissive etc., complete checking and testing of signals from PLC Cabinets (including FCs to PLC), checking of field values, field device status, controls of field devices and set points from MCS . During PLC online testing, Contractor shall ensure to establish fully functional serial interfaces with flow computers / PLCs / IEDs for transfer of data with them to meet the complete functionality. Complete checking and testing of signals and PLC I/O database points from PLC cabinets to PLC, testing of serial interfaces with flow computers & PLCs shall be included in the on-line testing of PLC. Prior to SAT, the activities of installation, PLC on-line</p>	
	<p>testing and Commissioning shall be performed by Contractor by following their Department standard & established practices & procedures to ensure that good techniques and Test Run. Test for continuous functional operation of the system with the required system reliability and availability. This test aims at keeping the complete integrated system operation for a period of 5 days for all the 24 hours a day. In case of failure, the tests will be restarted till the system operates without failure of any system functionality for 5 days. Failure of tests shall be limited to such system failures which will affect system availability & reliability and shall not be dependent upon established failure of third party supplied items. Department shall have the right to reject the complete system or part thereof in the event of the acceptance tests failing in two attempts.</p> <p>The 'Test Run' will be carried out after successful SAT, duly witnessed by department. The observations, exceptions and test results obtained during the test run shall be documented and produced in the form of a report by the contractor within seven days of the completion of Test Run which shall be subsequently reviewed / approved by department within ten days of submission of test report by contractor. All the SCADA systems providing at the individual stations should be able to be integrated and all the required data shall be displayed at a selected centralized monitoring station for effective maintenance of the entire system.</p>	
i)	AT KP CANAL	1
ii)	AT RAMAPURAM	1
iii)	AT MD Puttur	1
iv)	AT Mangalam	1
v)	AT Municipal Park	1

9	Civil works for replacement of pump sets, Errection Bladder Vessel, Surge Suppression Valve, Air Management System, District Metering, including Earth Work Excavation, Concrete Platform & Foundation for above all equipment's etc., Complete	1
10	Hiring of vehicles for supervision and maintenance 2 Nos x 24000x9 Months	1

BIDDING DOCUMENT -VOLUME 1

SECTION	DESCRIPTION	PAGE NOS.
SECTION I:	Instruction to Bidders	
SECTION II:	General Conditions of Contract	
SECTION III:	Special Conditions Of the Contract.	

Section – I - Instruction to Bidders :

Description of the works:

Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.

2. Source of funds

Expenditure of this project will be met from Govt., of AP Funds.

Period of Completion : 9 Months

3. The eligibility criteria for the above EPC Tender is as follows:

1. Civil Contractors/Contracting firm having registration with Government of Andhra Pradesh in appropriate eligible class as per the G.Os specified.
 - (i) G.O.Ms.No.178, I&CAD (PW-COD) Dept., dt: 27.9.1997.
 - (ii) G.O.Ms.No.132, TR&B (R.1) Dept., dt: 11.8.1998.
 - (iii) G.O.Ms.No.8, TR&B (R1) Dept., dt: 8.1.2003.
 - (iv) G.O.Ms.No.94, I & CAD (PW-COD) Dept., dt: 1.7.2003 are only eligible.
- 2(a). The bidder should furnish 'U' form obtained from the Principal manufacturers, double chamber Y pattern valves, DI air valves, control valves and as per the above deliverables where ever required and ISO 9001 Certification for pumping machinery.
- (b). Bidder should have MOU with manufactures/provided of surge protection system with bladder vessel technology.
- (c). In case of Manufacturers who participate in tenders, supposed to furnish / upload manufacturing license from the authority concerned.
- 3 The bids are limited to those individuals, firms, companies who meet the following qualification and the eligibility requirements and here in after referred to as bidder.
4. Joint ventures is allowed not exceeding maximum of 2 partners.
5. Bidder / joint ventures partners should have experience of supply, erection and commissioning in any water supply scheme of amount not less than Rs.945.00 Lakhs as per the deliverables.

4. Technical Requirement:

b) The Bidder as a Prime Contractor should have executed the following minimum quantities in any one financial year during the last ten Financial Years ending with 31-03-2015.

1. Pumping Machinery

Centrifugal pumps/ Vertical Turbines:

Should have supplied erected and commissioned Centrifugal / Vertical Turbine pumps with suitable motor of not less than 2 Nos having discharge 637 LPS, Head 32 mts, 2 no of 410 LPS with head of 55 mts or equivalent KW Pumps / Mortors.

4. Bladder Vessels

Should have supplied, erected and commissioned Bladder vessel(s) for surge protection with necessary accessories of total capacity of 50 cum, each of capacity not less than 10 cum

5. SCADA & Automation-

Should have supplied and installed the required SCADA system with all required components at minimum of 3 places / locations in any of the similar projects.

Note: - Proportionate Quantities will be considered, if the project is executed spanning over more than one financial year.

b) The bidder should enclose experience certificates in support of technical criteria issued

by the Engineer – In - charge of the State / Central Government departments / Undertakings not below the rank of Executive Engineer or Equivalent and countersigned by the next higher authority not below the rank of

Superintending

Engineer or equivalent.

5. Financial Requirement:

a. The bidder as a prime contractor should have executed similar type of project costing not less than **Rs. 945.00 Lakhs in any one financial year during the last ten financial years updated by giving 10% simple weight age per year to bring them to 2014-15 price level.**

b. The bidder should produce liquid asset / credit facilities / Solvency certificates from any Indian Nationalized / Scheduled Banks of value not less than **Rs.473.00 Lakhs**.

c. Assessed available Bid capacity as per formula (2AN-B) should be greater than internal Bench mark value assessed by the Department.

A= Maximum Value of Civil Engineering works executed in any one financial year during the last ten financial years (updated 2014-15 price level) taking into account the completed as well as works in progress.

N= Number of years prescribed for completion of the works for which tenders are invited.

B=Value of existing commitments and ongoing works to be completed during the period of completion of the project for which tenders are invited.

d. The bidder should furnish the availability (either owned or leased) of following key and critical equipment required for the work.

1. Cranes for erection of equipment pumping machinery, valves and vessels – 3 Nos.

2. JCB / Hitachi - 2 Nos.

3. Water Tanker – 2 Nos.

4. Tractor / Tippers – 3 Nos.

5. Concrete Hopper miller – 1 No.

e. The bidder should furnish the availability of following key personnel.

1. Graduate Engineers – 2 Nos.

2. Diploma Engineers – 2 Nos.

f. The bidders should furnish the particulars of quality control testing Lab owned, or tie up with established quality control testing laboratories.

g. The bidder should furnish the Income Tax Pan and submission of latest Income Tax return along with proof of receipt.

h. The bidder should furnish the VAT Registration Certificate and Latest VAT Clearance certificate.

Note: - The Internal Bench Mark (IBM) is arrived based on the probable quantities indicated in the deliverables.

The Scope, Deliverables, IBM Value and Eligibility Criteria for the NIT are submitted before the committee for approval and committee approved the same.

Technical evaluation will be done only based on the documents uploaded on the e-procurement platform as per G.O.M.S.No.94, I&CAD, Dt::01-07-2003 and subsequent G.O.s issued from time to time by the Government.

4. **Cost of tendering**

The bidder shall bear all cost associated with the preparation and submission of his tender and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the tendering procedure.

5. **Site Visit**

The bidder is strongly advised to visit and examine the site of work and its surroundings. He shall acquaint and obtain himself at his own responsibility all relevant information such as existing utilities including underground services, availability of labour, basic material, water, electricity etc, that may be necessary for preparation of the tender. A declaration to this effect will have to be signed by the bidder in his tender.

6. **Content of tendering documents**

- a) The tender document issued for the purpose of this tender is in two parts Technical Bid and Financial Bid. Technical Bid contains Volume-I & Volume-II and Financial Bid is in Volume-III.
- b) Bidder is expected to examine carefully all instructions, conditions, terms, specifications and drawings in the standard tender document viz. Technical Bid and Financial Bid, Technical Bid contains Volume-I & Volume-II and Financial Bid is in Volume-III. Failure to comply with the requirements of tender stipulations will be at the bidders risk. Pursuant to **clause 23**, the tenders which are not substantially responsive to the requirements of this tender will be rejected.

7. **Clarification of tender documents (Not used)**

In case any clarification is required by the bidder, he may obtain it personally or in writing well in advance from the Employer. Clarification for which written request has been received at least 3 days prior to pre-bid meeting only will be answered.

8. **Amendments to tender document**

At any time prior to the dead line for submission of tender, the employer may for any reason whether at his own initiative or in response to a clarification requested by a prospective bidder modify the tender document by issuance of

an addendum. The addendum will be kept in website www.eprocurement.gov.in one week prior to date of submission of bid.

9. **Language of the documents**

The language of tender shall be English.

10. **Documents comprising the tender**

The tender to be prepared by the bidder shall comprise of the form of tender and appendices thereto, the Bid Security, the information on technical man power to be available on this work, the contractors alternative technical proposals based on scope of work as defined in Volume II, design criteria, soil data and other such relevant information and any other material required to be completed and submitted in accordance with the instructions to bidders embodied in tender document. The forms and the data provided in this document shall be used without exception.

The Technical Bid shall comprise of the following:

- a. Scanned copy of EMD
- b. Scanned copy of Registration
- c. Scanned copy of Proof of Experience
- d. Data Sheet-1 – Bidder’s Appreciation of the Project
- e. Data Sheet-2- Bidder’s Organizational setup for the Project
- f. Data Sheet-3 – Project Components along with Drawings
- g. Data Sheet-4- Management of Design and Engineering Services
- h. Data Sheet-5 – Construction Methodology of different components proposed
- i. Data Sheet-6 – Proposed Deployment of Key Personnel
- j. Data Sheet-7 - Proposed Deployment of Construction Equipment
- k. Data Sheet-8- Proposed Sub-Contractors
- l. Data Sheet-9- Proposed Source of Key Materials
- m. Data Sheet-10- Proposed Construction Schedule of the Project
- n. Data Sheet-11 – Quality Control and Assurance System

11. **Tender prices**

- i. The bidder shall quote his offer on form of tender Volume III as Lump sum at appropriate place of the tender document to be submitted as per procedure set in **clause 17**. The Bidder shall quote further breakdown of Lump sum costs in **Annexure – I, Volume III**. The bidder shall also quote unit prices in **Annexure II, Volume – III**. Negotiations are not permitted at

any stage in respect of price bid. The additions & deductions will be worked out based on the **Annexure – II**.

- ii. The lump sum price quoted by the bidder shall include all the costs towards designing, executing and completing the works as per defined scope of work and based on design criteria. The lumpsum offer shall provide for all superintendence, labour, material, plant, equipments and all other things required for work including all taxes, VAT, duties, royalties, octroi and such other charges except for the exceptions provided for in the contract.
- iii. In addition to L.S. Price the bidder are also to quote unit prices as an **Annexure – II & III** which shall be reviewed and approved by the employer.

12. **Tender validity**

Validity of the tender will be **120 days** from the date fixed for opening of the tenders and thereafter until it is withdrawn by notice in writing duly addressed to the authority opening the tender. Such withdrawal after 120 days shall be effective from the date of receipt of notice by the Employer.

13. **Earnest money deposit, its forfeiture and penal action**

13.1 The bidder shall furnish as a part of his tender Bid Security for

Rs. 14,16,800/- (Rupees Fourteen Lakhs Sixteen thousand Eight Hundred only) valid for 90 days from the date of bid.

13.2 The Bid Security to be furnished shall be in the form of Demand draft/Bankers Cheque (Valid for 90 Days) in Favour of **PAO, TGP, Tirupati** /Bank guarantee obtained from any scheduled commercial Bank/ Nationalized Bank as per the proforma given (Irrevocable unconditional bank guarantee valid for 180 days) drawn in favour of **Superintending Engineer, Public Health Circle, Nellore**. The format of Bank Guarantee is given as **Annexure B (Vol. IV, Section XII, Model forms)**.

13.3 Any tender not accompanied by the Bid Security will stand rejected.

13.4 In the event of the tender being accepted subject to provisions of the **sub clause 13.5** below, the said amount of bid security, if so requested by the bidder be appropriated towards the amount of performance security deposit payable by him under the conditions of contract.

13.5 “Forfeiture of Bid security”: If after submitting the tender, the bidder withdraws his offer or modifies the same or if after acceptance of his tender fails or neglects to furnish the Performance security, without prejudice to any rights and powers of the Employer here under or in law, the employer shall be entitled to forfeit the full amount of Bid Security deposited by the bidder. The employer shall also have right to forfeit the full amount of Bid security if the contractor fails to submit the performance guarantee (as per clause 2.8.1) within 21 days from the receipt of LOA issued pursuant to clause No.27.0.

13.6 In the event of tender being not accepted the amount of Bid Security deposited by the bidder, shall unless it is prior thereto to forfeit under provisions of sub clause 12.5 above, be refunded to him on passing of receipt thereto without any interest.

14. **No Variations in tendering conditions**

The bidders are hereby instructed to not to alternate any changes in the bidding documents. If any changes are made by bidder it shall be treated as tampering of documents and the bid shall be summarily be rejected.

15. **Pre-tender meeting**

15.1 A pre tender conference open to all prospective bidders will be held at O/o the Superintending Engineer, Nellore wherein the prospective bidders will have an opportunity to obtain clarifications regarding the tender conditions and the work. For this, only questions received in writing 3 days prior to the pre tender meeting shall be clarified in writing.

15.2 The prospective bidders are free to ask any additional information or clarification in writing and reply to the same will be given in writing. Minutes of the meeting including copies of the questions raised and the replies given will be furnished to all those attending the meeting (subsequently to all the bidders). Any modifications of tender document which may become necessary as a result of pre tender conference shall be through issuance of an addendum pursuant to **clause 7** of these instructions.

16. **Format and signing of tenders**

16.1 The bidder shall prepare only one copy of the documents comprising the bid as described in **Clause 12** of these Instructions to Bidders.

16.2 The bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the bidder.

16.3 The bid shall contain no alterations, omissions or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case all such corrections shall be initialed by the person or persons signing the bid.

16.4 All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be printed below their signatures.

17, **Submission of tenders**

(a) Bidders need to contact the Superintending Engineer, Public Health, **Nellore** for information on e-procurement.

(b) Bidders need to register on the electronic procurement market place of Government of Andhra Pradesh i.e., "www.eprocurement.gov.in". On registration on the e-Procurement market place they will be provided with

a user ID and password by the system using which they can submit their bids online.

- (c) While registering on the e-procurement market place, bidders need to scan and upload the required documents as per the tender requirements on to their profile.
- (e) Steps for registration and submission of bids are described in detail in the “Bidders Training Booklet” available at the above web site.

18. **Tender opening**

Tender opening will be as per the e-procurement procedures.

19. **Process to be confidential**

After opening of the tenders publicly information relating to the examination, clarification, evaluation and comparison of tenders and recommendations concerning the award of contract shall not be disclosed to the bidders or other persons not officially concerned with such process until the award of the contract to successful bidder has been announced.

Any effort by a bidder to influence the employer in process of examination clarification evaluation comparison of bids and in decision concerning the award of contract may result in rejection of tender.

20. **Clarification of tenders**

To assist in examination, evaluation of tenders the employer may ask bidders individually for clarification of their offer including break down of costs, reasons in case of very high/very low offer. Such request shall be in writing and the response shall also be in writing.

21. **Tender liable for rejection**

The tender is likely to be rejected if on opening it is found that –

- a) The bidder has not strictly followed the procedure laid down for submission of tender.
- b) The bidder has proposed conditions which are inconsistent with or contrary to the terms and conditions specified.
- c) Additions, corrections or alteration are made by the bidder on any page of the tender document.
- d) Any page or pasted slips are missing.
- e) The bidder has not signed the tender.
- f) The bidder has specified any additional condition.
- g) The bidder has not attached the addendum to the main tender form as stated in para 7.

- h) In case the technical proposal of bidder who has quoted lowest price and who has satisfied other criteria is not conforming to the stipulations made, the bidder without revising the cost shall modify the same to conform to the stipulations. If the bidder refuses to modify this then the tender shall be treated as non responsive and rejected.
- i) The bidder has quoted financial offer anywhere other than specified in Financial Bid.

22. Correction of errors

If there is any discrepancy between the offer quoted in figures and in words, the rate quoted in words will be treated as the offer.

23. Evaluation and comparison of tenders

The Superintending Engineer will evaluate whether each tenderer is satisfying the eligibility criteria prescribed in the tender document and declares them as a qualified tenderer.

If the technical bid of a tenderer is not satisfying any of the eligibility criteria it will be rejected by the Superintending Engineer. However, the tender accepting authority detects any error in the evaluation of tenders by Superintending Engineer, the tender accepting authority while returning the tenders may direct the Superintending Engineer or Chief Engineer as the case may be, to re-evaluate the tenders.

If any alteration is made by the tenderer in the tender documents, the conditions of the contract, the drawings, specifications or statements / formats or quantities the tender will be rejected.

24. Award criteria

Subject to clause 23, the employer will award the contract to a bidder whose tender has been found to satisfy all requirements of tender document and who has offered the lowest price.

25. Department's right to accept any tender and to reject any or all tenders

Not with standing the clause 24, the employer reserves the right to accept or reject any tender and to annul the tender process and reject all the tenders at any time prior to award of contract without there by incurring any liability to the affected bidders or any obligation to inform affected bidder/s of the grounds for employer's action.

26. Notification of award.

Prior to the expiration of tender validity period or any such extended period, the employer will notify the successful bidder in writing by a registered letter that his tender has been accepted. This letter (herein after and in conditions of contract called letter of acceptance) shall name the sum which the employer will pay to the Contractor in consideration of the execution, completion and

maintenance of the work by the Contractor as prescribed in the Contract. This notification of award will constitute formation of contract.

Upon furnishing the performance security by the successful bidder in accordance with the **clause 27** the order to start work will be given. The work order shall be accompanied by a true copy of the agreement bearing the number under which it is registered in the office of the Superintending Engineer, Public Health, Nellore.

27. Performance guarantee

The successful bidder whose tender has been accepted will have to pay balance of 1.5% with a total of (1%+1.5%) 2.5% of accepted tender amount as performance security in any of the following forms.

The performance guarantee shall be either in the form of demand draft drawn in favour of **PAO, TGP, TIRUPATI** or in the form of bank guarantee issued by a Nationalized Banks of India or any scheduled Bank in favour of **Superintending Engineer, Public Health Circle, Nellore.** The period of validity for the performance security shall be up to the end of the Defect liability period of **24 Months** after the completion of work.

28. Signing of agreement

Upon furnishing the Performance guarantee the contractor will be invited to conclude the agreement.

VOLUME - I

Section – II : GENERAL CONDITIONS

1. Definitions:

Sub-clause 1.1

- a) The Employer is the Public Health and Municipal Engineering Department represented by the Engineer-in-Chief (PH).

Address : O/o the Engineer-in-Chief(PH),
A.C. Guards,
Hyderabad – 500 004.

E-mail: : **enc_pubhealth@ap.gov.in**

Website: : **www.appublichealth.gov.in**

Telephone Number : 040 -23316841

Fax No : 040-23393371

- b) The “Engineer” is Executive Engineer or any authorized representative.

The following additional words and expressions shall have the meanings assigned to them, except where the context otherwise required:

- i. Authority or Department shall mean the successors in office and assigns.
- ii. The "Engineer-in-Chief" shall mean the Engineer-in-Chief (Public Health).
- iii. The "Superintending Engineer" shall mean the Superintending Engineer (Public Health), Nellore who is designated as such for the time being, in whose jurisdiction the works lies.
- iv. The "Executive Engineer" shall mean the Executive Engineer (Public Health), Tirupati who is designated as such for the time being, in whose jurisdiction the works lies.
- v. The “Engineer” shall mean Executive Engineer or any authorized representative who is the consultant to the department appointed by the employer to perform the duties and responsibilities of the consultant in supervising the contract.
- vi. The “Engineer’s representative “means the project manager appointed / nominated by the Engineer, who is consultant to the department to perform the duties and the responsibilities of the engineer in supervising the contract.
- vii. A "Day" shall mean a day of 24 hours from midnight to midnight irrespective of the number of hours worked in that day.

- viii. A “Week” shall mean 7 consecutive days without regard to the number of hours worked in any day in that week.
- ix. The “Site” shall mean the lands and /or other places, on under, in or through which the work is to be executed under the Contract including any other lands or places which may be allotted by the Department or used for the purpose of Contract.
- x. “Urgent Works” shall mean any measures which, in the opinion of Engineer becomes necessary during the progress of the work to obviate any risk or accident or failure or which becomes necessary for security of the work or the persons working thereon.

Clause 2

Engineer’s Duties

Sub-Clause 2.1(d) The Engineer shall obtain the specific approval of the Employer in respect of the following:

- a. Approving subletting of the Work
- b. Granting claims to the Contractor
- c. Ordering suspension of the work
- d. Determining an extension of time
- e. Waiving off the penalty and arranging the repayment of compensation for delay
- f. Issuing of Variation Order
- g. Ordering any work/test beyond the scope of the Contract
- h. Determining rates for the extra items /extra work
- i. Any variations in the contract condition
- j. Approval to designs and working drawings

Duties of the Engineer’s Representative

Sub Clause 2.7

The duties of the Engineer's Representative are to watch and supervise the work and to test and examine any materials to be used or workmanship employed in connection with the Works

2. Interpretation:

- 2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female, and vice-versa. Headings have no significance. Works have their normal meaning under the language of the contract unless specifically

defined. The Engineers-in-charge will provide instructions clarifying queries about the conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

- 1) Agreement
- 2) Letter of Acceptance, notice to proceed with the works
- 3) Scope of work and drawings
- 4) Special Conditions of contract
- 5) General Conditions of Contract
- 6) CPHEEO manual on Water Supply and treatment
- 7) B.I.S. codes on HDPE / GRP pipes and their laying and other relevant BIS codes applicable to the work.
- 8) Technical Proposal of the contractor duly accepted by employer
- 10) L.S. Price Bid.
- 11) Any other document listed as forming part of the Contract.

3. Engineer-in-Charge's Decisions:

3.1 Except where otherwise specifically stated, the Engineer-in-charge will decide the contractual matters between the Department and the Contractor in the role representing the Department.

4. Delegation:

4.1 The Engineer-in-charge may delegate any of his duties and responsibilities to other officers and may cancel any delegation by an official order issued.

5. Communications:

5.1 Communications between parties, which are referred to in the conditions, are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act)

6. Sub-contracting:

6.1 If the prime contractor desires to sub-let a part of the work, he should submit the same at the time of filing tenders itself or during execution, giving the name of the proposed Sub-contractor, along with details of his qualification and experience. The Tender Accepting Authority should verify the experience of the Sub-contractor and if the Sub-contractor satisfies the qualification criteria in proportion to the value of work proposed to be sub-let, he may be permitted subject to the approval of Engineer –in-Chief (PH), Hyderabad. The total value of works to be awarded on sub-letting shall not exceed **50%** of contract value.

The extent of subletting shall be added to the experience of the sub-contractor and to that extent deducted from that of the main contractor.

- 6.2 The Agency shall submit the names of their representatives who will be supervising the work along with their photo ID card to the department within a month from the date of entering into agreement. Further, in case of change in the personnel the same shall be intimated to the department, a week in advance. If other are found to be executing / supervising the work, such work will be treated as a work let out unauthorizedly.
- 6.3 If it is found that the agency has sub-let the work unauthorizedly, the agency shall be black listed and barred from participating in bidding for Government works for a period of six years.
- 6.4 Recognition of unauthorized sub letting may be based on reports of V&E Department or any officer above the rank of Executive Engineer.
- 6.5 On receipt of such a report, the agreement concluding authority shall call for an explanation from the agency fixing a time limit not exceeding 30 days. If no reply is received within the time limit, it will be deemed that the agency has no explanation to offer and orders shall be passed black-listing the agency by the Government as per G.O.
- 6.6 If a reply is received, the reply shall be examined and an order after giving due to consideration to the reply shall be passed by the Government.
- 6.7 A contracting firm shall also be black listed it is found that the firm has a person as partner / director who is also a partner / director in a black –listed firm.

7. Other Contractors:

- 7.1 The Contractor shall cooperate and share the Site with other Contractors, Public Authorities, Utilities, and the Department. The Contractor shall also provide facilities and services for them as directed by the Engineer-in-charge.

8. Personnel:

- 8.1 The Contractor shall employ the required Key Personnel named in the Schedule of Key Personnel to carry out the functions stated in the Schedule or other personnel approved by the Engineer-in-charge. The Engineer-in-charge will approve any proposed replacement of Key Personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.

- 8.2 Failure to employ the required technical personnel by the contractor the following amounts will be recovered from the contractor over and above the provision made in Schedule-B from the contractors bills.
- 8.3 The technical personnel should be on full time and available at site whenever required by Engineer in Charge to take instructions.
- 8.4 The names of the technical personnel to be employed by the contractor should be furnished in the statement enclosed separately.
- 8.5 If the contractor fails to employ technical personnel the work will be suspended or department will engage a technical personnel and recover the cost thereof from the contractor
- 8.6 If the **Employer/Employer's Representative** asks the Contractor to remove a person who is a member of Contractor's staff or his work force stating the reasons the Contractor Shall ensure that the person leaves the site forthwith and has no further connection with the work in the contract.
- 8.7 **The List of Key Personnel to be deployed on this project is mentioned in Annexure – A.**

9. Contractor's Risks:

- 9.1 All risks or loss of or damage to physical property and of personnel injury and death, which arise during and in consequence of the performance of the Contract are the responsibility of the Contractor.

10. Insurance:

- 10.1 The Contractor shall provide, in the joint names of the Department and the contractor, insurance cover from the Start Date to the end of the Defects Liability Period i.e., 24 months after completion for the following events, which are due to the Contractor's risks.

- b) Loss of or damage to the Works, Plant and Materials;
- c) Loss of or damage to the Equipment;
- d) Loss of or damage of property in connection with the Contract; and
- e) Personal injury or death of persons employed for construction
- f) Professional liability insurance: The Contractor shall affect professional indemnity insurance, which shall cover the risk of professional negligence in the design of the works. This insurance shall be for a limit of not less than **Rs. 20.00 lakhs**. The Contractor shall use his best endeavor to maintain the professional indemnity insurance in full force and effect until defect liability period. The Contractor undertakes to notify the Employer promptly of any difficulty in extending, renewing or reinstating this insurance.

- 10.2 Policies and certificates of insurance shall be delivered by the Contractor to **Employer/Employer's Representative** at the time of concluding Agreement. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred.
- i) The contractor shall furnish insurance policy in force in accordance with proposal furnished in the Tender and approved by the Department for concluding the agreement.
 - ii) The contractor shall also pay regularly the subsequent insurance premium and produce necessary receipt to **Employer/Employer's Representative**, well in advance.
 - iii) In case of failure to act in the above said manner the department will pay the premium and the same will be recovered from the Contractors payments.
- 10.3 Alterations to the terms of insurance shall not be made without the approval of **Employer/Employer's Representative**.

11. Site Inspections:

- 11.1 The contractor should inspect the site and also proposed quarries of choice for materials source of water and quote his percentage including quarrying, conveyance and all other charges etc.

12. Contractor to Construct the Works:

- 12.1 The **Contractor** shall construct and Commission the Work in accordance with the specifications and Drawings.

13. Diversion of streams / Vagus / Drains.

- 13.1 The contractor shall at all times carry out construction of cross drainage works in a manner creating least interference to the natural flow of water while consistent with the satisfactory execution of work. A temporary diversion shall be formed by the contractor at his cost where necessary. No extra payment shall be made for this work.
- 13.2 No separate payment for bailing out sub-soils, water drainage or locked up rain water for diversion, shoring, foundations, bailing of pumping water either from excavation of soils from foundations or such other incidental will be paid. The percentage to be quoted by the contractor are for the finished item of work in situ and including all the incidental charges. The borrow pits are also to be de-watered by the contractor himself at his expense, if that should be found necessary.
- 13.3 The work of diversion arrangements should be carefully planned and prepared by the contractor and forwarded to the Executive Engineer technically substantiating the proposals and approval of the Executive Engineer obtained for execution

- 13.4 The contractor has to arrange for bailing out water, protection to the work in progress and the portion of works already completed and safety measures for men and materials and all necessary arrangements to complete the work.
- 13.5 All the arrangements so required should be carried out and maintained at the cost of the contractor and no separate or additional payments is admissible..
- 13.6 Coffor Dams.

Necessary coffer dams and ring bunds have to be constructed at the cost of contractor and same are to be removed after the completion of the work at the discretion of the department

14. Power Supply.

- 14.1 The contractor shall make his own arrangements for obtaining power from the Electricity dept., at his own cost. The contractor will pay the bills of Electricity Department for the cost of power consumed by him.
- 14.2 The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act 1910 and under Rule-45 (I) of the Indian Electricity Rules, 1956 as amended from time to time and other pertinent rules.
- 14.3 The power shall be used for bonafide departmental work only.

15. Temporary Diversions (Works on Highways/Municipal Roads)

- 15.1 The contractor shall at all times carryout work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all works involving improvements to the existing highway, the contractor shall in accordance with the directions of the Engineer-in-charge provide and maintain during the execution of the work a passage for traffic, either along a part of the existing carriage way under improvement or along a temporary diversion constructed close to the highway.
- 15.2 If in the opinion of the **Employer/Employer's Representative**, it is not possible to pass the traffic on part width of the carriageway for any reason, a temporary diversion close to the highway shall be constructed as directed. It shall be paved with the materials such as hard moorum, gravel and stone, metal to the specified thickness as directed by **Employer/Employer's Representative** . In all cases, the alignment, gradients and surface type of the diversion including its junctions, shall be approved by the **Employer/Employer's Representative** before the highway is closed to traffic..
- 15.3 The contractor shall take all necessary measures for the safety of traffic during construction and provide erect and maintain such barricades, including signs, markings, flags lights and information and protection of traffic approaching or passing through the section of the highway under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic on the highway shall be drawn up in consultation with the **Employer/Employer's Representative**.

15.4 The barricades erected on either side of the carriage way portion of the carriage way closed to traffic, shall be of strong design to resist violation and painted with alternative black and white stripe. Red lanterns or warnings lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

16. Ramps:

Ramps required during execution may be formed wherever necessary and same are to be removed after completion of the work at the discretion of the department. No separate payment will be made for this purpose.

17. Monsoon Damages:

Damages due to rain or flood either in cutting or in banks shall have to be made good by the contractor till the work is handed over to the Department. The responsibility of de-silting and making good the damages due to rain or flood rests with the contractor. No extra payment is payable for such operations and the contractor shall therefore have to take all necessary precautions to protect the work done during the construction period.

18. The works to be completed by the Intended Completion Date:

18.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the programme submitted by the Contractor, as updated with the approval of the **Employer/Employer's Representative**, and complete the work by the Intended Completion Date.

19. Safety:

19.1 **The** Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries:

20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Government. The Contractor is to notify **Employer/Employer's Representative** of such discoveries and carry out the **Employer/Employer's Representative** instructions for dealing with them.

21. Possession of the Site.

21.1 The **Department** shall give possession of the site to the Contractor. If possession of a part site is given, the Department will ensure that the part site so handed over is amenable to carryout the work at site by the Contractor.

21.2 Additional land acquisition, if required, in few isolated stretches is foreseen in this project. The Contractor shall submit relevant L.A. proposals as required and pursue with the authorities concerned to acquire the land. The Department will assist the Contractor in this regard and if any compensation has to be paid, department will arrange to pay the same.

The Site for the execution of the work will be available as soon as the work is awarded. In case it is not possible for the department to make entire site available on the award of the work, due to any unforeseen reasons like court orders etc., the contractor will have to modify his working programme accordingly. No claim whatsoever for not giving the entire site in one stretch on award of work, (or) for handing over the site in phases will be tenable.

22. Access to the Site:

22.1 The **Contractor** shall provide the **Employer/Employer's Representative** and any person authorized by the Engineer-in-Charge, access to the site and to any place where work in connection.

23. Instructions:

23.1 The **Contractor** shall carry out all instructions of the **Employer/Employer's Representative** and comply with all the applicable local laws where the Site is located.

Site Order Book:

A site order book shall be maintained on the site and it shall be the property of the Employer and the Contractor shall promptly sign orders given therein by the Engineer or his authorized representative and comply with them. The compliance shall be reported by Contractor to the Engineer in good time so that it can be checked. The blank site order book with machine numbered pages in quadruplicate with perforated sheet for three copies to be detached will be provided by the Engineer for this purpose. Whenever any instructions are written in the site order book, the Contractor will be supplied the first carbon copy.

24. Settlement of disputes:

- 24.1 If any dispute of difference of any kind whatsoever arises between the department and the Contractor in connection with, or arising out of the Contract, whether during the progress of the works or after their completion and whether before or after the termination, abandonment or breach of the Contract, it shall in the first place, be referred to and settled by the Employer/Employer's Representative who shall, within a period of thirty days after being requested by the Contractor to do so, give written notice of his decision to the Contractor. Upon receipt of the written notice of the decision of the Employer/Employer's Representative the Contractor shall promptly proceed without delay to comply with such notice of decision
- 24.2 If the Employer/Employer's Representative fails to give notice of his decision in writing within a period of **thirty days** after being requested or if the Contractor is dissatisfied with the notice of the decision of the Employer/Employer's Representative, the Contractor may within thirty days after receiving the notice of decision appeal to the Department who shall offer an opportunity to the contractor to be heard and to offer evidence in support of his appeal, the Department shall give notice of his decision within a period of thirty days after

the Contractor has given the said evidence in support of his appeal, subject to arbitration, as hereinafter provided. Such decision of the Department in respect of every matter so referred shall be final and binding upon the Contractor and shall forthwith be given effect to by the Contractor, who shall proceed with the execution of the works with all due diligence whether he requires arbitration as hereinafter provided, or not. If the Department has given written notice of his decision to the Contractor and no claim to arbitration, has been communicated to him by the Contractor within a period of thirty days from receipt of such notice the said decision shall remain final and binding upon the Contractor. If the Department fail to give notice of his decision, as aforesaid within a period of thirty days after being requested as aforesaid, or if the Contractor be dissatisfied with any such decision, then and in any such case the contractor within thirty days after the expiration of the first named period of thirty days as the case may be, require that the matter or matters in dispute be referred to arbitration as detailed below:

SETTLEMENT OF CLAIMS:

Settlement of claims for Rs.50,000/- and below by Arbitration.

All disputes or difference arising of or relating to the Contract shall be referred to the adjudication as follows:

- a) Claims up to a value of Rupees 10,000/-.
 - Superintending Engineer, Public Health, Nellore.
- b) Claims above Rs.10,000/- and up to Rupees 50,000/-.
 - Engineer-in-Chief (PH), Hyderabad

The arbitration shall be conducted in accordance with the provisions of Indian Arbitration and Conciliation Act 1996 or any statutory modification thereof.

The arbitrator shall state his reasons in passing the award.

Claims above Rs.50,000/-.

All claims of above Rs.50,000/- are to be settled by a Civil Court of competent jurisdiction by way of Civil suit and not by arbitration.

A reference for adjudication under this clauses shall be made by the contractor within six months from the date of intimating the contractor of the preparation of final bill or his having accepted payment which ever is earlier.

B. TIME FOR COMPLETION

25. Program:

- 25.1 The total period of completion is **9 (NINE) Months** from the date of entering with agreement to proceed including rainy season. Keeping in view, the schedule for handing over of site given in condition **21** work should be programmed such as to achieve the mile-stones as in "Rate of progress

statement". Mile stones will be drawn by the agency which should be acceptable to the Department.

25.2 The attention of the bidder is directed to the contract requirement at the time of beginning of the work, the rate of progress and the dates for the whole work and its several parts as per milestones. The following rate of progress and proportionate value of work done from time to time as will be indicated by Employer/Employer's Representative Certificate for the value of work done and completion of milestones will be required. Date of commencement of their programme will be the date for concluding agreement.

25.3 After signing the agreement, the contractor shall forthwith begin the work, shall regularly and continuously proceed with them.

25.4 Rate of progress:

(i) Work programme of achieving the milestones (Statement).

(a) Mile Stone I : After 3 months : 33% of work should be completed.

(b) Mile Stone II : After 6 months : 66% of work should be completed.

(c) Mile Stone III : After 9 months : 100% of work should be completed.

(ii) Site Schedule of programme of handing over Site to the Contractor

Site will be handed over to the contractor in stages according to the progress of work.

25.5 The contractor shall commence the works on site within the period specified after the receipt by him of a written order to this effect from **Employer/ Employer's representative** and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by **Employer/ Employer's representative**, or be wholly beyond the contractor's control.

25.6 Save in so far as the contractor may prescribe, the extent of portions of the site of which the contractor is to be given possession from time to time and the order in which such portions shall be made available to him and, Subject to any requirement in the contract as to the order in which the works shall be executed, Employer/ Employer's representative will with written order to commence the works, give to the contractor possession of so much of the site as may be required to enable the contractor to commence proceed with the execution of the works in accordance with the programme if any, and otherwise in accordance with such reasonable proposals of the contractor as he shall by written notice to the Employer/ Employer's representative, make and will from time to time as the works proceed, give to the contractor possession of such further portions of the site as may be required to enable the contractor to proceed with the execution of the works with due despatch in accordance with the said programme or proposals as the case maybe ; if the contractor suffers

delay or incurs cost from failure on the part of Employer/ Employer's representative to give possession in accordance with the terms of this clause, the Employer/ Employer's representative shall grant an extension of time for the completion of works.

- 25.7 The contractor shall bear all costs and charges for special or temporary way leases required by him in connection with access to the site. The contractor shall also provide at his own cost any additional accommodation outside the site required by him for the purposes of the work.
- 25.8 Subject to any requirement in the contract as to completion of any section of the works before completion of the whole of the works shall be completed in accordance with provisions of clauses in the Schedule within the time stated in the contract calculated from the last day of the period named in the statement to the tender as that within which the works are to be commenced or such extended time as may be allowed.

25.9 Delays and extension of time:

Time is considered as the essence of the contract. Should the amount of extra or additional work of any kind or any cause or delay referred to in these conditions or exceptional adverse climate conditions or other special circumstances of any kind whatsoever which may occur, other than through a default of the contractor be such as fairly entitle the contractor to an extension of time for the completion of works including for milestones as stipulated in Clause 24.4 the amount of such extension and shall notify the contractor has within 28 days after such work has been commenced or such circumstances have arisen or as soon there after as is practicable submitted to the Employer/ Employer's representative full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time to be approved by Employer/ Employer's representative. For award of EOT upto six(6) months, Engineer-in-Chief(PH), Hyderabad is competent and beyond six (6) months, Committee constituted for the purpose is competent.

26. Construction Programme:

- 26.1 The Contractor shall furnish within 15 days from the receipt of the work order, the work a programme showing the sequence in which he proposed to carry out the work, monthly progress expected to be achieved, also indicating date of procurement of materials plant and machinery. The schedule should be such that it is practicable to achieve completion of the whole work within the time limit fixed and in keeping with the Mile stone programme specified and shall obtain the approval of Employer/ Employer's representative. Further rate of the progress as in the program shall be kept up to date. In case it is subsequently found necessary to alter this program, the contractor shall submit sufficiently in advance the revised program incorporating necessary modifications and get the same approved by. Employer/ Employer's representative No revised program shall be operative with out approval Employer/ Employer's representative (Annexure – E).

- 26.2 The Employer/ Employer's representative shall have all times the right, without any way violating this contract, or forming grounds for any claim, to alter the order of progress of the works or any part thereof and the contractor shall after receiving such directions proceed in the order directed. The contractor shall also report the progress to the Employer/ Employer's representative within 7 days of direction to alter the order of progress of works.
- 26.3 The Contractor shall give written notice to the Employer/ Employer's representative whenever planning or progress of the works is likely to be delayed or disrupted unless any further drawings or order including a direction, instruction or approval is issued by Employer/ Employer's representative within a reasonable time. The notice shall include details of the drawing or order required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

27. Speed of Work:

- 27.1 The Contractor shall at all times maintain the progress of work to conform to the latest operative progress schedule approved by Employer/ Employer's representative. The contractor should furnish progress report indicating the programme and progress once in a month. The Employer/ Employer's representative may at any time in writing direct the contractor to slow down any part or whole of the work for any reason (which shall not be questioned) whatsoever, and the contractor shall comply with such orders of the Employer/ Employer's representative. The compliance of such orders shall not entitle the contractor to any claim of compensation. Such orders of the Employer/ Employer's representative for slowing down the work will however be duly taken into account while granting extension of time if asked by the contractor for which no extra payment will be entertained..
- 27.2 Delays in Commencement or progress or neglect of work and forfeiture of earnest money, Security deposit and withheld amounts:

If, at any time, Employer/ Employer's representative shall be of the opinion that the Contractor is delaying Commencement of the work or violating any of the provisions of the Contractor is neglecting or delaying the progress of the work as defined by the tabular statement. "Rate of progress" in the Articles of Agreement", he shall so advise the Contractors in writing and at the same time demand compliance in accordance with conditions of Tender notice. If the Contractor neglects to comply with such demand within seven days after receipt of such notice, it shall then or at any time there after, be lawful for the Employer/ Employer's representative to take suitable action in accordance with **Clause.60 of APSS.**

28. Suspension of works by the Contractor:

- 28.1 If the Contractor shall suspend the works, or sublet the work without sanction of the Employer/ Employer's representative, or in the opinion of Employer/ Employer's representative shall neglect or fail to proceed with due diligence in the performance of his part of the Contract as laid down in the Schedule rate of

progress, or if he shall continue to default or repeat such default in the respects mentioned in clause.27 of the APSS Employer/ Employer's representative shall take action in accordance with **Clause 61 of APSS**.

- 28.2 If the Contractor stops work for 28 days and the Stoppage has not been authorised by the Employer/ Employer's representative the Contract will be terminated under **Clause 61 of APSS**.
- 28.3 If the Contractor has delayed the completion of works the Contract will be terminated under **Clause.61 of APSS**.

29. Extension of the Intended Completion Date:

- 29.1 The Employer/ Employer's representative shall extend or recommend for extension, in accordance with the Government orders in force, the Intended Completion Date if a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.
- 29.2 The Employer/ Employer's representative shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer/ Employer's representative for the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

30. Delays Ordered by the Employer/ Employer's representative:

- 30.1 Employer/ Employer's representative may instruct the Contractor to delay the start or progress of any activity within the Work.

31. Early Warning:

- 31.1 The contractor is to warn the Employer/ Employer's representative at the earliest opportunity of specific likely future events or circumstances that may adversely affect the Execution of Works.
- 31.2 The Contractor shall cooperate with the Employer/ Employer's representative in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Employer/ Employer's representative.

32. Management Meetings:

- 32.1 The Employer/ Employer's representative may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the programme for remaining work and to deal with matters raised in accordance with the early warning procedure.

C. QUALITY CONTROL

33. Identifying Defects:

33.1 The Employer/ Employer's representative shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Employer/ Employer's representative may instruct the Contractor to verify the Defect and to uncover and test any work that the Employer/ Employer's representative considers may be a Defect.

34. Tests:

34.1 Laboratory for testing:

The contractor shall for the purpose of testing the material shall establish a field laboratory of 40 sq. meter area. The contractor shall provide all equipments as per list in **Annexure - D**.

34.2 If the Employer/ Employer's representative instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the Contractor shall pay for the test and any samples.

35. Correction of Defects:

35.1 The Employer/ Employer's representative shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins on Completion. The defects liability period shall be extended for as long as defects remain to be corrected by the Contractor.

35.2 Every time notice of a Defect is given, the Contractor shall correct the notified defect within the length of time specified by the Employer/ Employer's representative notice.

36. Uncorrected Defects:

36.1 If the contractor has not corrected the defect within the time specified in the Employer/ Employer's representative notice, the Engineer-in-Charge will assess the cost of having the defect corrected and the contractor will pay this amount.

36.2 The Employer/ Employer's representative shall introduce O.K. cards and prescribed the formats there of. O.K. cards shall relate to all major components of the work. The contractor with his authorized representative shall be required to initiate and fill in and present the O.K. card to the construction staff who would check the respective items and send to the quality control staff for final check and clearance / O.K. Any defects pointed out by the construction supervision staff or by the Quality Control staff shall promptly be attended to by the contractors and the fact of doing so be duly recorded on the back of O.K. card.

36.3 The Employer/ Employer's representative may also introduce check lists which shall be kept in Bound registers by the construction supervision staff. The

contractor may be required to fill up these lists in the first instance and shall be subsequently checked by the Construction / Quality Control engineers.

37. Quality Control:

In addition to the normal inspection by the Engineer regular staff in-charge of the Construction of work, the work will also be inspected by the Executive Engineer Quality control Circle or by the State or District level Vigilance Cell Unit and any other authorized external Agency if any sub-standard work or excess payments are noticed with reference to measurement books etc., during inspection, action will be taken based on their observations and these will be effected by the Engineer-in-Charge of the execution of the work.

D. COST CONTROL

38. Lump Sum Price:

38.1 The Contractor is paid for the quantity of the work done on prorata basis against each item as per Annexure-I, volume-III.

38.2 **Variations in Scope of Work:** It shall be generally understood that the price quoted by the tenderer shall be all inclusive price for completion of scope of work detailed in the tender document and is for finished work at site in all respects including minor modifications where felt essential.

In an unlikely event, should the exigencies of work so demand that any major modifications are found essential in any component of the works, the payment for the corresponding variations shall be regulated as per **Annexure II & III of Volume III**. The variations, not covered by Annexure II&III, rates of **CSSR 2011-2012** will be applied.

38.3 The extra items :

- (i) In case of contingent items, approval shall be accorded by Engineer-in-Chief (PH)
- (ii) Non-contingent shall be approved by the committee constituted for the purpose
- (iii) Contingent but outside the scope of the original contract shall be approved by the committee constituted for this purpose

39. Changes in the Scope:

39.1 The contractor is bound to execute all supplemental works that are found essential, incidental and inevitable during execution of main work.

40. Extra Items:

40.1 Extra items of work shall not vitiate the contract. The contractor shall be bound to execute extra items of work as directed by the Employer/ Employer's representative. The rates for extra items shall be worked out by the Employer/

Employer's representative as per the conditions of the Contract and the same are binding on the Contractor.

40.2 The contractor shall before the 15th day of each month, submit in writing to the Employer/ Employer's representative a statement of extra items if any that they have executed during the preceding month failing which the contractor shall not be entitled to claim any.

40.3 Entrustment of additional items:

40.3.1 Where ever additional items not contingent on the main work and outside the scope of original agreement are to be entrusted to the original contractor dispensing with bids and if the value of such items exceeds the limits up to which the officer is empowered to entrust works initially to contractor without calling for tenders, approval of next higher authority shall be obtained. Entrustment of such items on nomination shall be at rates not exceeding the estimated rates.

40.3.2 Payment for the additional scope of work executed shall be decided based upon the following:

- Unit rates quoted and duly agreed by the Department.
- A.P. Standard Schedule of rates for the year 2010-11.

41. Cash flow forecasts:

41.1 When the program is updated, the contractor is to provide the Employer/ Employer's representative with an updated cash flow forecast.

42. Payment Certificates:

42.1 The Contractor shall submit to the Employer/ Employer's representative monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

42.2 The Employer/ Employer's representative shall check the Contractor's monthly statement within 14 days.

42.3 The value of work executed shall be determined by the Employer/ Employer's representative.

42.4 The value of work executed shall comprise the value of the quantities in proportion on prorata basis against each sub-head in **Annexure – I, Volume – III.**

42.5 The Employer/Employer's representative may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

43. PAYMENT

43.1 EPC Contractor's Application for Payment

43.1.1 On the fifth Business Day of every month from the date of issue of the Notice to Proceed the EPC Contractor may serve a notice in writing on the Employer's Representative ("**Request for Payment**") requesting payment of the sum which is considers to be due on achievement of milestones as per the **Annexure 1. ("Milestone Payment")**.

Less

- (a) The amount to be deducted as Retention Money
- (b) Advance payment in proportionate amounts commencing upon the submissions by the EPC Contractor of the Request for Payment for the fourth monthly period after the date of issue of the Notice to proceed and ending upon the date of the last Request for payment; and
- (c) Any amounts due and owing from the EPC Contractor to the Employer pursuant to this Agreement.

43.1.2 The Request for Payment shall be:

- (a) Prepared on forms in the form indicated by the Employer's representative and at the expense of the EPC Contractor, the number of copies therefore shall be as the Employer's Representative may determine; and
- (b) Accompanied by such supporting documentation as the Employer's Representative may require to establish the value of the work property designed and Executed as referred to in the Request for payment and reasonableness of the amounts added in respect of goods and materials.

43.2 Certificates of Payment

43.2.1 Within fourteen (14) Business Days after the receipt of the Request for payment, the Employer's Representative shall, subject to the EPC Contractor's compliance with Article 43.2 inspect the relevant parts of the Works and the relevant goods and materials in order to satisfy himself that the request for payment is correct.

If the Employer's Representative is so satisfied he shall issue a Certificate of Payment certifying what amounts are due to the EPC Contractor pursuant to this Article 43 subject to the provisions of Article 43.2.2 to 43.2.3 after giving credit to the Employer for any sums to which the Employer is entitled under this Agreement.

43.2.2 No sum shall be included in the Certificate of Payment in respect of goods and materials yet to be incorporated into the payment works unless the employers' Representative is satisfied and has approved in writing that:

- (a) Such goods and materials have been properly acquired and properly and not prematurely delivered to the Project Site;

- (b) Such goods plant and materials are properly stored on the project site ;and fully protected against loss, damage or deterioration;
 - (c) The EPC Contractor's records of the requisitions, orders, receipts and use of any goods and materials are kept in a form approved by the Employer's Representative, and such records are available for inspection by the Employer's Representative; and
 - (d) The EPC Contractor has submitted a proper statement of the cost of acquiring the goods and materials together with such documents as may be required for evidencing such cost.
- 43.2.3 In the event that the Employer's Representative ascertains that the value of the works properly designed and Executed in the relevant period is less than the Milestone Payment for the period, he shall include in the Certificate of payment, the value of the works and goods and materials so ascertained by him.
- 43.2.4 All Certificates of Payment shall specify the amount, which the Employer proposes to pay to the EPC Contractor and the basis on which that amount was calculated. Such amount shall become due on the issue of the said Certificate of Payment.
- 43.2.5 **5%** of the interim payment certificate shall be paid with in **7 days** & balance shall be paid with in 14 days of receipt from the Engineer.
- 43.2.6 The final payment certificate (statement at completion) shall be paid with in **84 days** of receipt form the Engineer.

44. Certificate of Completion of works:

44.1 Certificate of Completion of works:

- 44.1.1 When the whole of the work has been completed and has satisfactory passed any final test that may be prescribed by the Contract, the Contractor may give a notice to that be in writing and shall be deemed to be request by the Contractor for the Employer/ Employer's representative to issue a Certificate of completion in respect of the Works. The Employer/ Employer's representative shall, within **twenty one days** of the date of delivery of such notice either issue to the Contractor, a certificate of completion stating the date on which, in his opinion, the works were completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the Works which, in the" Employer/ Employer's representative opinion, required to be done by the Contractor before the issue of such Certificate. The Employer/ Employer's representative shall also notify the Contractor of any defects in the Works affecting completion that may appear after such instructions and before completion of the Works specified there in. The Contractor shall be entitled to receive such Certificate of the Completion within twenty one days of completion to the satisfaction of the Employer/ Employer's representative of the Works so specified and making good of any defects so notified.

44.1.2 Similarly, the Contractor may request and the Employer/ Employer's representative shall issue a Certificate of Completion in respect of:

- a) Any section of the Permanent works in respect of which a separate time for completion is provided in the Contract, and
- b) Any substantial part of the Permanent Works which has been both completed to the satisfaction of the Employer/ Employer's representative and occupied or used by the Department.

44.1.3 If any part of the Permanent Works shall have been completed and shall have satisfactorily passed any final test that may be prescribed by the Contract, the Employer/ Employer's representative may issue such certificate, and the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the Works during the period of Maintenance.

45. Taxes included in the bid:

45.1 The percentage quoted by the contractor shall be deemed to be inclusive of the sales Tax and other taxes on all materials that the contractor will have to purchase for performance of this contract including VAT for Cylindrical and Non – Cylindrical PSC pipes CED is not included.

45.2 Interest on Money due to Contractor

No omission by the Executive Engineer or the sub Divisional officer to pay the amount due upon certificates shall vitiate or make void the contract nor shall the contractor be entitled to interest upon any guarantee fund or payments in arrear, nor upon any balance which may be on the financial settlements of his accounts, founded to be due to him.

45.3 Income Tax:

- (a) **The income tax will be deducted as per rules in force from the contractor bills**
- (b) Income Tax clearance certificate should be furnished before the payment of final Bill.
- (c) The contractors staff, personal and labour will be liable to pay personnel income taxes in respect of their salaries and wages as are chargeable under the Laws and regulations for the time being in force and the contractor shall perform such duties in regard to such deductions there of as may be imposed on him by such laws and regulations.

45.4 Seigniorage Charges:

45.5.1 Seigniorage charges will be recovered as per rules from the work bills of the contract or based on the theoretical requirement of materials

45.5.2 The Seigniorage charges will be recovered from the contractors bills as per the seigniorage charges adopted in the data rates of the sanctioned estimate or as per the rates fixed by the Mines & Geology Department from

time to time as on Date of recording measurements in measurement books which ever is higher for the materials consumed theoretically on the work only.

45.6 VAT (Value Added Tax):

45.6.1 VAT Tax @ 5.00 % on Running Bills will be recovered as per rules.

45.6.2 The contractor should produce a valid VAT Clearance Certificate before the payment of the final bill, otherwise payment to the contractor will be withheld.

45.6.3 **Labour Cess:-** The Labour Cess @ 1.00 % on running bills will be recovered for according payment the same to the Labour department.

46. Price Adjustment: Price adjustment for steel, cement, bitumen and POL is applicable as per Rules In Force

TERMS OF PAYMENT

The payment will be made to the contractor as per clause 68 of PS to APSS.

Payment Conditions :

S.No.	Description	Percentage of payment on the rate.
1.	After Supply, delivery of pipes to site in good condition and after Quality inspection	65 %
2.	After laying and jointing of pipes as per specification	25 %
3.	After successful completion of hydraulic filed testing of pipes, refilling with excavated soils as directed by the department and commissioning	10 %

47. Retention:

47.1 The department shall retain from each payment due to the contractor @ the rate of **7.5%** of bill amount until completion of the whole of the Works.

47.2 Deleted

47.3 On completion of the whole of the Works half (5%)of the total amount retained including 2.5 % EMD is re-paid to the Contractor and balance half (5%) when the Defects Liability Period has passed and the Employer/ Employer's representative has certified that all the Defects notified by the Employer/ Employer's representative to the Contractor before the end of this period have been corrected.

47.4 On completion of the whole works, the Contractor may substitute retention money with an "on demand" Bank Guarantee.

48. Liquidated Damages:

- 48.1 If for any reason, which does not entitle the contractor to an extension of item, the rate of progress of works, or any section is at any time, in the opinion of the Employer/ Employer's representative too slow to ensure completion by the prescribed time or extended time for completion Employer/ Employer's representative shall so notify the contractor in writing and the contractor shall there upon take such steps as are necessary and the Employer/ Employer's representative, may approve to expedite progress so as to complete the works or such section by the prescribed time or extended time. The contractor shall not be entitled to any additional payment for taking such steps. If as a result of any notice given by Employer/ Employer's representative under this clause the contractor shall seek Employer/ Employer's representative permission to do any work at night or on Sundays, if locally recognised as days or rest, or their locally recognized equivalent, such permission shall not be unreasonably refused..
- 48.2 If the contractor fails to complete whole of the works or any part thereof or section of the works within the stipulated periods of individual mile stones (including any bonafide extensions allowed by the competent authority without levying liquidated damages), the Employer/ Employer's representative may without prejudice to any other method of recovery will deduct one tenth of one percent of contract value per calendar day or part of the day for the period of delays subject to a maximum of 10% of the contract value as a penalty from any monies in his hands due or which may become due to the contractor. The payment or deductions of such damages shall not relieve the contractor from his obligation to complete the works, or from any other of his obligations and liabilities under the contract.
- 48.3 The liquidated damages for the whole of the work will be filled up at the time of concluding agreement

Rs.	(amount per day)	
For milestone 1	Rs.50.00/lakh	Per day
For milestone 2	Rs.50.00/lakh	Per day
For milestone 3	Rs.50.00/lakh	Per day

The maximum amount of liquidated damages for the whole of the works is **ten percent** of final contract price.

The milestones will however be firmed up at the time of agreement after obtaining a program of the work from the bidder.

49. Mobilisation Advance: (As per G.O. Ms. Rt. No. 1474 MA & UD (A1) Dept. Dt : 12-12-2007 and as per Memo No.1708/E.IN.C/ P.H/Mobilisation /2008-09, Dt: -06-2008 of Engineer - in - Chief (PH) Hyderabad.

- 49.1 The contractors are permitted to avail the facility of Mobilization advance of 10% towards Labour and Material Mobilization against an 100 % Unconditional and irrevocable Bank Guarantee acceptable to the Department, to facilitate the agencies in procurement of materials to achieve better progress of works. The interest rate will be + 2% of prevailing PLR of Banks.
- 49.2 A form of Bank Guarantee acceptable to Executive Engineer is indicated at Annexure B. The advance mobilization loan shall be used by the contractor exclusively for Labour and material mobilization expenditures, in connections with the works.
- 49.3 Should the contractor misappropriate any portion of the advance loan, it shall become due to the Employer/ Employer's representative and payable immediately in one lump by the contractor and no further loan will be considered thereafter.
- 49.4 The above advance shall bear an interest of prevailing SBI PLR+2% per annum. The interest on the amounts paid as advance is chargeable from the date the amount is paid. However if completion is delayed by circumstances beyond control of the contractor for which an extension has been granted by the Executive Engineer the interest charges on such advances shall be waived for the period of extension.
- In case of contractor not maintaining the progress of works as per agreed programme the interest of mobilization advance shall be levied at prevailing SBI PL R+4% per annum for the period in which the progress is not maintained. In case the progress is made good as per the programme the rate of interest shall be at prevailing SBI PLR+2% per annum.
- 49.5 The value of Bank Guarantee for the advance payment given to the contractor can be progressively reduced by the amount repaid by the contractor as certified by the Executive Engineer.

49.6 Recovery of advances:

- 49.6.1 The advance loan together with interest at the rate as specified above shall be repaid within percentages deductions from the intermediate payments under the contract. Deduction shall commence from the first intermediate bill. The total advance amount plus interest amount shall be recovered before 90% of work is completed. The rate of recovery shall be adjusted suitably to satisfy the above criteria.

50. Securities:

- 50.1 The Earnest Money Deposit and Additional Security (for discount tender percentage beyond 25%) shall be provided to the Department not later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank acceptable to the Department. The Earnest Money

shall be valid until a date 28 days from the date of expiry of Defects Liability Period and the additional security shall be valid until a date 28 days from the date of issue of the certificate of completion.

51. Cost of Repairs:

- 51.1 Loss or damage to the Works or materials to the Works between the Start Date and the end of the Defects Correction Periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

FINISHING THE CONTRACT

52. Completion:

- 52.1 The Contractor shall request the Employer/ Employer's representative to issue a Certificate of completion of the Works and the Employer/ Employer's representative will do so upon deciding that the work is completed.

53. Taking Over:

- 53.1 Except as stated in clause 52 the works shall be taken over by the Employer when they have been completed in accordance with the Contract (except as described in sub-paragraph (a) below), have passed the Tests on Completion and a taking-Over Certificate for the works has been issued, or has deemed to have been issued in accordance with this Sub-Clause. If the works are divided into sections, the Contractor shall be entitled to apply for a Taking-over certificate for each section.

The Contractor may apply by notice to the Employer's Representative for a taking-over certificate not earlier than 14 days before the works or section (as the case may be) will, in the contractor's opinion, be complete and ready for taking over. **"The request for taking over shall be accompanied by as built drawings."** The employer's representative shall, within 28 days after the receipt of the contractor's application:

- (a) issue the taking-over certificate to the contractor, stating the date on which the works or section were completed in accordance with the contract (except for minor outstanding work that does not affect the use of the works or section for their intended purpose) including passing the tests on completion: or
- (b) reject the application, giving his reasons and specifying the work required to be done by the contractor to enable the taking-over certificate to be issued: the contractor shall then complete such work before issuing a further notice under this sub-clause.

If the Employer's representative fails to issue the taking over certificate or to reject the Contractors application within the period of 28 days, and if the works or section (as the case may be) are substantially in accordance with the contract, the taking-over certificate shall be deemed to have been issued on the last day of that period.

53.2 Use by The Employer

The Employee shall not use any part of the works unless the employer's representative has issued a taking-over certificate for such part. If a taking-over certificate has been issued for any part of the works (other than a section), the liquidated damages for delay in completion of the reminder of the works (and of the section of which it forms part) shall, for any period of delay after the date stated in such taking-over certificate, be reduced in the proportion which the value of the part so certified bears to the value of the works or section (as the case may be), such values shall be determined by the Employer's Representative.. The provisions of this paragraph shall only apply to the rate of liquidated damages , and shall not affect the limit of such damages.

If the Employer does use any part of the works before the taking-over certificate is issued:

- (a) the part which is used shall be deemed to have been taken over at the date on which it is used,
- (b) the Employer's Representative shall, when requested by the Contractor, issue a taking-over certificate accordingly, and
- (c) the contractor shall cease to be liable for the care of such part from such date, when responsibility shall pass to the Employer.

After the Employer's Representative has issued a taking-over certificate for a part of the works, the contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding tests on completion, and the contractor shall carry out such tests on completion, and the contractor shall carry out such tests on completion as soon as practicable, before the expiry of the contract period.

53.3 Interference with Tests on Completion

If the contractor is prevented from carrying out the tests on completion by a cause for which the Employer (or another contractor employed by the Employer) is responsible, the employer shall be deemed to have taken over the works or section (as the case may be) on the date when the Tests on Completion would otherwise have been completed. The Employer's Representative shall then issue a taking-over certificate accordingly, and the contractor shall carry out the tests on completion as soon as practicable, before the expiry of the contract period. The Employer's Representative shall require the tests on completion to be carried out by 14 days notice and in accordance with the relevant provisions of the Contract. If the contractor incurs additional cost as a result of this delay in carrying out the tests on completion, such cost plus reasonable profit shall be determined by the employer's Representative and shall be added to the contract price.

54. Final Account:

54.1 The Contractor shall supply to the Employer/ Employer's representative a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer/ Employer's representative shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer/ Employer's representative shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the final Account is still unsatisfactory after it has been resubmitted, the Employer/ Employer's representative shall decide on the amount payable to the Contractor and issue a payment certificate with in 56 days of receiving the Contractor's revised account.

55. Termination:

55.1 The Department may terminate the Contract if the contractor causes a fundamental breach of the Contract.

55.2 Fundamental breaches of Contract include, but shall not be limited to the following.

- a) The Contractor stops work for 28 days when no stoppage of work is shown on the current program and the stoppage has not been authorised by the Employer/ Employer's representative.
- b) The Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation.
- c) The Employer/ Employer's representative gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer/ Employer's representative; and
- d) The Contractor does not maintain a security which is required and
- e) The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined.
- f) If the contractor, in the judgement of the Department has engaged in corrupt or fraudulent practices in competing for or in the executing the contract.

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment o the Government and includes collusive practice among Bidders (prior to or after Tender submission) designed to establish Tender prices at artificial non-

competitive levels and to deprive the Government of the benefits of free and open competition.

55.3 Notwithstanding the above the Department may terminate the contract for convenience.

55.4 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secured leave the Site as soon as reasonably possible.

56. Payment upon Termination:

56.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer/ Employer's representative shall issue a certificate for the value of the work done less advance payments received upon the date of the issue of the certificate, less other recoveries due in terms of the Contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed. Additional Liquidated Damages shall not apply. If the total amount due to the Department exceeds any payment due to the Contractor the difference shall be a debt payable to the Department.

57. Property:

57.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Department if the Contract is terminated because of Contractor's default.

58. Release from Performance:

58.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Department or the Contractor the Employer/ Employer's representative shall certify that the contract has been frustrated. The Contractor shall make the site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any work carried out afterwards to which commitment was made.

VOLUME - I

SECTION – III : SPECIAL CONDITIONS

59. Water Supply:

The Contractor has to make his own arrangements for water required for the work and to the colonies and work sites, which are to be established by the Contractor.

60. Electrical Power:

The Contractors will have to make their own arrangements for drawing electric power from the nearest power line after obtaining permission from the Andhra Pradesh State Electricity Board at his own cost. In case of failure of electricity, the Contractor has to make alternative arrangements for supply of electricity by Diesel Generator sets of suitable capacity at place of work. If the supply is arranged by the Department, necessary Tariff rates shall have to be paid based on the prevailing rates.

The contractor will pay the bills of Electricity Board for the cost of power consumed by him.

The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act 1910 and under rule —45(I) of the Indian Electricity Rules, 1956 as amended from time to time and other pertinent rules.

The power shall be used for bonafide Departmental works only.

60.1 Electric Power for Domestic Supply:

- a) The contractor has to make his own arrangements for the supply of electric power for domestic purposes and the charges for this purpose have to be paid by him at the rates as fixed by the Andhra Pradesh State Electricity Board from time to time.
- b) The contractor will have to make his own arrangements to lay and maintain the necessary distribution lines and wiring for the camp at his own cost. The layout and the methods of laying the lines and wiring shall have the prior approval of the Employer/ Employer's representative. All camp area shall be properly electrified. All lines, streets, approaches for the camp etc., shall be sufficiently lighted for the safety of staff and labour of the contractor, at the cost of the Contractor and it will be subject to the approval of the Employer/ Employer's representative.

61. Land:

61.1 Land for Contractor's use:

The contractor will be permitted to use Government land for execution of work. The contractor shall have to make his own arrangements for acquiring and clearing the site, leveling, providing drainage and other facilities for labour staff colonies, site office, work-shop or stores and for related activities. The

Contractor shall apply to the Department within a reasonable time after the award of the contract and atleast 30 days in advance of its use, the details of land required by him for the work at site and the land required for his camp and should any private land which has not been acquired, be required by the contractor for his use. The same may be acquired by the contractor at his own cost by private negotiations and no claim shall be admissible to him on this account.

The Employer/ Employer's representative reserves the right to refuse permission for use of any government land for which no claim or compensation shall be admissible to the contractor. The contractor shall, however, not be required to pay cost or any rent for the Government land given to him.

61.2 Surrender of Occupied Land:

- a) The Government land as here in before mentioned shall be surrendered to the Employer/ Employer's representative within seven days, after issue of completion certificate. Also no land shall be held by the contractor longer than the Engineer-in-Charge shall deem necessary and the contractor shall on the receipt of due notice from the Employer/ Employer's representative, vacate and surrender the land which the Engineer-in-Charge may certify as no longer required by the Contractor for the purpose of the work.
- b) The contractor shall make good to the satisfaction of the Employer/ Employer's representative any damage to areas, which he has to return or to other property or land handed over to him for purpose of this work. Temporary structures may be erected by the contractor for storage sheds, offices, residences etc., for non-commercial use, with the permission of the Employer/ Employer's representative on the land handed over to him at his own cost. At the completion of the work these structures shall be dismantled site cleared and handed over to the Employer/ Employer's representative. The land required for providing amenities will be given free of cost from Government lands if available otherwise the contractor shall have to make his own arrangements.

61.3 Contractor not to dispose off Spoil etc.:-

The contractor shall not dispose off or remove except for the purpose of fulfillment of this contract, sand, stone, clay ballast, earth, trees and shrubs or other materials obtained in the excavation made or lying on the site of the work, and all such materials and produce shall remain property of the Government. The Department may upon request from the contractor, or if so stipulated in the conditions of the contract allow the contractor to use any of the above materials for the works either free of cost or after payment as may be specifically mentioned or considered necessary during the execution of the work.

62. Roads:

In addition to existing public roads and roads Constructed by Government, if any, in work area all additional approach roads inside work area and camp required by the Contractor shall be constructed and maintained by him at his own cost. The layout design, construction and maintenance etc. of the roads shall be subject to the approval of the Employer/ Employer's representative. The contractor shall permit the use of these roads by the Government free of charge.

It is possible that work at, or in the vicinity of the work site will be performed by the Government or by other contractors engaged in work for the Government during the contract period. The contractor shall without charge permit the government and such other contractor and other workmen to use the access facilities including roads and other facilities, constructed and acquired by the contractor for use in the performance of the works.

The contractor's heavy construction traffic or tracked equipment shall not traverse any public roads or bridges unless the contractor has made arrangement with the authority concerned. In case contractor's heavy construction traffic or tracked equipment is not allowed to traverse any public roads or bridges and the contractor is required to make some alternative arrangements, no claim on this account shall be entertained.

The contractor is cautioned to take necessary precautions in transportation of construction materials to avoid accidents.

63. Payment for Camp Construction:

No payment will be made to the contractor for construction, operation and maintenance of camp and other camp facilities and the entire cost of such work shall be deemed to have been included in the tendered rate for the various items of work in the schedule of quantities and bids.

64. Explosive And Fuel Storage Tanks:

No explosive shall be stored within 1/2 (half) KM of the limit of the camp sites. The storage of gasoline and other fuel oils or of Butane, Propane and other liquefied petroleum gases, shall conform to the regulations of Andhra Pradesh State Government and Government of India. The tanks, above ground and having capacity in excess of 2000 liters, shall not be located within the camp area, nor within 200m, of any building.

65. Labour:

The contractor shall, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

Labour importation and amenities to labour and contractor's staff shall be to the contractor's account. His quoted percentage shall include the expenditure towards importation of labour amenities to labour and staff;

The contractor shall, if required by the Employer/ Employer's representative, deliver to the Employer/ Employer's representative a written in detail, is such form and at such intervals as the Employer/ Employer's representative may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the contractor on the Site and such information respecting Contractor's Equipment as the Employer/ Employer's representative may require.

65.1 Transportation of Labour:

The contractor shall make his own arrangement for the daily transportation of the labour and staff from labour camps colonies to the work spot and no labour or staff of the contractor shall stay at the work spot. No extra payment will be made to the contractor for the above transportation of the labour and his quoted percentage to the work shall include the transportation charges of labour from colonies to work spot and back.

- II. The contractor will at all times duly observe the provisions of employment of children Act XXVI of 1938 and any enactment or modification of the same and will not employ or permit any person to do any work for the purpose under the provisions of this agreement in contravention of said Act. The contractor here by agrees to indemnify the department from and against all claims, penalties which may be suffered by the department or any person employed by the department by any default on the part of the contractor in the observance and performance of the provisions of the employment of children Act. XXVI of 1938 or any enactment or modification of the same.

As per Govt. memo No.721/Gr.(I)/81-35, dt:17.11.87. The contractor shall obtain the insurance at his own cost to cover the risk on the works to labour engaged by him during period of execution against fire and other usual risks and produce the same to the Employer/ Employer's representative concerned before commencement of work.

66. Safety Measures:

1. The contractor shall take necessary precautions for safety of the workers and preserving their health while working in such jobs, which require special protection and precautions. The following are some of the measures listed but they are not exhaustive and contractor shall add to and augment these precautions on his own initiative where necessary and shall comply with directions issued by the Employer/ Employer's representative or on his behalf from time to time and at all times.
2. Providing protective foot wear to workers situations like mixing and placing of mortar or concrete sand in quarries and places where the work is done under much wet conditions.
3. Providing protective head wear to workers at places like under ground excavations to protect them against rock falls.

4. Providing masks to workers at granulates or at other locations where too much fine dust is floating about and sprinkling water at frequent intervals by water hoses on all stone crushing area and storage bins abate to dust.
5. Getting the workers in such jobs periodically examined for chest trouble due to too much breathing in to fine dust.
6. Taking such normal precautions like fencing and lightening in excavation of trenches, not allowing rolls and metal parts of useless timber spread around, making danger areas for blasting providing whistles etc.
7. Supply work men with proper belts, ropes etc., when working in precarious slopes etc.
8. Avoiding electrical wire etc., as they would electrocute the works.
9. Taking necessary steps towards training the workers concerned on the machinery before they are allowed to handle them independently and taking all necessary precautions in around the areas where machines hoists and similar units are working.

67. Fair Wage Clause:

1. The contractor shall pay not less than fair wages to labourers engaged by him on the work.
2. "Fair" wages means wages whether for time or piecework notified by the Government from time to time in the area in which the work is situated.
3. The contractor shall notwithstanding the revisions of any contract to the contrary cause to be paid to the labour, in directly engaged on the work including any labour engaged by the sub-contractor in connection with the said work, as if the labourers had been directly employed by him.
4. In respect of labour directly or indirectly employed in the works for the purpose of the contractor's part of the agreement the contractor shall comply with the rules and regulations on the maintenance of suitable records prescribed for this purpose from time to time by the Government. He shall maintain his accounts and vouchers on the payment of wages to the labourers to the satisfaction of the Employer/ Employer's representative.
5. The Employer/ Employer's representative shall have the right to call for such record as required to satisfy himself on the payment of fair wages to the labourers and shall have the right to deduct from the contract amount a suitable amount for making good the loss suffered by the worker or workers by reason of the "fair wages" clause to the workers.

6. The contractor shall be primarily liable for all payments to be made and for the observance of the regulations framed by the Govt. from time to time without prejudice to his right to claim indemnity from his sub-contractors.
7. As per contract labour (Regulation and abolition) Act. 1970 the contractor has to produce the license obtained from the licensing officers of the labour department along with the tender or at the time of agreement.
8. Any violation of the conditions above shall be deemed to be a breach of his contract.
9. Equal wages are to be paid for both men and women if the nature of work is same and similar.
10. The contractor shall arrange for the recruitment of skilled and unskilled labour local and imported to the extent necessary to complete the work within the agreed period as directed by the **Employer/ Employer's representative** in writing.

68. Indemnity Bond:

Name of work Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.

I _____ contractor S/o. _____ aged Resident of _____ do hereby bind myself to pay all the claims may come (a) under Workmen's Compensation Act. 1933 with any statutory modification there of and rules there under or otherwise for or in respect of any damage or compensation payable in connection with any accident or injury sustained (b) under Minimum wages Act 1948 (c) under payment of wages Act. 1936 (d) under the Contractor labour (Regulation and Abolition) Act. 1970 by workmen engaged for the performance of the business relating to the above contract ie., Failing such payment of claims of workmen engaged in the above work, I abide in accepting for the recovery of such claims, effected from any of my assets with the departments. accepting for the recovery of such claims, effected from any of my assets with the departments.

69. Compliance With Labour Regulations:

During continuance of the contract, the contractor and his sub contractors shall abide at all times by all existing labour enactment and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notifications that may be issued under any labour law in future either by the State or the Central Government or the local authority and also applicable labour regulations, health and sanitary arrangements for workmen, insurance and other benefits. Salient

features of some of the major labour laws that are applicable to construction industry are given below. The contractor shall keep the Department indemnified in case any action is taken against Department by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Department is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for nonobservance of the provision stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the contractor, the Engineer-in-charge /Department shall have the right to deduct any money due to the contractor including his amount of performance security. The Department/Engineer-in-Charge shall also have right to recover from the contractor any sum required or estimated to be required for making good the loss or damage suffered by the Department.

The employees of the Contractor and the Sub-contractor in no case shall be treated as the Employees of the Department at any point of time.

70. Salient features of some major labour laws applicable to establishment engaged in buildings and other construction work:

- (a) **Workmen compensation Act 1923:** The Act provides for compensation in case if injury by accident arising out of and during the course of employment.
- (b) **Payment of Gratuity Act 1972:** Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if any employee has completed 5 years service or more, or on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments, employing 10 or more employees.
- (c) **Employees P.F. and Miscellaneous provision Act 1952:** The Act provides for monthly contributions by the Department plus workers @ 10% or 8.33%. The benefits payable under the Act are:
 - (i) Pension or family pension on retirement or death, as the case may be.
 - (ii) Deposit linked insurance on the death in harness of the worker.
 - (iii) Payment of P.F. accumulation on retirement/death etc.,
- (d) **Maternity Benefit Act 1951:** The Act provides for leave and some other benefits to women employees in case of confinements or miscarriage etc.
- (e) **Contract Labour (Regulation & Abolition) Act 1970:** The Act provides for certain welfare measures to be provided by the contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided by the Principal Department by Law. The Principal Department is required to take certificate of Registration and the contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Department if they employ 20 or more contract labour.

- (f) **Minimum wages Act 1948:** The Department is supposed to pay not less than the Minimum wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment construction of Buildings, Roads, Runways are scheduled employment.
- (g) **Payment of wages Act 1936:** It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made form the wages of the workers.
- (h) **Equal Remuneration Act 1979:** The Act provides for payment of equal wages for work of equal nature to Male or Female workers and for not making discrimination against Female employee in the matters of transfers, training and promotions etc.
- (i) **Payment of Bonus Act 1965:** The Act Is applicable to all establishments employing 20 or more employees. The Act provides for payment of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs.2500/-per months or above and up to Rs.3500/- per month shall be worked out by taking wages as Rs.2500/- per monthly only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
- (j) **Industrial Disputes Act 1947:** The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock- out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- (k) **Industrial Employment (Standing Orders) Act 1946:** It is applicable to all establishments employing 100 or more workmen' (employment size reduced by some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Department on matters provided in the Act and get the same certified by the designated Authority.
- (l) **Trade Unions Act 1926:** The Act lays down the procedure for registration of trade unions of workmen and Departments. The Trade Unions registered under the act have been given certain immunities from civil and criminal liabilities.
- (m) **Child Labour (Prohibition & Regulation) Act 1986:** The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes, Employment Child Labour is prohibited in Building and Construction Industry regulation of employment of children in all other occupations and processes,

Employment Child Labour is prohibited in Building and Construction Industry.

- (n) **Inter-State Migrant workmen's (Regulation of Employment & Conditions of service) Act 1979:** The Act applicable to an establishment, which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another State). The inter State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home up to the establishment and back, etc.
- (o) **The Building and Other Construction workers (regulation of Employment and conditions of service) Act 1996 and the Cess Act of 1996:** All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 1% of the cost of construction as may be modified by the Government. The Department of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Department to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.
- (p) **Factories Act 1948:** The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 person or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

71. Liabilities of the Contractor:

71.1 Accident Relief and workmen compensation:

The contractor should make all necessary arrangements for the safety of workmen on the occurrence of the accident, which results in the injury or death of any of the workmen employed by the contractor, the contractor shall within 24 hours of the happenings of the accident and such accidents should intimate in writing to the **Employer/ Employer's representative** of the Department the act of such accident. The contractor shall indemnify Government against all loss or damage sustained by the Government resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by Govt. as a consequence of

Govt. failure to give notice under workmen's compensation Act or otherwise conform to the provisions of the said Act in regard to such accident.

- 71.2 In the event of an accident in respect of which compensation may become payable under the workmen's compensation Act VIII 23 whether by the contractor, by the Government it shall be lawful for the Employer/ Employer's representative to retain such sum of money which may in the opinion of the Employer/ Employer's representative be sufficient to meet such liability. The opinion of the Executive Engineer shall be final in regard to all matters arising under this clause.
- 71.3 The contractor shall at all times indemnify the Govt. of A.P. against all claims which may be made under the workmen's compensation act or any statutory modification
- (a) The contractor shall, at all times, maintain on the works, staff of qualified Engineers, and Supervisors of sufficient experience of similar other jobs to assure that the quality of work turned out shall be as intended in the specifications. The contractor shall also maintain at the works, a Work Manager or sufficient status, experience and office and duly authorize him to deal with all aspects of the day-to-day work. All communications to any commitments by the Work Manager shall be considered as binding on the Contractor.
 - (b) The Contractor shall at all times submit details of skilled and unskilled labour and equipment employed to the Engineer-in-Charge in prescribed proforma as he may require to assess and ensure the proper progress of work.
 - (c) If the contractor does not employ the technical person agreed to on the work a fine of Rs.25,000/- will be imposed. If he does not employ for 30 days, thereafter it becomes a fundamental breach of contract.

Accommodation and food:

The contractor should arrange accommodation he needs, at his own cost. The contractor shall make his own arrangements for supply of food grains, fuel and other provision to his staff and labourers including controlled commodities.

74. Relationship:

Contractor shall have to furnish information along with tender, about the relationship he is having with any officer of the Department, Government of Andhra Pradesh of the rank Assistant Engineer and above engaged in the work and any officer of the rank of Assistant Secretary and above of the Department of Government of Andhra Pradesh.

75. Protection of adjoining premises:

The contractor shall protect adjoining sites against structural, decorative and other damages that could be caused by the execution of these works and make good at his cost any such damages.

76. Work during night or on Sundays and holidays:~

The works can be allowed to be carried out during night, Sundays or authorised holidays in order to enable him to meet the schedule targets and the work shall require MORT&H round the clock working keeping in view:

- (i) The provisions of relevant labour laws being adhered to:
- (ii) Adequate lighting, supervision and safety measures are established to the satisfaction of the Employer/ Employer's representative and
- (iii) The construction programme given by the Contractor and agreed upon by the Employer/ Employer's representative envisages such night working or working during Sundays or authorised holidays.
- (iv) The construction programme given by the Contractor and agreed upon by the Employer/ Employer's representative envisages such night working or working during Sundays or authorised holidays.

The contractor shall deposit materials for the purpose of the work on such parts only of the ground as may be approved by the Employer/ Employer's representative before starting work. A detailed survey, clearly indicating position and areas where materials shall be stacked and sheds built is to be conducted by the contractor at his own cost and only after obtaining necessary approval of the plan for use of sites by the Employer/ Employer's representative, the Contractor can use the sites accordingly.

Procurement of blasting materials and its storage is the responsibility of the contractor. The contractor shall engage licensed blaster for blasting operation. The contractor is to act in accordance with Indian Explosive Act and other rules prevailing, during the execution of work. It is the responsibility of the contractor to see, that works by other agencies in the vicinity are not hampered, in such cases if any claim is made by other agencies that should be borne by the contractor. Carriage of blasting materials, from the magazine to the work site, is the responsibility of the contractor.

79. Plant and Equipment:

79.1 The contractor shall have sufficient plant, equipment and labour and shall work such hours and shifts as may be necessary to maintain the progress on the work as per the approval progress schedule. The working and shifts hours shall comply with the Govt. Regulations in force.

79.2 It is to expressly and clearly understood that contractor shall make his own arrangements to equip himself with all machinery and special tools and plant for the speedy and proper execution of the work and the department does not undertake responsibility towards their supply.

79.3 The department shall supply such of the machinery that may be available on hire basis but their supply cannot be demanded as matter of right and no delay in progress can be attributed to such non-supply of the plant by the department and the department cannot be made liable for any damage to the contractor. The Contractor shall be responsible for safe custody of the departmental machinery supplied to him (which will be delivered to contractor at the machinery yard at site of work) and he has to make good all damages and losses if any other than fire, wear and tear to bring it to the conditions that existed at the time of issue to the contractor before handing over the same to the department. The hire charges for the machinery handed over to the contractor will be recovered at the rate prevalent at the time of supply. The contractor will have to execute supplemental agreement with Employer/ Employer's representative at the time of supply of the machinery.

79.4 The acceptance of departmental machinery on hire is optional to the contractor.

The contractor shall not deposit materials at any site, which will cause inconvenience to public. The Employer/ Employer's representative may direct the contractor to remove such materials or may undertake the job at the cost of the contractor.

82. Conflict of interest:

Any bribe, commission, gift or advantage given, promised or offered by or on behalf of contractor or his partner, agent or servant or any one on his behalf to any officer, servant, representatives, agents of Employer/ Employer's representative, or any persons on their behalf, in relation to the obtaining or to execution of this, or any other contract with Employer/ Employer's representative shall in addition to any criminal liability, which it may incur, subject to the cancellation of this or all other contracts and also to payment of any loss or damage resulting from any such cancellation. Employer/ Employer's representative shall then be entitled to deduct the amount, so payable from any money, otherwise due to the contractor under this or any other contract.

83. Contract documents and materials to be treated as confidential:

All documents, correspondences, decisions and orders, concerning the contract shall be considered as confidential and/or restricted in nature by the contractor and he shall not divulge or allow access to them by any unauthorized person.

84. General obligations of Contractor:

84.1 The contractor shall, subject to the provision of the contract and with due care and diligence, execute and maintain the works in accordance with specifications and drawings.

84.2 The contractor shall promptly inform the Department and the Employer/ Employer's representative of any error, omission, fault and such defect in the

design of or specifications for the works which are discovered when reviewing the contract documents or in the process of execution of the works.

- 84.3 If Contractor believes that a decision taken by the Employer/ Employer's representative was either outside the authority given to Employer/ Employer's representative by the Contract or that the decision was wrongly taken, the decision shall be referred to the technical expert within 14 days of the notification of the Employer/ Employer's representative decisions
- 84.4 Pending finalisation of disputes, the contractor shall proceed with execution of work with all due diligence.

85. Security measures:

- a) Security requirements for the work shall be in accordance with the Government's general requirements including provisions of this clause and the Contractor shall conform to such requirements and shall be held responsible for the actions of all his staff, employees and the staff and employees of his sub-contractors.
- b) All contractors' employees, representatives and sub-contractor's employees shall wear identifications badges provided by the contractor. Badges shall identify the contractor, showing and employee's number and shall be worn at all times while at the site. Individual labour will not be required to wear identification badges.
- c) All vehicles used by the contractor shall be clearly marked with contractor's name.
- d) All contractors' employees, representatives and sub-contractor's employees shall wear identifications badges provided by the contractor. Badges shall identify the contractor, showing and employee's number and shall be worn at all times while at the site. Individual labour will not be required to wear identification badges.
- e) The contractor shall be responsible for the security of the works for the duration of the contract and shall provide and maintain continuously adequate security personnel to fulfill these obligations. The requirements of security measures shall include, but not limited to maintenance of order on the site, provision of all lighting, fencing, guard flagmen and all other measures necessary for the protection of the works within the colonies, camps and elsewhere on the site, all materials delivered to the site, all persons employed in connection with the works continuously throughout working and non working period including nights, Sundays and holidays for duration of the contract.
- f) Other contractors working on the site concurrently with the contractor will provide security for their own plant and materials. However, their security provisions shall in no way relieve the contractor of his responsibilities in this respect

- g) Separate payment will not be made for provision of security services.

86. Fire fighting measures:

- a) The contractor shall provide and maintain adequate fire fighting equipment and take adequate fire precaution measures for the safety of all personnel and temporary and permanent works and shall take action to prevent damage to destruction by fire of trees shrubs and grasses.
- b) Separate payment will not be made for the provision of fire prevention measures.

87. Sanitation:

The contractor shall implement the sanitary and watch and ward rules and regulations for all forces employed under this contract and if the Contractor fails to enforce these rules, the Employer/ Employer's representative may enforce them at the expenses of the Contractor.

88. Training of personnel:

The contractor, shall, if and as directed by the Employer/ Employer's representative provide free of any charge adequate facilities, for vocational training of Government Officers, students, Engineers, supervisors, foremen, skilled workman etc. not exceeding six in number at any one time on the contractor's work. Their salaries, allowances etc. will be borne by the Government and the training schemes will be drawn up by the Employer/ Employer's representative in consultation with the contractor.

89. Ecological balance:

- a) The contractor shall maintain ecological balance by preventing deforestation, water pollution and defacing of natural landscape. The contractor shall so conduct his construction operation as to prevent any unnecessary destruction, scarring, or defacing of the natural surrounding in the vicinity of the work. In respect of the ecological balance, Contractor shall observe the following instructions.
 - i) Where unnecessary destruction, scarring, damage or defacing may occur, as result of the operation, the same shall be repaired replanted or otherwise
 - ii) All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall be protected from any damage that may be caused by the contractor's construction operation and equipment. The removal of trees and shrubs will be permitted only after prior approval by the Employer/ Employer's representative. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the contractor shall adequately protect such trees by use of protective barriers or other methods

approval by the Employer/ Employer's representative. Trees shall not be used for anchorages. The contractor shall be responsible for injuries to trees and shrubs caused by his operations. The term "injury" shall include, without limitation bruising, scarring, tearing and breaking of roots, trunks or branches. All injured trees and shrubs be restored as nearly as practicable without delay to their original condition at the contractor's expense.

(iii) The contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter contaminants, debris and other objectionable pollutants and wastage into river. Such pollutant and waste include earth and earth products, garbage, cement concrete, sewage effluent, industrial wastes, radio-active substances, mercury, oil and other petroleum products, aggregate processing, mineral salts and thermal pollution. Pollutants and wastes shall be disposed off in a manner and at sites approved by the Employer/ Employer's representative.

(iv) In conduct of construction activities and operation of equipments the contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize the air pollution. The excessive omission of dust in to the atmosphere will not be permitted during the manufacture, handling and storage of concrete aggregates and the contractor shall use such methods and equipment as a necessary for collection and disposal or prevention of dust during these operation. The contractor's methods of storing and handling cement shall also include means of eliminating atmospheric discharges of dust, equipment and vehicles that give objectionable omission of exhaust gases shall not be operated. Burning of materials resulting from clearing of trees, bushes, combustible construction materials and rubbish may be permitted Only when atmospheric conditions for burning are considered favorable.

b) Separate payment will not be made for complying with the provisions of this clause and all cost shall be deemed to have been included in the unit rates and prices included in the contract if any provision is not complied with within a reasonable time even after issue of a notice in this respect, the necessary operations would be carried out by the Employer/ Employer's representative at the cost of the Contractor, Orders of the Employer/ Employer's representative in this respect would be final and binding on the contractor.

90. Preservation of existing vegetation:

a) The contractor will preserve and protect all existing vegetation such as trees, on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Employer/ Employer's representative. The contractor will be held responsible for all

unauthorized cutting or damage of trees, including damage due to careless operation of equipment, stockpiling of materials or trekking of grass areas by equipment. Care shall be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damages to vegetation and trees that are to remain in place and to structures under construction or in existence and to workmen.

- b) All the produce from such cutting of trees by the contractor shall remain the property of Government and shall be properly stacked at site, approved by the Employer/ Employer's representative.. No payment whatsoever, shall be made for such cutting and its stacking by the Contractor. If any produce from such cutting is not handed over to the Government by the contractor, he shall be charged for the same at the rates to be decided by the Employer/ Employer's representative.. The recovery of this amount shall be made in full from the intermediate bill that follows.
- c) The contractor shall also make arrangements of fuel deposits for supply of required fuel for the labourer to be employed for cooking purpose at his own cost in order to prevent destruction of vegetation growth in the surrounding area of the work site.

91. Possession prior to completion:

The Employer/ Employer's representative shall have the right to take possession of or use any completed part of work or works or any part thereof under construction either temporarily or permanently. Such possession or use shall not be deemed as an acceptance of any work either completed or not completed in accordance with the contract with in the interest of Clause 28 of APSS except where expressly otherwise specified by the Employer/ Employer's representative.

92. Payment upon termination:

If the contract is terminated because of a fundamental breach of contract by the contractor, the Employer/ Employer's representative shall issue a certificate for the value of the work done less advance payment received upon the date of the issue of the certificate and less the percentage to apply to the work not completed as indicated in the contract data. Additional liquidated damages shall not apply. If the total amount due to the Department exceeds any payment due to the contractor the difference shall be a debt payable to the Department. In case of default for payment within 28 days from the date of issue of notice to the above effect, the contractor shall be liable to pay interest at 12% per annum for the period of delay.

93. Access to the contractor's books:

Whenever it is considered necessary by the Engineer-in-Charge to ascertain the actual cost of execution of any particular extra item of work or supply of the plant or material on which advance is to be made or of extra items or claims, he shall direct the contractor to produce the relevant documents such as

payrolls, records of personnel, invoices of materials and any or all data relevant to the item or necessary to be by the Employer/ Employer's representative. and the Engineer-in-Charge's representative and by any other persons authorised by the Employer/ Employer's representative. in writing.

95. B.I.S. [I.S.I.] books and APSS to be kept at site:

A complete set of Indian Standard specifications ,CPHEEO manual on sewerage and treatment and any other relevant literature referred to in "Technical Specifications" and A.P.S.S. shall be kept at site for reference.

96. Variations by way of modification, omissions or additions:

For all modifications, omissions from or additions to the drawings and specifications, the Employer/ Employer's representative will issue revised plans, or written instructions, or both and no modification, omission or addition shall be made unless so authorised and directed by the Employer/ Employer's representative. in writing.

The Employer/ Employer's representative shall have the privilege of ordering modifications, omission or additions at any time before the completion of the work and such orders shall not operate to annul those portions of the specifications with which said changes do not conflict.

Employer/ Employer's representative Decision:

It shall be accepted as in separable part of the contract that in matters regarding materials, workmanship, removal of improper work, interpretation of the contract drawings and contract specification, mode of the procedure and the carrying out of the work, the decision of the Engineer-in-Charge, which shall be given in writing shall be binding on the contractor.

97. Care and diversion of river/stream:

The contractor shall submit details regarding the diversion and care of river or stream during construction of the work along with a separate print-out of the time table showing earliest and latest start and finish dates of various activities. He should submit a detailed layout plan with drawings for the diversion and care of river during construction of work. The above arrangements shall be at contractor's cost.

98. Income tax:

- a) Income Tax will be recovered as per rules in force.
- b) Income Tax clearance certificate should be furnished before the payment of final bill.
- c) The contractor's staff, personnel and labour will be liable to pay personnel income taxes in respect of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the contractor shall perform such duties in regard to such

deductions thereof as may be imposed on him by such laws and regulations.

99. Seigniorage charges:

99.1 *Seigniorage charges will be recovered as per rules from the work bills of the contract or based on the theoretical requirement of materials*

99.2 The rates are liable to be revised and amended from time to time by the State Government, by notification in the 'Andhra Pradesh Gazette'. If the revised Seigniorage fee is more than the above mentioned, the recovery from the contractor's bills is as per revised rates.

99.3 The Sand consumed in all Government works by the contractors, normal Seigniorage fee with one time penalty may be recovered from the work bills by the consuming department in case of procurement of sand is without valid permits issued by the concerned Assistant Director of Mines & Geology.

100. Value added tax:

100.1 Value added tax at the rate of 5.0 % on all the items of works. Any changes made in the VAT structure from time to time shall be effected

100.2 The contractor should produce a valid Sales Tax Clearance Certificate before the payment of the final bill, otherwise payment to the contractor will be withheld.

101. Supply of construction materials:

i) The contractor has to make his own arrangements for procurements, supply and use of construction materials.

[Any other special conditions applicable to the work put to Tender]

102. In respect of EPC works the conventional Schedule- A giving the quantities against each item of work is dispensed with. Only project information regarding project features, major components as available are given in project profile of bid documents. Scope of work and basic project parameters of the project and deliverables shall be defined in the bid documents. The bidders shall review the data / information provided in bid documents and satisfy themselves. Any doubts shall be got cleared in pre bid meeting. The contractor shall quote the bid price in lump-sum after careful analysis of cost involved for the performance work considering all basic parameters, specifications and conditions of contract The bid offer shall be for the whole work and not for individual item / part of work. The bidder shall quote for the entire work on a single source responsibility basis. The cost of all items of work necessary to achieve the objective as set out in the basic parameters shall be included in the bid price. The total cost of work shall be mentioned.

103. In respect of EPC works the execution shall be strictly in accordance with bid conditions. Contractors shall not deviate from basic parameters of the project to reduce his costs. EPC being a turnkey system extra items / financial claims on the department contingent to the work other than price adjustments shall not be considered.
104. In respect of EPC the Internal Bench Mark (IBM) put to tender value shall be the basis for comparison of tenders.
105. **The agency shall furnish the detailed estimates prepared based on approved drawings as per provision of agreement.**
106. Drawings given, listed and indexed in bid documents are indicative. The above drawings show the system, as a whole .The contractor shall carry out investigation to prepare detailed layout, designs and drawings of all components of the work within the stipulated time period, to be approved by consultant/ departmental authority. The contractor shall follow all relevant BIS codes / circulars issued by the department from time to time for various components of the works. In case of difference of opinion on technical matters between the contractor and the Engineer-in-charge, the decision of the appellate authority shall be final and binding on the contractor.
107. The appellate authority is Superintending Engineer in respect of designs and drawings approved by Engineer-in-charge.
108. The appellate authority is Engineer –in - Chief (PH)/ Chief Engineer in respect of designs and drawings approved by Superintending Engineer.
109. The appellate authority is the Committee constituted by the Government in respect of designs and drawings approved by Engineer – in – Chief (PH) /Chief Engineer.
110. In case of EPC works, if the prime contractor desires to sublet a part of the work, he should submit the same at the time of filing bids (itself) or during execution, giving the name of the proposed sub contractor, along with details of his qualification and experience. The bid accepting authority should verify the experience of the sub contractor and if the sub contractor satisfies the qualification criteria in proportion to the value of work proposed to be sub let, including his past track record of completion and quality of work, he may permit the same. The aggregate value of works to be awarded on sub letting shall not exceed 50% of contract value. The extent of sub letting shall be added to the experience of the sub contractor and to that extent deducted from that of the main contractor.
111. The Engineer – in- Chief (PH) shall permit grant of extension of time up to six months and the State level Committee constituted by the Govt. for beyond six months, subject to levying liquidated damages wherever necessary and the employer conveys the same to the agency.
112. Termination of contact shall also be as per condition No.55 of General Conditions of EPC contract.

113. Entrustment of additional items of work contingent to main work and outside the scope of the contract will be authorized by the employer with the prior approval of the Committee constituted by the Government and the contractor shall be bound to execute such additional items and shall be compensated at the price decided by the Committee formulated by the Government.
114. Whenever additional items not contingent on the main work and outside the scope of original contract are entrusted to the contractor, entrustment of such items and the price to be paid shall be referred to the Committee formulated by Government for final decision.
115. In respect of open category tenders, technical evaluation shall be done first following the criteria specified in the bid document and financial bid evaluation shall be done in respect of those who are qualified in technical bid evaluation.
116. In addition to the four methods of execution viz., (i) the departmental method (ii) the piece work contract method (iii) the lump sum contract method and (iv) the schedule contract method , (v) fifth method is introduced for execution of EPC works by an agreement in the form approved by Government for EPC works.
117. In regard to method (v) the details are set forth clearly in the form of articles of agreement, tender notice and tender documents approved by committees constituted by Government.
118. In case of EPC works, measurements shall be recorded by EPC agency in M.Books and L.F. Books issued by the concerned EE duly numbered and certified. The M. Books and L.F. Books have to be maintained by the EPC agency through authorized graduate engineers as per procedure prescribed in Code and finally to be handed over to the department (Engineer-in-charge).
119. Wherever Quality Control agencies are in existence, such agency has to record its findings in M Books/LF Books besides furnishing certificates as prescribed separately.
120. Contractors are permitted to avail the facility of Mobilization advance in two installments equivalent to 10% (5% for Labour Mobilization and 5% for Machinery & equipment) of the contract amount. The Mobilization advance of 5% towards Labour Mobilization be paid in two installments as detailed below
121. 1% after concluding the agreement
122. 4% at the time of commencement of work (After completion of investigation, survey & designs).
123. Mobilization advance on Machinery is payable against the production of invoices in proof of purchase of the machinery by the contractor / firm / joint venture.
124. The invoices should be on the name of the contractor / firm / joint venture only and the machinery should have been purchased only after the date of

conclusion of the agreement for the work on which the payment of mobilization advance is proposed.

125. Mobilization advance is payable against copies of bills in respect of new machinery purchased @ 100% value as prescribed in the agreement. The same is payable in respect of old machinery at 50% of the value (as prescribed in the agreement) as per the registered sale deed.
126. No Mobilization advance is payable on the pre-owned machinery prior to conclusion of the agreement for the work or leased machinery or purchased by the contractor.
127. Recovery of mobilization advance along with interest shall be made as per provisions of the contract. The interest rate will be +2% of prevailing PLR of Banks.
128. The estimate shall be prepared based on available preliminary data, the scope of works and project parameters taking into consideration
129. Superintending Engineer should prepare project profile and basic project parameters with project cost under EPC turnkey System. The same shall be approved by the Committee constituted for the purpose.
130. in case the department has any new facts which will materially affect the cost of the project they shall be taken into consideration and brought to the notice of the IBM Committee. After approval of the IBM Committee, technical sanction will be accorded.
131. If that cost of estimate is found to exceed the Administrative approval, Revised administrative approval must be obtained before according Technical sanction.
132. In case of EPC works the designs are to be submitted by the executing agency which shall be approved by the competent authority. The EPC agency responsible for the technical features of designs.
133. In addition to the three methods of execution fourth method is introduced for execution of EPC works. (iv) By an agreement in the form approved by Government for EPC.
134. In regard to method (iv) The details are set forth clearly in the form of articles of agreement, tender notice and bid documents approved by Government.
135. Contract documents approved by the Committee constituted by Government for EPC works in terms of Para 153 of "D" Code shall be followed whenever tenders are invited for EPC works.
136. In respect of EPC works limited/ open tender system shall be followed.
137. In respect of EPC works, M. Books and L.F. Books have to be issued by the Executive Engineer to EPC agency duly certified and numbered for recording measurements and levels. The M. Books and L.F. Books shall be maintained by EPC Agency and bills are to be submitted to the **Engineer in Charge** by the

EPC agency along with a true extract of the entire set for checking and making payment. The Engineer-in-charge has to keep the full set of true extract with him and return the originals to the agency for further use. The entire original record shall be finally handled over for record to the Engineer-in-charge by the EPC Agency.

138. In respect of EPC works, EPC Agency shall prepare monthly work bills based on measurements of work done and submit to Engineer-in-charge.
139. In respect of EPC works, payments shall be regulated in accordance with Annexure-II- Schedule of Payments component wise.
140. The components may be further divided into appropriate sub components and stages. The payment of each stage of sub component shall be expressed as percentage of total cost of approved bid which shall also be approved by the Superintending Engineer and shall form part of contract. Sum of all such stages of particular component shall be equal to the percentage of that component shown in Annexure-II of Schedule of Payments.
141. The percentage fixed for sub component shall be correlated to the main component and volume of the work.
142. The eligibility for payment shall be limited to completed portions of works, subject to other conditions envisaged in the agreement and executive instructions from time to time.
143. Schedule-A indicates only firm lump-sum amount of the contract.
144. Bidder shall quote lump sum amount for the work as a whole.
145. Percentages of components shall be indicated by the department in Annexure-II to Schedule .A
146. The Chief Engineer is empowered to modify the percentage of components; stage wise based on the detailed investigation, detailed drawings, and detailed estimation done by the EPC agency keeping the total price bid unaltered.
147. The Superintending Engineer is empowered to modify the sub-components reach-wise/stage-wise keeping the percentages of component unaltered.
148. The Sub Divisional Officer and Engineer-in-charge shall exercise check to see that the bill submitted by EPC agency is in accordance with agreement conditions and certified by the departmental Quality Control Authorities (or) 3rd Party Quality Control Agency (or) by both if both are deployed on the work.
149. Engineer-in-charge (EE) should check the claim with reference to the measurements recorded to see that the percentage at which the bill is claimed is clearly traceable into the documents on which payments are to be made. Payments shall be adjusted for recovery of advance payments, liquidated damages in terms of agreement conditions, security deposit for due fulfillment

of the contract. Recoveries shall be affected towards seignorage charges on the materials used and VAT and other statutory recoveries as per State and Central Government Rules and Acts.

In relaxation of provisions contained in APDSS, D-code, Financial Code, Accounts code, the following shall be applicable to the EPC turnkey system:

150. Definitions: (i) The employer is the Superintending Engineer i.e., the agreement concluding authority (ii) "Engineer-in-Charge" is the Executive Engineer in charge of execution.
151. In respect of EPC works the conventional Schedule- A giving the quantities against each item of work is dispensed with. Only project information regarding project features, major components as available are given in project profile of bid documents. Scope of work and basic project parameters of the project and deliverables shall be defined in the bid documents. The bidders shall review the data / information provided in bid documents and satisfy themselves. Any doubts shall be got cleared in pre bid meeting. The contractor shall quote the bid price in lump-sum after careful analysis of cost involved for the performance work considering all basic parameters, specifications and conditions of contract. The bid offer shall be for the whole work and not for individual item / part of work. The bidder shall quote for the entire work on a single source responsibility basis. The cost of all items of work necessary to achieve the objective as setout in the basic parameters shall be included in the bid price. The total cost of work shall be mentioned.
152. The execution shall be strictly in accordance with bid conditions. Contractors shall not deviate from basic parameters of the project to reduce his costs. EPC being a turnkey system extra items / financial claims on the department contingent to the work other than price adjustments shall not be considered.
153. In respect of EPC works drawings given, listed and indexed in bid documents are indicative. The above drawings show the system as a whole. The contractor shall carry out investigation to prepare detailed layout, designs and drawings of all components of the work within the stipulated time period, to be approved by consultant/ departmental authority. The contractor shall follow all relevant BIS codes / circulars issued by the department from time to time for various components of the works. In case of difference of opinion on technical matters between the contractor and the Engineer-in-charge, the decision of the appellate authority shall be final and binding on the contractor.

NOTE ON ROLES AND RESPONSIBILITIES OF CONSTRUCTION STAFF, QUALITY CONTROL WING AND THIRD PARTY QUALITY CONTROL AGENCY IN EXECUTION OF PROJECT TAKEN UP UNDER EPC TURNKEY SYSTEM.

The Government of Andhra Pradesh has taken up large number of Drinking Water Supply Projects to bring the water supply position to the standards of CPHEEO. Government have also taken up Under Ground Drainage, Storm Water Drainage, Solid Waste Management Projects in different ULBs to improve the standard of living of the people. Most of the projects are being grounded and are at

various stages of progress. As the projects are to sustain for number of decades, Quality Control assumes an important role. Maintenance of Quality of Projects is a continuous process and has to be ensured and assured by the executing agency under EPC System, construction staff, Department Quality Control and the third party Quality Control agencies wherever appointed.

The following guidelines are drafted with reference to the roles and responsibilities of field staff, quality control staff and 3rd party quality control agencies, procedure for recording of work executed in M Books for making payments to the contractors for the work executed every month including maintenance of records and certification of quality of work executed and the same may be followed to have a uniform procedure in maintaining the quality controls / assurance in the project taken up under EPC turnkey system

- A) The roles and responsibilities of field staff, Quality Control Staff and 3rd Party Quality Control Agencies.

I) FIELD STAFF

- 1) The field staff (construction staff) has to associate with the EPC agency while conducting the tests. In case of necessity they may conduct tests independently whenever required. Under EPC system the field staff play a vital role in quality assurance of the works.
- 2) The field staff shall invariably check and produce all the following Records and OK **cards maintained by EPC Agency at the site to the Inspecting Officers.**

A) Registers

- 1) Site Order
- 2) Register of Bench Marks
- 3) Material OK Register
- 4) Register of Foundations
- 5) Register of placement for concrete, Embankment, reinforcement and other test reports.
- 6) Register of laying pipelines, testing.
- 7) Register of test reports of comprehensive strength of concrete specimens
- 8) Cement Day Book
- 9) In case of Earthwork excavation embankment, the field staff have to check and record the pre levels 25% of the pre levels taken by the EPC agency. In case of cut-off and foundations the field staff have to check and record 100% levels.

II) Department Quality Control Staff

- a) The Department Quality Control staff shall verify the records maintained at site by EPC agency and the third party quality control agency. The field quality control staff have to check 25% of works such as pipes, laying, jointing, testing including pumping machinery and record independently.
- b) Regarding the tests and frequency of tests, the field quality control staff have to conduct / associate with construction staff as mentioned in Annexure – D. In case of ambiguity, they shall conduct tests in APERL / independent laboratory approved by employer.
- c) Wherever the Third Party quality control agency is not appointed, the Department Quality Control staff have to issue the quality certificates for releasing payment to the EPC agency during construction and other completion.

III Third Party Quality Control Agency

- a) The Third Party Quality Control agency should possess all the testing facilities as per agreement and conduct independent testing to assure the quality of work. They should also verify 10% of the tests being done by the EPC agency independently.
- b) The third party quality control agency has to submit the reports and records to the Engineer-in-Charge vide appendix “E”.

B Recording of measurements and certifying payments to the EPC Agency.

- a) Measurements are to be recorded by the EPC Agency in the Measurement Book and LF Books.
- b) The measurement book and LF book are to be issued by the concerned Executive Engineer duly certified and numbered.
- c) Field Engineer (AE/AEEs) have to check and record 25% of prevels and 100% for final levels.
- d) Field Engineer (AE/AEEs) have to check measure 20% of final measurement.
- e) Field Dy. EEs have to check the measure 25% of the levels and measurements spread over the entire work
- f) Field EE/SEs have to check measure as per codal provisions and rules in vogue.
- g) The measurement books and LF books have to be maintained by the EPC agency and finally to be handed over the Department (Engineer-in-Charge)

- h) The Department QC Staff have to check 25% of the work such as pipes, laying, jointing, testing, concrete work, etc.
- i) Measurement will be recorded by the EPC agency for the finished work duly certifying that all tests are conducted and work done by the agency in accordance with specifications and contracts conditions by using the material specified in the contract.
- j) The EPC Agency shall prepare monthly work bills based on the recorded measurement of work done and submit to the Engineer-in-charge duly signed by them or his authorized signature for arranging
- k) The Engineer-in-Charge shall recommend for release of payment duly ensuring quality certificate by the third party quality control agency / Department quality control staff (in absence of third party quality control).

NOTE: The above guidelines have to be followed duly inter relating with the relevant conditions / clauses of the respective Agreements concluded.

(C) Reporting procedure for adverse remarks of 3rd party Quality Control Agency and Departmental Quality Control Staff.

- 1 Reporting procedure shall be followed as per Appendix 'E'.
- 2 The third party quality control agency shall submit reports in four sets for specific cases of deficiencies for corrective action to the Engineer-in-charge soon after verification. The sub-standard material shall be rejected and got them removed from the site. In case necessity, Engineer-in-Charge shall arrange to stop the work till the deficiencies are rectified to the satisfaction of the 3rd party Quality control Agency / departmental quality staff.
- 3 The Engineer-in-Charge shall communicate the above remarks of 3rd party quality control agency to the EPC agency for compliance of corrective action.
- 4 The EPC agency shall furnish compliance report to the Engineer-in-Charge, who in turn forward the same to the third party quality control agency / department quality control as the case may be for verification.
- 5 Soon after receipt of report on the compliance to the remarks of the third party quality control agency by the EPC agency, evidence of compliance of corrective action has to be furnished to the Engineer-in-Charge to proceed with further work.
- 6 In addition to the above, the observations made by the third party quality control and the Department quality control staff have to be invariably completed with before the next bill is present for payment and certificate to that effect has to be recorded in bills presented by the EPC agency duly countersigned by their field construction staff before making payments.

- 7 On completion of the works, the third party control agency and Department Quality Control staff have to certify that the work has been executed as per design and specifications satisfying intended scope of project as indicated in the agreement before making final payments to the EPC agency.
- 8 All Quality Control Units inclusive of 3rd party agency shall be under the Technical Control of Engineer –in-Chief (Public Health)

Salient points on the Duties of the Construction Engineers under E.P.C. System:

- Under E.P.C. System, the field Engineers are primarily responsible for Quality Assurance of the work executed by them and conduct all field tests before allowing further work.
- Shall check and produce to inspecting officers the following Records and O.K. Cards maintained by the E.P.C. Agency.

A) Registers:-

1. Site order.
2. Register of Bench Marks.
3. Material O.K. Register.
4. Register of pipes, laying, jointing, testing.
5. Register of foundations.
6. Register of placement of concrete, Embankment, Reinforcement and other test reports.
7. Register of test reports of compressive strength of concrete specimens.

E.Es/S.Es have to check measure as per Codal provisions and rules in vogue.

- The Measurement records have to be maintained by E.P.C. Agency and finally handed over to the Engineer-in-Charge.
- The observations made by Third party Quality Control, Department Quality Control Staff have to be invariably complied with before the next bill for payment is presented. To that effect certificate has to be recorded by E.P.C. Agency and countersigned by the field Engineers.

Under E.P.C. System of contract, fortnightly Management Meetings with E.P.C. Agency by the Superintending Engineer shall invariably discuss the Quality Assistance Aspects and records in the Minutes of Meeting regularly.

Salient Points on the Duties of Department Quality Control Staff.

- Shall verify the records maintained @ site by the E.P.C. agency and the Third Party Quality Control agency.

- Shall check 25% of the pipe laying, testing, final levels/measurements of Earth work, revetment, leveling, concrete, linear dimensions of important structures, etc.
- Shall conduct/Associate with construction staff with regard to Test & Frequency of Tests as stipulated in the Annexure 'D' of Committee on Q.C. Recommendations.
- In case of Ambiguity of Test Results, they shall conduct tests in A.P. E.R.L. independently.
- Shall issue quality certificates for releasing payment in absence of Third Party Quality Control to the E.P.C. Agency during construction and after completion.
- Shall certify that the work has been executed as per designs & Specifications (agreement) before final payment to E.P.C. Agency.

Third Party Quality Control Agency

The Third Party Quality Control Agency should possess all the testing facilities as per Agreement and conduct independent Testing to assure the Quality of Work.

- Shall verify 10% of the tests done by the E.P.C. Agency.
- Shall submit the Reports and Records to Engineer-in-Charge as per agreement with the Department.
- Shall give Quality Control Certificate for each work bill executed by the EPC Agency.
- On completion of the work, the third Party Quality Control Agency shall certify that the work has been executed as per Design and specifications indicated in the agreement satisfying intended scope project before marking final payment to the E.P.C. Agency.

BIDDING DOCUMENT
VOLUME – II
TECHNICAL SPECIFICATIONS

Technical Special conditions

1. Specifications for Surge Protection System

Surge Analysis:

The contractor shall undertake surge analysis to determine the extent of surge pressures or other adverse hydraulic conditions that may occur during the operation of rising mains.

The contractor shall undertake the following tasks as an integral part of the surge analysis for each system:

1. Construct a mathematical model of the system using internationally recognized transient simulation computer software. The network model should be as detailed as possible incorporating high and low elevation points along the pipeline and detailed piping manifold in pump station area.
2. List all the steady state scenarios under which the system will operate;
3. List, with reasons, the most adverse surge conditions under which the system will operate;
4. Determine maximum and minimum surge pressures along the system that can occur due to system operation with and without cavitation conditions. The case with cavitation conditions must capture high and low surge pressures by simultaneously limiting low pressures to vapor pressure at all nodes considered in the mathematical model.
5. Add surge protection system to the network model and determine the maximum and minimum surge pressures for the most adverse surge conditions. The network model used for studying the effectiveness of surge protection system should also include all air venting valves, though they are not normally considered as part of the surge protection system.
6. Verify the adequacy of the surge protection system for other important operating scenarios such as new pipe roughness condition, power failure during single pump operation, and pump start up conditions.
7. The surge simulations must be carried out for at least 10 times $2L/c$ value where L is the total length (m) of the pipeline and c is the average celerity (wave speed) in m/s. Results presented should indicate the total simulation time, for

example, pressure variation graphs with respect to time at some specific locations along the pipeline.

8. Computational time should be at a minimum of 0.005 seconds to capture all the pressure spikes arising from air valve slam conditions, NRV slam conditions, and any other rapidly varying slam pressures. The report generated by the surge analysis software should be attached to demonstrate the use of small computational time step.

9. Maximum positive surge pressures on the pipeline should not exceed **25 % than** the maximum working pressure. The sustained (lasting for more than 10 seconds) negative pressures on the pipeline should not be less than -2m and all other negative pressure occurrences must be no less than -5m. Thickness of the pipeline must be capable of withstanding both highest and lowest negative pressures in accordance with the appropriate Indian or AWWA standards.

10. Prepare a Surge Analysis Report providing full details of tasks (1) to (6), including sufficient data sheets, figures, and analysis output etc. from the transient simulation computer software to allow the vetting authority to undertake a detailed review of the Surge Analysis Report.

If the review by a competent vetting authority such as IIT (or equivalent institute) suggests additional simulations and/or changes to the protection methods, the contractor shall incorporate all the necessary changes as agreed mutually by client and contractor and resubmit the report.

SURGE PROTECTION SYSTEM SHOULD COMPRISES OF ANY OR ALL OF THE FOLLOWING EQUIPMENTS DEPENDING ON THE RECOMMENDATION OF SURGE ANALYSIS TO PREVENT THE POSITIVE AND NEGATIVE SURGES IN THE PIPELINE.

TECHNICAL SPECIFICATIONS OF SURGE PROTECTION EQUIPMENT :

A) Design, manufacture, Supply, erection, commissioning & Testing at site and supply of Bladder type air vessels:



The surge tank shall be vertical, Bladder type vessel suitable for use of with water. The tank, supports & anchor bolts shall be designed & with stand confirm to Indian / international standards.

Surge Tank

The surge tank shall be vertical, bladder type vessel suitable for use with raw Water. Nitrogen should be used to avoid the corrosion.

Tank Sizing.

Surge Tank Design and Materials

Materials for the tank, design, and shop fabrication and inspection shall comply with Pressure Equipment standards (IS/ASME/BS5500/CODAP)

Minimum design pressure shall be as stated in this section of the Specifications, Perform hydrostatic testing in shop. Test pressure shall be 150% of the design pressure of the tank.

Provide a **V2** inch threaded connection at the top of the tank to contain a gas charging valve and pressure gauge. Tank shell will be constructed of deep drawn carbon steel double welded domes and side shells with double welded seams. Tank shall be equipped with a heavy duty butyl rubber bladder. The precharge pressure will be located between the shell of the tank and the bladder. The side manhole shall be removable to allow inspection and maintenance of the bladder. The bladder shall be sized to conform to the inner shape of the vessel. Bladder surge tank shall be of the vertical configuration.

Bladder tank shall be equipped with a Hydro control Level Gauge Equipment with Output 4/20 MA.

Bladder Manufacturing

Service Conditions

Surge tank hydraulic performance conditions and design data shall be as shown

below. Tank :Vertical

Minimum Capacity: -m3

Minimum Design Pressure: — Bar

Bladder materials: Butyl rubber inverted with coating

Minimum Test pressure: — Bar

Tank Installation:

The surge tank shall be installed in accordance with the manufacturer's/Suppliers suggested procedures. All supports, piping, valves, and related appurtenances shall be provided and installed by the Contractor at no additional cost to the Owner.

Painting and Coating

All painting and coating shall be completed at the factory. Field painting and coating will not be accepted. The tank interior shall be painted with anti-corrosion epoxy paint with a uniform layer thickness of no less than 100 microns, The tank exterior shall be painted with 3 coat zinc based epoxy to a minimum thickness of 110 microns.

MATERIAL SPECIFICATIONS FOR BLADDER TYPE SURGE VESSEL

SHELL	: CARBON STEEL P265GH/SA 516 Gr
ELLIPTIC CAP	70/EQUIVALANT : CARBON STEEL P265GH /SA 516
BLADDER	Gr 70/EQUIVALANT :BUTYL
COATING INSIDE	: SAND BLASTING SA 2.51 COAT FOOD EPOXY THICKNESS
COATING	100 MICRON
OUTSIDE	: SAND BLASTING SA 2.5 ZINC EPOXY DRESSING LACQUER RAL 2002 TOTAL THICKNESS 110
LIFTING PAD	MICRONS. : CARBON STEEL P265GH /SA 516 Gr 70/
OUTLET DESIGN	EQUIVALANT : CARBON STEEL S/ENS or
TEMP. POSITION	EQUIVALANT
LOAD CELL	: 60°C
	: VERTICAL
	: HYDROCONTROL LEVEL GAUGE EQUIPMENT WITH OUTPUT 4/20 MA.

b) Specifications of Three Stage Surge Suppression Valve-Three Stage:

The Valve should be able to take high air intake capacity and Discharge the Air in Controlled Way by predesigned Small Orifice to allow the rejoining of columns slowly.

SPECIFICATION:

- > **Air Intake:** The Valves should offer very high air intake capacity with nominal orifice size for ex. 6" valve should have a large orifice of 6" along with better aerodynamic design to reduce the obstruction of air flow through the valve.
- > **Sealing:** The models should be equipped with a two stage sealing, a soft EPDM seal and Bronze seat. As float approaches the orifice it meets first the rubber seal and as pressure increases the seal is pushed and the float seats on the Bronze seat. This ensures low minimum sealing pressure of 2 meters and long life maintenance and leakage free operation
- > **Float design:** Floats should be made of polycarbonate, and should be tested for 100 bar bursting pressure for all pressure ratings of the valves. The float design should offers long term maintenance free operation and resistance against drowning effect of float against orifice. The float design and the air valve body design should offer better protection against pre-mature closing of the valve. The spherical hollow design of the float will offer less resistance which leads to high flow capacities and also avoids accumulation of debris.
- > **Air discharge and surge suppression:** The Surge Suppression Disc should be used in Surge Suppression Air Valve The following parameters are emphasized for the purpose of simulation:
 1. **Air Intake Orifice:** Both the models offer nominal size of orifice for ex. 6" valve has a large orifice of 6" offering very high intake capacity due to less frictional losses.
 2. **Air Outlet Orifice (Surge Suppression orifice):** Manufacturer should develop standard Surge Suppression orifice sizes for each size for Customization of specific requirement as per the hydraulic analysis.
- > **Switching pressure:** This denotes differential pressure required to switch from large orifice to Surge Suppression orifice during air release. **The Valve should have Surge Suppression Disc operating from a differential**

pressure less than 2.75 KPA (27.5cm) of water column to ensure proper switching action even under low intake volumes.

High Flow Combination Air Release Valve Material of Construction

- Body & Cover: Ductile Iron ASTM A 536/EN 1563
- Float (Kinetic) : Polycarbonate
- Float (Automatic) : Foamed Polypropylene
- Nozzle Seat : Bronze ASTM B-62 B-271
- Nozzle Seal : Rubber E.P.D.M.
- Seal (Automatic) : EPDM
- O-Ring : Buna-N
- Screen Cover : Ductile Iron ASTM A 536 / EN 1563
- Screen : Stainless Steel SAE 304
- Bolt and Nut : Galvanized Steel
- Working Pressure: 16 Kg/cm²

2. Technical Specifications of Pump Control Valve:

The Pump Control Valve shall open fully or shut off in response to electric signals. It shall isolate the pump from the system during pump starting and stopping, to prevent pipeline surges.

Main Valve: The main valve shall be a center guided, diaphragm actuated globe valve of oblique (Y) pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The valve shall have an unobstructed flow path, with no stem guides, bearings or supporting ribs. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex® coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.

Actuator: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit. The stainless steel valve shaft shall be center guided by a bearing in the separating partition. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-Port Throttling Plug by bolting if required.

Control System: The control system shall consist of a 3-Way solenoid pilot (for 8" and larger valves, an accelerator shall be added to the solenoid), two check valves (for 12" and larger valves, an additional check valve), a limit switch, and a filter. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested.

Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.

Material Construction:

Body & Actuator : Ductile Iron ASTM A 536/EN 1563

Diaphragm : Nylon Fabric reinforced natural rubber.

Stem & Seat : Stainless Steel

Seal : NBR

Control Tubing & Fitting: Stainless Steel.

Pilot: Brass/Bronze.

Pressure rating : 16 Bar

Large Control Filter with Body of Epoxy Coated Steel, Cover of Brass and

3. AIR MANAGEMENT SYSTEM

Disc of Polypropylene

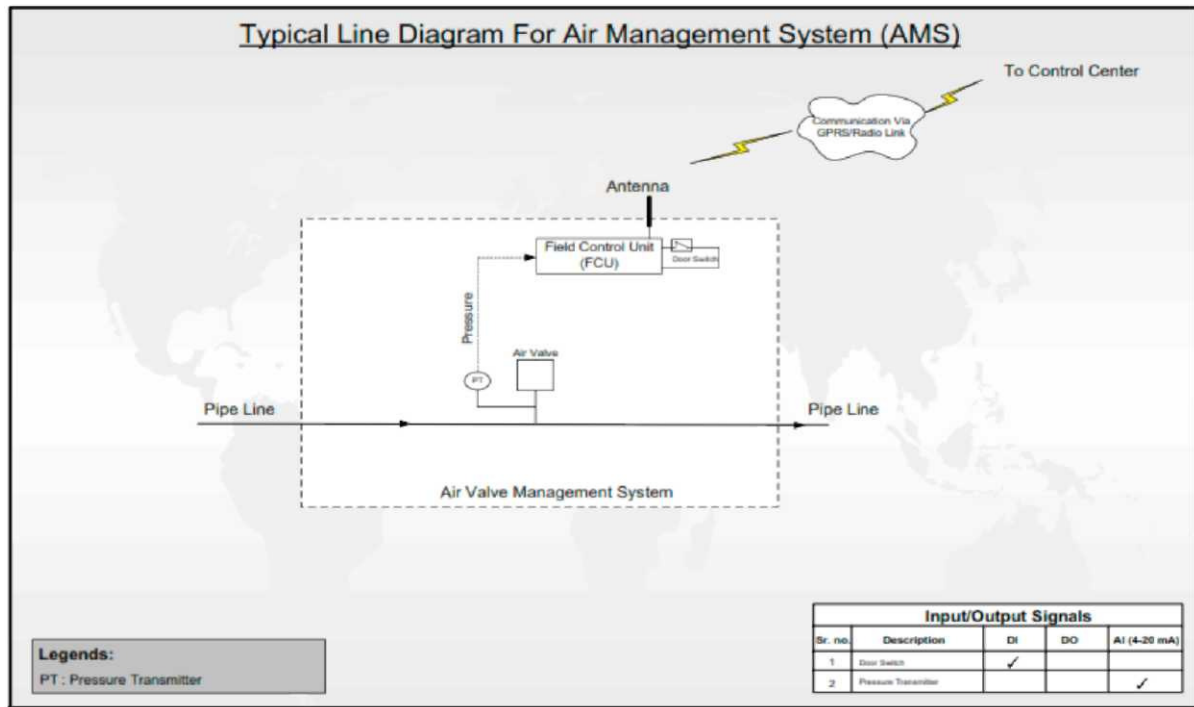
Air Management System is considered on the pipeline by replacing the Existing Air Valve at suitable location. Air Management is necessary for effective working of system as the chock air will leads to water hammer and less flow. This Air Management System is also consist of Pressure Monitoring which will assist for Burst Monitoring and Water Theft Monitoring.

- AIR MANAGEMENT SYSTEM Should capable of Efficient Air Release Valves
- AIR MANAGEMENT SYSTEM Should have Tamperproof Enclosure System with Vandalized Alert
- AIR MANAGEMENT SYSTEM Should Capable of Burst Monitoring by pressure monitoring at Air Valve locations.

Air Management Consist of following equipment's

- 1. Dynamic Air Valve**
- 2. Pressure Transmitter**
- 3. Field Controller**

4. Enclosure System with made up of Reinforced Polyester having vandalism alert



Dynamic Air Valve:

The Combination Dynamic Air Valve should be capable of **not only reducing the Air Slam Effect but also able to provide the local Pressure Relieving Effect.** The Dynamic Valve should **operate without a float**, utilizing the rolling diaphragm principle. This unique structure will allow the dynamic valves to release air from the water system in a controlled and gradual manner, preventing slam and local up-surges, and to draw in large volumes of air into the water system, impeding down surges and, consequently, all pressure surges in the line. **The valves should normally be closed when the line is not operating, thus preventing the infiltration of foreign particles e.g. insects, dirt, snakes etc. into the water system.**

Operation

When the pipeline system begins to fill with water, air becomes compressed in the line and flows into the air valves, raising their sealing assemblies to their open position. Air is then released through an automatic kinetic nozzle. When the water reaches the air valve, it fills the kinetic chamber, where some of it outflows through the kinetic nozzle, and some of it enters into the seal operating chamber, causing it to close. Pressure develops in the

operating chamber, bringing about a controlled lowering of the sealing assembly, until the kinetic nozzle is completely closed. At this stage, the automatic small orifice air release valve continues to work, releasing air through its nozzle. With a reduction in pressure in the line during drainage or shutoff, the force is reduced on the kinetic sealing assembly and it rises and opens the kinetic nozzle, drawing in air from the atmosphere into the system.

The Combination Dynamic Air Valve should be capable of not only reducing the Air Slam Effect but also able to provide the local Pressure Relieving Effect.

The Combination Dynamic Air Valve should be capable of **operating without a float**, utilizing the rolling diaphragm principle to avoid the premature closing problem.

The Dynamic Air Valves should be able to release air from the water system in a controlled and gradual manner, preventing slam and local up-surges.

The Dynamic Air Valves should be designed to draw in large volumes of air into the water system, impeding down surges and, consequently, all pressure surges in the line.

The Dynamic Air valves should be Normally Closed when the line is not operating, which will prevent the infiltration of foreign particles e.g. insects, dirt etc. into the water system.

Main Valve Body and Cover should be of Ductile Iron ASTM A 536
Operating Valve Assembly Should be with Rolling Seal of EPDM for continuous removal of Entrapped Air in pipeline.

Operating Valve Body should be made of Reinforced Nylon. Operating Valve

MATERIAL of CONSTRUCTION :

- | | |
|--------------------------|---|
| 1. Operating Valve Body | : Reinforced Nylon |
| 2. Drainage Elbow | : Polypropylene |
| 3. Rolling Seal | E.P.D.M. Rubber |
| 4. Operating Ass. | : Elastomer + Stainless Steel |
| 5. Clamping Stem | : Reinforced Nylon |
| 6. O-ring seal | : BUNA-N |
| 7. Bolt and nut | : Steel Coated |
| 8. Cover | : Ductile Iron ASTM A 536/ EN 1563 |
| 9. Kinetic Sealing Ass. | : Reinforced Nylon + E.D.P.M. Rubber
+ Stainless Steel |
| 10 Nozzle | : Stainless Steel |
| 11 Body (80mm and above) | : Ductile Iron ASTM A 536 |
| (50 mm) | : Reinforced Nylon |

Assembly should be capable for discharges Entrapped Air up to 160 m³/hr.

4. Technical Specifications for Pump House Automation

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SCOPE OF WORK:

- 1 Complete set of design and engineering documents and drawings.
- 2 Field instruments with field cabling and hook-up to the field instruments, motor operated valves and control system, inclusive of supply and installation of enclosures, housings, junction boxes and accessories.
- 3 All power cables and interconnecting wiring to all items of equipment.
- 4 Adequate power supply distribution and earthing cabling with lightning protection for all I&C equipment.
- 5 Auto Operation of Raw Water pumps, water treatment plant and Product water pumps using PLC & HMI
- 6 Flow metering.

- 7 Cabling between I/O cards & individual field instruments & valves.
- 8 Provision for connection of the new instrumentation, flow meter and control valve signals with adequate spare I/Os
- 9 Power supply is required for all the instruments and flow meters.
- 10 Site Acceptance Tests (SAT).
- 11 Supply of manufacturer's test certificates and tests on completion certificate.
- 12 Supply of operations and maintenance manuals.
- 13 Supply of as-built drawings.
- 14 Supply of all documentation.
- 15 Supply of spares.
- 16 Supply of all specialist test equipment (if applicable).
- 17 Training of Operation and Maintenance personnel.
- 18 Final System Testing.

INTRODUCTION:

This report presents results from a transient modeling study conducted on Small Pumping Stations. The potential for high and low transient pressures resulting from closure of valves or emergency shutdown and rapid expulsion of air from air venting valves cannot be ignored and requires a formal transient modeling study. The study shall be conducted using the popular Software & Experts for understanding all the aspects.



DESCRIPTION OF CONTROL:

Pump Houses and Product water tanks & distributaries shall be constructed under this project. The details of the complete plant are shown in the **P&ID** which shall be interlocked to allow various modes of operation.

The Pump House shall include but not limited to: shut off valves, pressure reducing and flow control valves, pressure transmitter, flow meter.

Pump house field instruments The field instruments and system parameters shall be monitored and controlled. They are as follows

1. Level transmitter for sensing the level in the pump.
2. Pressure switches at discharge of each pump.
3. Pump REMOTE / RUN / TRIP status and Emergency Stop.
4. Motorized valves on discharge line of pumps and valves status indication for open / close position. (Limit switches mounted on valves not in scope of Automation system Supplier)
5. Bladder Vessel load cell sensor weight.
6. Pressure transmitter at discharge.
7. Flow transmitter at discharge.
8. Non return valve at discharge.
9. Pumps Start / Stop commands for all the Main Pumps
10. Valves Open / Close commands for all the motorized valves.
11. Cooling water system Start & Stop commands.
12. Main Incomer Breaker OPEN / CLOSE command.

Control and Operation Philosophy:

Operation of the pumps:

Control shall be provided for required nos. of pumps & MOVs present at pump house. Opening / Closing of these valves and starting, stopping of pumps will be done from Panel HMI Operator Station. Open / Close feedbacks of the valves will be taken from respective limit switches. Operation of the pumps starts stage wise as follows. However detailed control philosophy will be discussed during detailed engineering.

Starting Permissive:

1. Selector switch in HMI is in Auto
2. Level of the sump is normal.
3. Respective discharge valves for the pumps are open.
4. Pressure for circulating water system is normal.
5. Trip circuits supervisory relay giving healthy indication.

After the system finds that above conditions are healthy, system issues start commands to pumps. The system keeps track of total no. of running hours of each pump.

Following parameters shall be made available on the system.

1. DC and AC supply OK.
2. Open / Close indication of MOV.
3. Trip circuit healthy indication.
4. Winding and Bearing Temperature of motor is fine
5. Discharge pressure is OK at delivery side of each pump.
6. Level of the sump.
7. Motor voltage, current, frequency, KWH.
8. Overall incoming voltage, current.
9. "Breaker tripped on fault" indication from each breaker.

Alarms

1. Circulating with respect to pressure is not OK.
2. Hi / Low water sump level.
3. Winding and bearing temperature of motor is high if given
4. B.F.V (MOV) is not opened.
5. "Breaker tripped on fault".
6. Trip circuit unhealthy.
7. Alarms related to power supply system of the control system such as rack power supply.
8. Communication related

alarms. **INSTRUMENTS - FIELD**

MOUNTED

All outdoor instruments with LCD display shall be protected as follows:

- a. The housing shall be at least triple of the transmitter size.

- b. The GRP box shall have a small window for meter reading and its orientation shall be to the north to minimize the effect of direct sunlight.
- c. Include one opening with mesh to prevent the increase of temperature inside the box. The box shall also be protected by relatively large sunshade for extra protection if needed

Ultrasonic Flow Meters: Main Features

The Transit Time Flow Meter measures flow rate by calculating the spreading time of an ultrasonic Wave in a liquid, going upstream and downstream into a pipe. This flow meter is mostly used to measure the flow rate of homogeneous fluids, also with a The measuring system is composed of a couple of ultrasonic transducers acoustically coupled to the external pipe's wall (it is also possible to use transducers in direct contact with fluid to be measured- called wetted sensors) and a HOST unit elaborating the signal that are sent and received from the transducers. The HOST unit has a DSP microprocessor; it gives signals for interfacing with the process or the control systems. The series includes a range of flow meters whose electronics is composed of a single board: high precision, high fidelity, high competitively.

The main features are:

Clamp-on sensors: it is not necessary to stop the flow to install them;

Wetted sensors.

AC and DC supply: 85..264VACand24VDC.

The time difference during the measuring process could be 0.2 ns. Analog (4-20 ma), pulses (relays), frequency (OCT) and MODBUS RS485 outputs. All the measures could be driven to the RS485 in order to save data Into a PC remotely transmitted by telemetry.

English display, easy to operate, in the near future other languages will be implemented Three types of clamp-on sensors for sizes from DN15-100, DN50-10000, DN300-6000, no pressure drop, no pipe disturbance. Pressure

/level sensors with range from which to choose by customers. 1 Analog Input for pressure/level sensor; 1 digital input RS232/485 MODBUS MODEM

GSM/GPRS QUAD BAND Built-In 4Mbytes Data Logger and 4 G bytes USB PEN

Clamp-on Sensors - Standard Type

Temperature Range -20 +80 °C Range:

DN15.. .100 Working Frequency 1. 5

MHz Range: DN50... 1000 Working

Frequency 1 MHz Range: DN300... 6000

Working Frequency 0.6 MHz

Pressure Transmitters

Pressure transmitters shall conform to Standard Specification with the following additions or exceptions specific for this project:

1. Protection class IP67 shall only be required when mounted in underground chamber or pit.
2. Operating temperature below freezing point is not required.
3. Installation

Pressure transmitters shall be installed in a two valve arrangement or be fitted with similar two valve manifolds. Process pipe work (lead piping) shall be run in AISI 316 stainless steel 1/2 inch nominal diameter pipe or 12 x 2mm tubing, with double ferrule compression joints as necessary and appropriate, with a minimum gradient of 1 in 12 after an initial rise (gas) or fall (liquid) of 300 mm from the process isolation valve to the instrument. Union joints shall be used for connecting if necessary. Welding or soldering of tubes is not allowed. All valves used on process piping (lead piping) shall be stainless steel gate or ball type.

Each pressure transmitter shall be of rigid construction, suitable for the application and:

- i) Have an electrical output of 0/4-20 mA or 0 - 10 V proportional to gauge or absolute pressure, as appropriate,
- ii) Be capable of withstanding a 100% overload (i.e. twice the pressure required for full output) without sustaining damage,
- iii) Have a stainless steel sensing element,
- iv) Have independent span and zero adjustments,
- v) Be operable on a 2 wire system,
- vi) Have an accuracy within $\pm 0.5\%$ of the span, repeatability within $\pm 0.2\%$ of the span and a dead band not exceeding 0.2% of the span, each installation shall be supplied and installed complete with:
 - vii) Sensing lines of stainless steel, grade 3,
 - viii) A local indicator which shall have a separate isolating valve if not incorporated within the transmitter,
 - ix) A test point with separate isolating valve,
 - x) An isolating valve for the transmitter.

Pressure Transducer Level Measuring Equipment

Pressure transducer, level measuring equipment shall comprise a strain gauge or differential transformer type pressure transducer, a controller/transmitter and be complete with all necessary cable, conduits, etc, as detailed below. Differential transformer transducers are to be preferred for very low ranges. Each pressure transducer shall be enclosed within an all- welded stainless steel case not less than 19.0 mm diameter and shall:

- i) have a single molded cable which is securely bonded to the stainless steel case and comprising electrical connections, venting tube, strain cord or wire within the cable to obtain the necessary strength, and an outer covering suitable for the application,
- ii) be suitable for continuous immersion in all process fluids including potable water, wastewater, raw sewage, primary sludge, secondary sludge, thickened sludge and final effluent,

- iii) Be constructed so that the sensor diaphragm is protected against damage by chock, debris, etc., without restricting the transference of pressure changes from the surrounding medium,
- iv) Incorporate automatic temperature compensation,
- v) Withstand a continuous overpressure of up to 400% without sustaining permanent deformation or calibration change.

The controller/transmitter shall:

- i) be suitable for mounting within a control panel,
- ii) Accept the signal from the transducer and provide a 0/4-20 mA or 0 - 10 V output proportional to level (gauge pressure), for indication and control,
- iii) include independent zero and span adjustments,
- iv) have a system checking module which will simulate the transducer output.

The complete system shall provide an accuracy within $\pm 0.75\%$ of span with a linearity better than $\pm 0.1\%$.

Pressure Transducer Installation

For installations in sumps and for similar applications where the depth is in excess of 3 m or where the available headroom over the sump is limited, the pressure transducer shall be installed within a 100 mm dia. G.R.P. tube to provide protection against mechanical damage to both the transducer and the cable. The G.R.P. tubing shall have an adequate number of holes and/or slots to allow it to fill and drain as the level varies. The tubing shall be fixed to the sump wall at intervals not exceeding 2.5 m.

For installations where the sump depth does not exceed 3 m, the sensor shall be supplied and installed as a rigid assembly comprising a stainless steel tube, a tube holder (both as used for control electrodes) and the transducer, with the cable passing through the tube. The transducer shall be close fit, located completely within the tube at the lower end. The assembly shall be fixed at not less than two places to the sump wall and installed with the bottom of the tube just clear of the sump invert.

For all installations the cable between the transducer and the controller/transmitter shall be a continuous length, and kept as short as is reasonably possible. This cable shall be run in conduit and installed above all AC mains and power cables.

Float Switches

Float switches shall be the pendant type with the float suspended on a flexible cable when the float is out of the liquid. As the liquid level rises, the float shall rise and have a tendency of being inverted.

The float shall be of robust design and comprise a mercury switch having changeover contacts encapsulated in a hard plastic foam and connected to a 3 core cable. The whole assembly shall be covered and hermetically sealed in Hypalon or similar material.

With the tilting action that occurs on rising level, the contacts shall change over. There shall be a dead band between opening and closing contacts. The dead band shall provide both of the contacts to be open for a while. This dead band shall operate over an arc approximately 200 either side of the horizontal.

The contacts shall be rated for a minimum of 5 amps at 220 volts. The voltage on the contacts shall not exceed 55 volts (nominal).

In all applications the installation shall be complete with approved means of preventing the float (and lead) from movement due to wind or liquid turbulence.

Where float switches are submerged during normal operation (e.g. pump control and/or low level alarm); they shall be attached to a weighted chain to minimize movement due to turbulence and also to provide a means of raising the units for maintenance and repair. All brackets, fixings etc., as necessary for the complete installation shall be provided. The chain/float assembly shall be installed such that the point of suspension is not less than 400 mm from any side-wall.

Flow Switches for installation in pipelines shall:

- a. be suitable for the maximum possible flow rate,
- b. withstand reverse flow without sustaining damage,
- c. have the operating set point adjustable over the range 20% to 100% of the normal flow,
- d. have change-over contacts rated at 5 Amps 220 VAC (50 Hz) or 1 Amp at 24 volts DC,
- e. be complete with all fittings necessary to carry out installation in the pipeline, including waterproof cable gland,
- f. have a metal housing compatible with the pipe material and rated for the system temperature and pressure,
- g. be suitable for the application and process fluid in respect of the principle of operation and the material of the wetted parts.

Pressure Switches:

Pressure switches shall be of either the bellows or bourdon type, and shall be rated to withstand the maximum possible surge pressures.

The switches shall:

- a. have a signal pole change-over contact, with the contact material and rating suitable for the application,
- b. have a calibrated set point adjustment which shall be lockable to prevent any movement due to vibration,
- c. have a switching differential adjustable between 5%. and 25% of the set point adjustment range,
- d. have all wetted parts compatible with the process fluid,

- e. be housed within an enclosure to ff55 or ff67 according to location.

Control and Interposing Relays

All control and interposing relays, except those used for lamp switching shall operate on a supply not exceeding 55 volts (nominal) potential difference with the earth and shall:

- a. operate reliably over the range $\pm 10\%$ to 20% of nominal supply voltage,
- b. be of the plug-in type complete with plastic cover and retaining clip,
- c. have vacuum impregnated coils and be suitably treated for operation under the specified environmental conditions,
- d. have contact material suitable for each application,
- e. have relay bases of the front connected, screw clamp type,
- f. incorporate indication of energization / de-energization

All relays operating on a D.C. supply shall have a surge suppression diode connected directly across the coil.

Mixed voltages shall not be connected to the contacts of any relay.

All relays and the associated wiring shall be protected by suitably rated fuses.

Relays having different contact arrangements or coil voltages shall not be interchangeable. A

permanent means of identification shall be fixed to each relay base and this identification shall

be in accordance with the circuit diagram reference.

Where voltages from a remote source (i.e. voltages which cannot be readily isolated from within the cubicle), are connected to a relay or associated terminals, fuses etc., the Contractor shall ensure that all such live parts are fully shrouded and that appropriate warning notices are fitted. . The Contractor shall be responsible for ensuring that A.C. relays cannot be held in due to capacitance effects on long switching lines. Where such a possibility exists, a D.C. supply shall be provided.

SPECIFICATIONS OF FIELD CONTROL UNIT FOR REMOTE CONTROL AND MONITORING:

The field control unit shall be able to control and monitor the required parameters from Control Centre with the help of licence free radio frequency or GPRS system.

Remote Control Centre

The remote Control Centre shall provide a management tool for controlling all the reservoirs, outlets, VTC and WMD in the water network. Remote control station will have developed application so that user can monitor and control each outlet from any place.

System configuration:

- The Remote Control Centre shall be able to configure system's parameters for optimal operation.
- The user shall be able to define all field Units and their associated configurations,
- The user shall be able to define all software application functionality and download (send) the data to the field units, in order for them to perform the on-site function.
- The user will be able to upload the existing data from the field units in order to monitor the entire system.
- The Control Centre shall provide the ability to analyze every level of single element characteristics (i.e. Input/Sensor, Output/Pump etc.) at each site.
- The user will be able to monitor site conditions like inside panel temperature, Battery Voltages, GSM/Radio signal strength.
- The user will be able to monitor the Panel door status at central

Management tools:

- Historical trends views and Events/Alarms logging.
- Interface to third party database , SCADA and communication systems such as SMS, paging alarms and weather stations
- Time based and/or Volume based Weekly Auto schedule will be stored into the controllers / HMI
- Onsite Critical alarms and events are sent by email /SMS to user given email ID or mobile nos.

Edit Mode. The same Remote Control Centre SW package shall provide both functionality of what is known as Runtime Mode and Edit Mode (when changes to the runtime screens are needed).

Part of the Remote Control Centre a Zonal Field Control Unit (ZFCU).

- The ZFCU shall provide communication capabilities and interface between the Remote Control Centre and Field Control unit which is on the site.
- The ZFCU shall have the ability to perform "regular" Field Control Unit's functionalities, such as monitoring sensors or activating pumps, in addition to its ZFCU functionalities.
- As part of the Control Centre a front end (FEP) is requested (HW and/or SW) enabling the communication between the Control Centre and the Field Control Units.
- The Control Centre shall be able to interface with various software applications (third party), such as weather stations, and other management SW packages.

The Remote Control Centre shall be able to execute and support the following features:

- **Displaying the entire data of Field Control Unit such as, flow rate/accumulated flow, and total time of operation, balance time in the form of tables and graphical screens**
- **Displaying Field Control Unit's events and alarms and ability to report them utilizing SMS technology.**
- **Display the communication healthiness of field units.**
- **The user shall be able to change valve operation timings, from the graphical screens**
- **The user shall be able to operate valve from the graphical screens**
- **Shall be able to call the Downloading and Uploading data from the Field Control Units**
- **Shall allow the quantity of water as per the Demand set by the operator.**
- **Shall have a program to design and display an event report for each outlet in the water network.**
- **Shall have a program to calculate the predicted flow load, over the hydraulic system.**
- **Shall have a program for displaying sensors data historical trends and alarms.**
- **Shall have an Off-Line program for the Field Units in addition to the current runtime unit's program.**

Field Control Units:

- Shall have Logic board incorporating microcontroller/microprocessor and data storage components.
- Shall run on solar power or long life lithium battery.
- Shall be with I/O port required for on-site sensor connection. I/O boards may be expanded/ replaced on-site. These may be inputs such as water meters, reservoir level, pressure meters, or general digital inputs, or outputs such as valves, pump starts, general relays, etc.
- Communication Ports - enabling the Field Unit to communicate with the Remote Control Centre, and/or each other, and on-site programming/diagnostic tool (such as laptop).
- Shall be able to operate not only the local I/Os (on board I/O connections), but remote I/Os as well.
- Shall be able to update the Remote Control Centre database upon request (by the remote Control Centre) or by exception. The Field Unit shall be able to report to the Remote Control Centre every defined alarm which occurs in the field.
- Shall be capable of functioning in a stand-alone mode (no Remote Control Centre), as well as a part of a system with a Remote Control Centre.
- Shall be able to perform Store & Forward functionality - receive information from other sites, store it in memory, and then transmit (forward) the data to another site.
- Shall be able to support both local I/O's and Remote I/O's modules. The remote I/O modules shall be equipped with radio technology, allowing the Field Unit full access and control, as if they are locally connected.
- Shall be able to report by exception (known as burst) to the Control Centre upon **any Change-Of-State (COS)**
- Shall be equipped with a multi-tasking Operating System, specially designed for a real time environment.

Radio / GPRS communication Network

The Radio/GPRS communication network shall be able to make the communication link between the remote control Centre and outlets/ Reservoir with conventional (865-867MHz licenses free) frequency or using GPRS network.

The communication protocol shall be able to support multiple logical channels per physical port, enabling simultaneous Central-to-Field Control Unit and Field Control Unit -to-Field Control Unit sessions.

The communication protocol shall be able to support the following messaging methods: Burst (also known as Contention) - this is transmission

upon change of state. Polling (also known as Interrogation) - automatically or manually request for data updating. Report by Exception - the unit shall only report data that have changed since the last poll.

HMI CUM PLC Controllers

GENERAL FEATURES:

1. The PLC CPU shall collect data, perform process control functions, communicate with other PLCs, and distribute process information along the local area network.
2. The PLC & HMI shall be able to have its program downloaded from a remote workstation over the local area network, and be locally programmed from a portable laptop computer.
3. The executive firmware of all intelligent modules shall be stored in Flash memory and can be updated in the field using standard programming tools
4. The PLC shall have provisions for communicating unsolicited messages (report by exception) to an operator interface to reduce network traffic.
5. The PLC shall be field expandable to allow for the expansion of the system by the simple addition and configuration of hardware.
6. All cables and connectors shall be as specified by the manufacturer. Cables shall be assembled and installed as per the manufacturer's recommendations.
7. The PLC shall utilize Ethernet protocols that meet the following:
 - a) Protocols that are assigned to port 502 of the TCP/IP stack by the IANA (Internet Assigned Numbers Authority).
 - b) Devices must be able to utilize embedded web pages, or a physical means such as DIP switches, to be recognized and properly addressed on the network. Ethernet protocols that require network management software, or utilize configuration files.

Other than that system shall have following features:

- Access Level Password protection.
- Maintenance Routine using Calendar function - RTC.
- Energy log & Energy management.
- Alarm Logging.
- Back of program & reinstallation of program using SD Card.

- Frequency control via MODBUS RTU protocol.
- Data access by SCADA using OPC server.
- Web server in built for web monitoring.
- Data export to PC using DATA EXPORT software.
- Customized screen & logo during boot-up & programming.
- ActiveX & .Net communication driver.

Technical Specs Expected:

- Power Supply
- Input voltage 12 or 24VDC or 230 AC
- Permissible range 10.2-28.8VDC
- Max. current consumption 1A@12V
- 0.5A@24V Battery
 - Back-up 7 years typical at 25°C, battery back-up for RTC and system data, including variable data.
 - Replaceable Yes, without opening the controller.

Features

- Up to 1000 I/O; Supports Remote I/O
- Digital, Analog, Temperature, Weight
- 10.4" Color Touch screen, 64K Colors
- Auto tune PID 24 loops
- 2MB Logic, up to 500 Images (32MB)
- Cellular Communication- SMS, GPRS
- Ethernet, RS485, MODBUS RTU/IP, CANopen, J1939, SNMP etc
- Web Server, send emails & attachments
- SD Card, Data logging, Recipes & Cloning
- Built in Trends, Alarms, & Multilanguage Support

Program

- Memory size Application Logic - 2MB, Images - 32MB, Fonts - 1MB
- Operand type Quantity Symbol Value
- Memory Bits 8192 MB Bit (coil)
- Memory Integers 4096 MI 16-bit
- Long Integers 512 ML 32-bit
- Double Word 256 DW 32-bit unsigned
- Memory Floats 64 MF 32-bit

- Timers 384 T 32-bit
- Counters 32 C 16-bit
- Data Tables 120K dynamic RAM data (recipe parameters, datalogs, etc.)
- Up to 256K Flash data
- HMI displays Up to 1024
- Program scan time 9 usec per 1K of typical

application **Communication**

Serial ports		
RS232		
Galvanic isolation	Yes	
Voltage limits	+20VDC absolute maximum	
Baud rate range	300 to 115200 bps	
Cable length	Up to 15m (50')	
RS485		
Galvanic isolation	Yes	
Voltage limits	+7 to +12VDC differential maximum	
Baud rate range	300 to 115200 bps	
Nodes	Up to 32	
Cable type	Shielded twisted pair, in compliance with EIA	
	RS485	
Cable length	1200m maximum (4000')	
USB		
Port type	Mini-B	
Galvanic isolation	No	
Specification	USB 2.0 compliant; full speed	
Baud rate range	300 to 115200 bps	
Cable	USB 2.0 compliant; up to 3m	
CANbus port	1	
Nodes	CANopen	CANbus protocols
127	60	
Power requirements	24VDC ($\pm 4\%$), 40mA max. per unit. See Note 5	
Galvanic isolation	Yes, between CANbus and controller	

I/Os

Number of I/Os and types vary according to module. Supports up to 1024 digital, high-speed, and analog I/Os.	
Snap-in I/O modules	Plugs into rear port to create self-contained PLC with up to 62 I/Os.
Expansion modules	Local adapter (P.N. EX-A1), via I/O Expansion Port. Integrate up to 8 I/O Expansion Modules comprising up to 128 additional I/Os. Remote adapter (P.N. EX-RC1), via CANbus port. Connect up to 60 adapters; connect up to 8 I/O expansion modules to each adapter.
Exp. port isolation	Galvanic

Environments

- Inside cabinet IP20 / NEMA1 (case)
- Panel mounted IP65 / NEMA4X (front panel)
- Operational temperature 0 to 50°C (32 to 122°F)
- Storage temperature -20 to 60°C (-4 to 140°F)
- Relative Humidity (RH) 5% to 95% (non-condensing)

Operator Panel Features

All the Panels shall have an Operator Panel with inbuilt PLC CPU. Each OP has to be programmed for each location to provide the statuses for the particular location. In addition provision to be provided to control the devices from the OP independently.

The OP shall facilities to:

- Display status of Plant in a graphical and text format (i.e. running, stopped, fault etc.);
- Display analog values on the appropriate graphic screen (displays shall change colour when in fault conditions or when data is suspect)
- Display status and values at other sites;
- Annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred

- Provide facilities for the operator to: adjust process set points; select process modes; provide all other facilities required for operation of the Plant; acknowledge alarms; view a journal of unacknowledged alarms; view a journal of the last 200 alarms acknowledged and unacknowledged.
- Display process set points;
- Provide real time and historic data for site parameters
- Provide data archiving facilities through LAPTOP.
- Any additional features required to assist in the effective and efficient operation of the plants.
- Security systems shall be provided to prevent unauthorized adjustment of process set points.

Panels

The Panels provided to house all the HMI with PLC will be Wall mounted type with all the necessary power supplies, TBs & Wiring done. Every Panel will have a Power Meter which shall show the power consumption & other voltage , current details.

Testing and Commissioning:

All equipment, including panels, consoles, pillars and all separate items shall be subject to inspection and full function test at the manufacturer's works. All equipment, sequences, programs and the like shall be proved and demonstrated to the Engineer as being in accordance with the application requirements.

Test certificate including characteristics covering the full operating range of measured variable against output signal, shall be provided for all instruments or sets of equipment measuring primary quantities.

Site testing shall include demonstration of the satisfactory operation of each system individually and the complete system as a whole, before the start-up of main plant commissioning.

The Contractor shall ensure and demonstrate that all items of equipment incorporating any form of variable setting (level electrodes, float switches, transmitters, trip amplifiers, meter relays, controllers, timer etc) have been adjusted to achieve optimum control of the process or plant operation.

INSPECTION & TESTING

All factory tests will be witnessed by the department.

The department shall have free entry and access at all phases of the project to all parts of contractor's facilities associated with manufacturing and testing of system. The equipment will not be shipped before they have been officially released in the form of release notes by department. The contractor shall provide the department with all reasonable facilities necessary to determine compliance to the system specification.

The contractor shall note that acceptance of the equipments and the system by department or exemption of inspection & testing shall in no way absolve the contractor of his responsibility to deliver the system meeting all the requirements specified in the specification. Contractor shall be responsible till the completion of the warranty, for any corrections/ modifications including supply and implementation of hardware & software to fulfill the requirements of the contract/ up gradation including supply and implementation of hardware & software to meet the functionality and performance of the contract. Contractor personnel shall be actively involved during factory acceptance and site acceptance testing.

Testing shall concern HMI Panel equipments at all stations including PLC.

The tests shall consist

of:

- Factory Acceptance Testing (FAT)
- Site Acceptance Testing (SAT)
- Test Run

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The contractor shall submit to department detailed test plans and procedures, one month prior to actual testing for all factory and site acceptance tests for review.

Factory Acceptance Testing (FAT):

The contractor shall invite department well in advance with minimum 1 month's notice of the date at which the system is ready for testing. FAT shall be conducted only on confirmation of successful Pre-FAT by the contractor.

The FAT document shall be prepared covering all hardware, software and system functionalities including system expansion requirements of tender & FDS. Factory acceptance test will be done based on the stipulations in the approved FAT document, which shall completely fulfill the contract requirements and approved FDS documents. FAT shall be carried out in contractor's premises. FAT shall cover the testing of complete Integrated SCADA System. It shall systematically, fully and functionally test all the hardware and software in the presence of DEPARTMENT inspectors to ascertain compliance with the contract document and approved FDS documents. Test bed shall be prepared with all the equipments interconnected to actual configuration to perform the testing on total integrated SCADA system. The SCADA system testing shall cover the following aspects as a minimum: Visual and mechanical testing to ensure correct, proper, good and neat workmanship.

- Input/output testing for PLC and serial interface with Flow computers & IEDs by simulation to meet the requirement of I/O parameters.
 - Integrated testing with the PLC.
- Demonstration of the complete system functionalities, hardware & software compliances w.r.t. all the equipments including PLC.
 - Checking of complete database definitions for the proper system configuration.
 - Checking of displays, graphics and alarms etc w.r.t. approved HMI document.
- Checking of correct functioning of panel keypad operation for operator & engineering functions.
 - Testing of system passwords and security features.
 - Checking of various log formats, reports, archiving and trending functions.
 - Checking of system performance parameters as per the requirements.
- Checking of monitor updates of HMI & LCS, database updates and display call up timings.
- Checking of system diagnostics for all the equipments as per the requirements, power failure and system restarts.
 - Switchovers and recoveries.
 - System building procedures and verifications.
 - Database and alarms synchronization.
 - Computer workstation system resources utilization tests.
 - Remote workstations and network testing

On line testing, Commissioning:

Prior to SAT, all PLC shall be tested online by contractor, when all the MCS hardware & software w.r.t. SCADA system have been successfully tested, with regard to correctness of complete database using plant simulator, remote diagnostics, proper representation of all PLC data on graphics, alarms, trending, reports etc., checking of operation of various control commands i.e. valves open/close and permissive etc., complete checking and testing of signals from PLC Cabinets (including FCs to PLC), checking of field values, field device status, controls of field devices and set points from MCS . During PLC online testing, Contractor shall ensure to establish fully functional serial interfaces with flow computers / PLCs / IEDs for transfer of data with them to meet the complete functionality. Complete checking and testing of signals and PLC I/O database points from PLC cabinets to PLC, testing of serial interfaces with flow computers & PLCs shall be included in the on-line testing of PLC. Prior to SAT, the activities of installation, PLC on-line testing and commissioning shall be performed by Contractor by following their Department standard & established practices & procedures to ensure that good techniques and best engineering practices had been followed, while ensuring correctness & completeness of the same.

SAT shall be conducted by the Contractor after successful integration & commissioning of the complete system and after all actual field signals have

been interfaced with the SCADA system including the successful completion of on-line testing of all the PLC and complete system having been made fully operational.

Site Acceptance Testing (SAT):

The contractor shall invite the department well in advance on confirmation of successful Pre-SAT by the contractor. SAT shall involve integrated testing of complete SCADA system. Site Acceptance Testing will be done based on the stipulations in the approved SAT document. Once the test is successfully performed, then the system would be ready for commencement of test run. SAT shall be conducted by the experienced system engineering group of the Contractor (earlier involved in system design, engineering, integration & FAT).

Test Run

Test for continuous functional operation of the system with the required system reliability and availability. This test aims at keeping the complete integrated system operation for a period of 5 days for all the 24 hours a day. In case of failure, the tests will be restarted till the system operates without failure of any system functionality for 5 days. Failure of tests shall be limited to such system failures which will affect system availability & reliability and shall not be dependent upon established failure of third party supplied items. Department shall have the right to reject the complete system or part there of in the event of the acceptance tests failing in two attempts. The 'Test Run' will be carried out after successful SAT, duly witnessed by department. The observations, exceptions and test results obtained during the test run shall be documented and produced in the form of a report by the contractor within seven days of the completion of Test Run which shall be subsequently reviewed / approved by department within ten days of submission of test report by contractor. After that the PRE WARRANTY COMPLETION CERTIFICATE shall be issued by the department and thereafter Warranty phase will start.

Failure of components

A log of all failed hardware and software modules shall be maintained which shall give date and time of failure, description of the failed components & cards/ software along with designation, effect of failure on the system, cause of failure and number of hours of operation of the part before it failed. Upon failure of the components/ cards/ modules, the same shall be replaced by better graded components/cards. And the test shall be restarted from the beginning or the previous logical point as the case may be. If after this one replacement the unit of sub-system still fails to meet the specifications, the contractor shall replace the complete unit or sub-system with the one that meets the requirements and restarts the test all over again. At least one contractor's engineer fully conversant with the system hardware and software shall be present at MCS during the test run.

All the System tests as per the approved documents shall be carried out at the contractor's works, testing laboratory and work sites of the department at contractor's cost. The contractor shall provide assistance, instruments, labour and materials as are normally required for the examining, measuring and testing any workmanship as may be selected and required. These tests will encompass all the material and equipment delivered and software pertaining to SCADA system including the equipment and software supplied by contractor. Pre-FAT report duly witnessed and cleared by contractor shall be available for reference during FAT. If a unit or sub-system has failed during the test and is not repaired and made successfully operational or not replaced within few hours of active repair time after the failure, the test shall be suspended and restarted all over again only after the contractor has placed the device back into acceptable operation. The department's approval shall be obtained for any allowable logistic time required to replace the failed component/sub-system. All cost for repair/ replacement of defective component/ system shall be to contractor's account.

The department shall be free to request any specific test on any equipment and the system considered necessary by him, although not listed in the testing documents to verify the compliance with the specifications. Any statutory test/ inspection certificate, as may be required, under any law or directive issued by Govt. or any competent authority, shall be carried out by contractor.

For operational software tests, the plans shall include summary of the method, a list of typical test cases, the sequence of execution and expected results. For hardware tests, the plans shall include purpose of the test, definition of test inputs, specifications of test procedures and definition of results to be obtained.

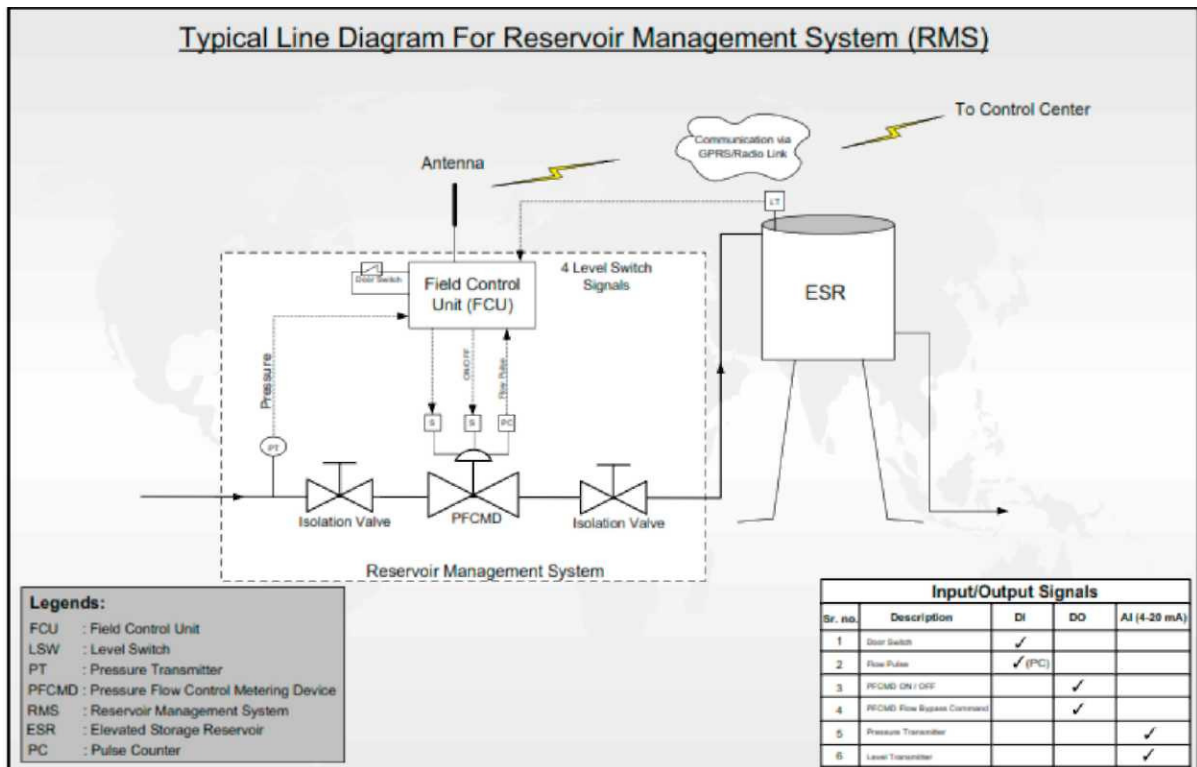
WARRANTY:

The contractor shall be responsible for the manufacture in respect of proper design, quality, workmanship & maintenance of all equipment, accessories etc. supplied by the contractor including all services, spares and consumables for a period of 12 months after taking over the system at site or 18 months from the date of major supply, for meeting the functionality and performance requirements of this contract. To fulfil the same, it shall be obligatory on the part of contractor to modify/ upgrade or replace any hardware from the supplied equipments and modify/ upgrade the operating system software, HMI software, application software, other software's supply the required spares and consumables and attend to the maintenance of the system, free of cost, during start-up and on-line operation & maintenance of the SCADA system, within the Warranty period. Any modifications/ up gradation or replacement of any hardware & software during warranty shall

not affect the performance & functionality of the system. After the successful completion of warranty, COMPLETION CERTIFICATE shall be issued by the department.

5. RESERVOIR MANAGEMENT SYSTEM (RMS)

Design, Supply, Erection and Commissioning of Reservoir Management System(RMS) to enable to avoid the overflow of Reservoirs/Sumps, Uniform Distribution of Water to the Reservoirs /Sumps irrespective of its location and distance from the source of supply. Also system should be enabled to record, monitoring and control of the instantaneous and cumulative flow Delivered to the Reservoirs/Sumps without any external Electric Energy and no high recovery cost for Energy/Communication Cost such as GSM/GPRS/RADIO etc.



SPECIFICATION OF RESERVOIR MANAGEMENT SYSTEM (RMS):

- The System should be able to operate without any External Electric Energy.
- The System should be capable to achieve the Uniform Distribution of Water to all the reservoirs/Sumps in the Network irrespective its Elevation and Distance from the Source of Supply.
- The System should be capable to avoid the overflow of Reservoirs/Sumps in the Networks.
- The System should be able to Operate/Isolate remotely without any Electrical Energy.
- The System should be able to record and generate the report of the instantaneous and Cumulative Flow Delivered to Every Reservoirs/Sumps in the Network.
- The System should be able to allow the flow to Reservoirs/ Sumps as per the Demand.
- The System should be able to Operate, Monitor, Control and Manage the Water to Reservoirs/ Sumps in Complete Distribution Network without any External Electric Energy.
- The System should not have any high recurring cost for Energy/Communication Cost such as GSM/GPRS/RADIO etc.
- The System should be kept in Protective Cover Box capable of giving Vandalism Alert messages such as door open and site GPS co-ordinates.
- The System should update battery status and atmospheric temp to control centre. Low battery & High temp Alert messages shall be generated to avoid the faults.

COMPONENTS OF RESERVOIR MANAGEMENT SYSTEM

(RMS): 1. Pressure Flow Control Metering Device (PFCMD)

The Pressure & Flow Control and Metering Device (PFCMD) shall integrate a flow meter with a diaphragm actuated hydraulic control valve equipped with suitable pilots. The PFCMD automatically performs one, two or more

independent functions as per the requirements, such as Anti Draining of System, Reducing higher upstream pressure to a constant maximal downstream pressure or sustaining maximum set Flow. All functions are performed irrespective of change in upstream pressure and/or demand. Functions can easily be added or removed in a modular way. The meter accuracy is independent and not affected by the action of the valve. An adjusting screw on each pilot allows setting of the desired set-point for Pressure and Flow. The valve shall be compatible with Automation System.

I. Main Valve

- 1.1 The main valve shall integrate a flow meter with a diaphragm actuated hydraulic control valve.
- 1.2 The valve shall be of a Globe or Angle pattern design.
- 1.3 The valve should be designed for both horizontal and vertical installation
- 1.4 The valve pressure rating shall be PN16.
- 1.5 Valve body shall be with flats for vertical support.
- 1.6 Valve flanges shall accommodate for drilling according to various standards, such as ISO 7005-2 and ANSI B16.42.

II. Construction Materials

- 2.1. Body and cover: Cast Ductile Iron to EN 1563 or ASTM A-536.
- 2.2. Diaphragm and seals: EPDM & NBR.
- 2.3. Bolts and nuts: Steel.

III. Coating

- 3.1 Valve body, cover and separating partition shall have a protective fusion bonded epoxy coating OR Polyester Coating.

IV. Metering

- 4.1. The metering accuracy shall not be affected by varying pressure or flow conditions.
- 4.2. The integrated metering device shall have a visual flow rate indicator and flow totaling counter.
- 4.3. The integrated metering device shall be equipped with, or accommodate for an electric pulse output option.

V. Control System

- 5.1. The valve shall be self-contained hydraulic controlled and shall not require any Electric Power.
- 5.2. The complete valve shall function normally when fully submerged.
- 5.3. The control shall consist of one, two or more 2-Way adjustable pilots with a single setting spring.
- 5.4. Isolating cock valves shall be installed on upstream, downstream and control chamber ports.

- 5.5. The control system shall be equipped with an external "Y" shape filter. Washing the filter shall not require isolating the main valve.
- 5.6. Commissioning, setting and on-site readjusting of the valve shall be simple, according to IOM directions supplied with the valve, and shall not require a manufacturer specialist.
- 5.7. The valve shall be compatible with Automation System.

VI. Service

- 6.1. All valve components shall be accessible and serviceable without removing the valve from the pipeline.
- 6.2. The valve cover shall be removable via unfastening bolts for quick in-line inspection and service.

VII. Testing

- 7.1 Prior to shipment the valve shall be tested a complete functional test performed under dynamic conditions similar to the project specification.
- 7.2. Valve will be Tested for Low Pressure Sealing of 0.8 Kg/cm².
- 7.3. Valve will be Tested for High Pressure Sealing of 16 Kg/cm².

VIII. Approvals And Certifications

- 8.1. The valve manufacturer quality system shall be certified to ISO 9001-2000

2. SPECIAL COMBINATION AIR VALVES (FOR RMS)

- Working pressure range; 0.1 to 10 bar
- Testing pressure : 16 bar
- Working temperature: 60 °C maximum
- Shall be suitable to prevent premature closing.
- Shall be suitable for low pressure sealing.
- **Kinetic components:** Valve shall discharge air at high velocity during filling of system and admit air during draining of water.
 - **Automatic components:** Vacuum orifice making it less prone to obstruction by debris.
 - **Body material:** Reinforced Nylon.
- **Installation:** It shall be installed before the PFCMD in the WMD System and has the features of an Air-release valve and Air / vacuum valve.

3. **Automation System**

The Automation System for Reservoir Management System (RMS) shall be able to control and monitor the Reservoir level from remote control room. Automation shall consist of remote control Room, Radio Communication Infrastructure and Reservoir Field Control Units known also as Remote Terminal Units (RTU)

3.1 Remote Control Centre

The remote Control Center shall provide a management tool for controlling all reservoirs in the water network.

System configuration:

- The Remote Control Centre shall be able to configure system's parameters for optimal operation.
 - The user shall be able to define all field Units and their associated configurations,
- The user shall be able to define all software application functionality and download (send) the data to the field units, in order for them to perform the on-site function.
- The user will be able to upload the existing data from the field units in order to monitor the entire system.
- The Control Centre shall provide the ability for the user to "zoom in" to the level of single element characteristics (i.e. Input/Sensor, Output/Pump etc.) at each site.
- The user can able to monitor site conditions like inside panel temperature, Battery Voltages, GSM/Radio signal strength.
 - The user can able to monitor the Panel door status at central

Management tools:

- Accumulation reporting, historical trends views and Events/Alarms logging.
- Interface to third party database and communication systems such as SMS, paging alarms and weather stations
- Time based and/or Volume based Weekly Auto schedule will be stored into the controllers.
- Onsite Critical alarms and events are sent by email /SMS to user given email ID or mobile nos.

Edit Mode. The same Remote Control Centre SW package shall provide both functionality of what is known as Runtime Mode and Edit Mode (when changes to the runtime screens are needed).

Part of the Remote Control Centre a Zonal Field Control Unit (ZFCU).

- The ZFCU shall provide communication capabilities and interface between the Remote Control Center and Field Control unit which is on the site.
- The ZFCU shall have the ability to perform "regular" Field Control Unit's functionalities, such as monitoring sensors or activating pumps, in addition to its ZFCU functionalities.
- As part of the Control Center a front end (FEP) is requested (HW and/or SW) enabling the communication between the Control Center and the Field Control Units.
- The Control Centre shall be able to interface with various software applications (third party), such as weather stations, and other management SW packages.

The Remote Control Centre shall be able to execute and support the following features:

- Displaying the entire data of Field Control Unit such as, flow rate/accumulated flow, and total time of operation, balance time in the form of tables and graphical screens
- Displaying Field Control Unit's events and alarms and ability to report them utilizing SMS technology.
- Display the communication healthiness of field units.
- The user shall be able to change valve operation timings, from the graphical screens
- The user shall be able to operate valve from the graphical screens
- Shall be able to call the Downloading and Uploading data from the Field Control Units
- Shall allow the quantity of water as per the Demand set by the operator.
- Shall have a program to design and display an event report for each unit in the water network.
- Shall have a program to calculate the predicted flow load, over the hydraulic system.
- Shall have a program for displaying sensors data historical trends and alarms.
- Shall have an Off-Line program for the Field Units in addition to the current run-time unit's program.

3.2 Field Control Units:

- Shall have Logic board incorporating microcontroller/microprocessor and data storage components.
- Shall run on solar power or long life lithium battery.
- Shall be with I/O port required for on-site sensor connection. I/O boards may be expanded/ replaced on-site. These may be inputs such

as water meters, reservoir level, pressure meters, or general digital inputs, or outputs such as valves, pump starts, general relays, etc.

- Communication Ports - enabling the Field Unit to communicate with the Remote Control Centre, and/or each other, and on-site programming/diagnostic tool (such as laptop).
- Shall be able to operate not only the local I/Os (on board I/O connections), but remote I/Os as well.
- Shall be able to update the Remote Control Centre database upon request (by the remote Control Centre) or by exception. The Field Unit shall be able to report to the Remote Control Centre every defined alarm which occurs in the field.
- Shall be capable of functioning in a stand-alone mode (no Remote Control Centre), as well as a part of a system with a Remote Control Centre.
- Shall be able to perform Store & Forward functionality - receive information from other sites, store it in memory, and then transmit (forward) the data to another site.
- Shall be able to support both local I/O's and Remote I/O's modules. The remote I/O modules shall be equipped with radio technology, allowing the Field Unit full access and control, as if they are locally connected.
- Shall be able to report by exception (known as burst) to the Control Center upon *any Change-Of-State (COS)*
- Shall be equipped with a multi-tasking Operating System, specially designed for a real time environment.

3.3. Radio / GPRS communication Network:

- The Radio/GPRS communication network shall be able to make the communication link between the remote control Centre and Reservoir with conventional (865-867MHz licenses free) frequency or using GPRS network.
- The communication protocol shall be able to support multiple logical channels per physical port, enabling simultaneous Central-to-Field Control Unit and Field Control Unit -to-Field Control Unit sessions.
- The communication protocol shall be able to support the following messaging methods: Burst (also known as Contention) - this is transmission upon change of state. Polling (also known as Interrogation) - automatically or manually request for data updating. Report by Exception - the unit shall only report data that have changed since the last poll.

4. ISOLATION WAFER TYPE BUTTERFLY VALVE

Wafer Type BFV should be provided to Inlet and outlet of PFCMD

Material of Construction

Body : Ductile Iron GGG40
Disc : Ductile Iron GGG50
Shaft : Stainless Steel 410
O-Ring : NBR
Plug : Stainless Steel 410
Bushing : Bronze
Washer : Stainless Steel 410
Half Washer : Stainless Steel 410
Bolts : Stainless Steel

TEST PRESSURE:

a) SEAT TEST: 16 Kg/cm²

b) BODY TEST: 24 Kg/cm²

5.ENCLOSURE

Enclosure to be made up of Reinforced Polyester with Door having vandalism alert.

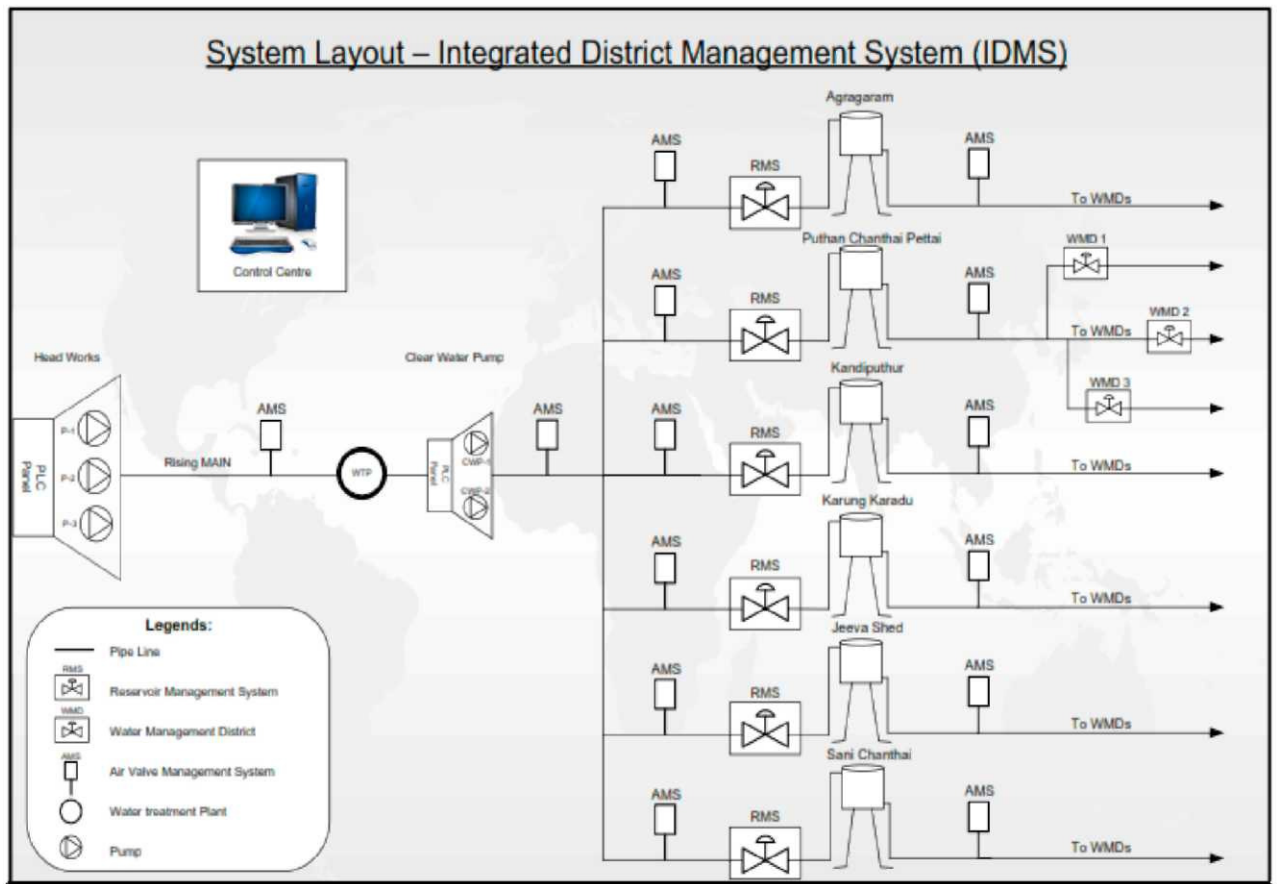
6. SPECIFICATIONS OF WATER MANAGEMENT DISTRICT (WMD) SYSTEM

Scope:

1. Supply, Erection and Commissioning of WMD System which should be able to control the flow as per demand to facilitate Uniform Distribution of Water to the Consumers irrespective of its location, elevation and distance from the water source.
2. The system should be able to record, monitor and control the cumulative quantity delivered to the Consumers without any external Electric Energy and with no high recurring cost for
Communication with GSM/GPRS/RADIO etc.

General specifications:

- The System should be able to Operate, Monitor, Control and Manage the Water to Consumers in Complete Distribution Network without any External Electric Energy.
- The System should be capable to achieve the Uniform Distribution of Water to all the Consumers in the Network irrespective of its Elevation and Distance from the Source of Supply.
- The System should be able to record and generate the report of the Cumulative Quantity delivered to every Consumers in the Network.
- The System should be able to allow the quantity to Consumers as per the Demand / Quota.
- The System should have minimum recurring cost for Communication by using
GSM/GPRS/RADIO etc.
- The System should be kept in Protective Enclosure capable of giving Vandalism Alert
- WMD SYSTEM should consist of PFCMD, Air valve, inlet and outlet isolation valves, pressure transmitter, solar power panel of suitable capacity with 12 V battery having 5 days back up capacity for communication, protective enclosure of IP 65 standard.



1. Pressure Flow Control Metering Device (PFCMD)

The Pressure & Flow Control and Metering Device (PFCMD) shall integrate a flow meter with a diaphragm actuated hydraulic control valve equipped with suitable pilots. The PFCMD automatically performs one, two or more independent functions as per the requirements, such as Anti Draining of System, Reducing higher upstream pressure to a constant maximal downstream pressure or sustaining maximum set Flow. All functions are performed irrespective of change in upstream pressure and/or demand. Functions can easily be added or removed in a modular way. The meter accuracy is independent and not affected by the action of the valve. An adjusting screw on each pilot allows setting of the desired set-point for Pressure and Flow. The valve shall be compatible with Automation System.

1. Main Valve

- 1.1. The main valve shall integrate a flow meter with a diaphragm actuated hydraulic control valve.
- 1.2. The valve shall be of a Globe or Angle pattern design.
- 1.3. The valve should be designed for both horizontal and vertical installation
- 1.4 The valve pressure rating shall be PN16.
- 1.5 Valve body shall be with flats for vertical support.
- 1.6 Valve flanges shall accommodate for drilling according to various standards, such as ISO7005-2 and ANSI B16.42.

2. Construction Materials

2.1. Body and cover: Cast Ductile Iron to EN 1563 or ASTM A-536.

2.2. Diaphragm and seals: EPDM & NBR.

2.3. Bolts and nuts: Steel.

3. Coating

3.1 Valve body, cover and separating partition shall have a protective fusion bonded epoxy coating OR Polyester Coating.

4. Metering

4.1. The metering accuracy shall not be affected by varying pressure or flow conditions.

4.2. The integrated metering device shall have a visual flow rate indicator and flow totaling counter.

4.3. The integrated metering device shall be equipped with, or accommodate for, an electric pulse output option.

5. Control System

5.1. The valve shall be self contained hydraulic controlled and shall not require any Electric Power.

5.2. The complete valve shall function normally when fully submerged.

5.3. The control shall consist of one, two or more 2-Way adjustable pilots with a single setting spring.

5.4. Isolating cock valves shall be installed on upstream, downstream and control chamber ports.

5.5. The control system shall be equipped with an external "Y" shape filter. Washing the filter shall not require isolating the main valve.

5.6. Commissioning, setting and on-site readjusting of the valve shall be simple, according to IOM directions supplied with the valve, and shall not require a manufacturer specialist.

5.7. The valve shall be compatible with Automation System.

6. Service

6.1. All valve components shall be accessible and serviceable without removing the valve from the pipeline.

6.2. The valve cover shall be removable via unfastening bolts for quick in-line inspection and service.

7. Testing

7.1. Prior to shipment the valve shall be tested a complete functional test performed under dynamic conditions similar to the project specification.

7.2. Valve will be Tested for Low Pressure Sealing of 0.8 Kg/cm².

7.3. Valve will be Tested for High Pressure Sealing of
16 Kg/cm².

8. Approvals And Certifications

8.1. The valve manufacturer quality system shall be certified to ISO 9001-2000

2. SPECIAL COMBINATION AIR VALVES (FOR WMD)

- Working pressure range; 0.1 to 10 bar
- Testing pressure : 16 bar
- Working temperature: 60 °C maximum
- Shall be suitable to prevent premature closing.
- Shall be suitable for low pressure sealing.
- **Kinetic components:** Valve shall discharge air at high velocity during filling of system and admit air during draining of water.
 - **Automatic components:** Vacuum orifice making it less prone to obstruction by debris.
 - **Body material:** Reinforced Nylon.
- **Installation:** It shall be installed before the PFCMD in the WMD System and has the features of an Air-release valve and Air / vacuum valve.

3. TECHNICAL SPECIFICATIONS OF AUTOMATION SYSTEM FOR REMOTE CONTROL AND MONITORING;

The proposed Automation System for VTC shall be able to control and monitor the required parameters from Control Centre with the help of license free radio frequency and GPRS system.

A: Remote Control Centre

The remote Control Center shall provide a management tool for controlling the all VTCs in the water network. Remote control station will be web based application so that user can monitor and control each VTC from any place with the help of internet connection.

System configuration:

- The Remote Control Centre shall be able to configure system's parameters for optimal operation.
 - The user shall be able to define all field Units and their associated configurations,
- The user shall be able to define all software application functionality and download (send) the data to the field units, in order for them to perform the on-site function.
- The user will be able to upload the existing data from the field units in order to monitor the entire system.
- The Control Centre shall provide the ability for the user to "zoom in" to the level of single element characteristics (i.e. Input/Sensor, Output/Pump etc.) at each site.
- The user can able to monitor site conditions like inside panel temperature, Battery Voltages, GSM/Radio signal strength.
 - The user can able to monitor the Panel door status at central

Management tools:

- Accumulation reporting, historical trends views and Events/Alarms logging.
- Interface to third party database and communication systems such as SMS, paging alarms and weather stations
- Time based and/or Volume based Weekly Auto schedule will be stored into the controllers
- Onsite Critical alarms and events are sent by email /SMS to user given email ID or mobile nos.

Edit Mode. The same Remote Control Centre SW package shall provide both functionality of what is known as Runtime Mode and Edit Mode (when changes to the runtime screens are needed).

Part of the Remote Control Centre a Zonal Field Control Unit (ZFCU).

- The ZFCU shall provide communication capabilities and interface between the Remote Control Center and Field Control unit which is on the site.
- The ZFCU shall have the ability to perform "regular" Field Control Unit's functionalities, such as monitoring sensors or activating pumps, in addition to its ZFCU functionalities.

- As part of the Control Center a front end (FEP) is requested (HW and/or SW) enabling the communication between the Control Center and the Field Control Units.
- The Control Centre shall be able to interface with various software applications (third party), such as weather stations, and other management SW packages.

The Remote Control Centre shall be able to execute and support the following features:

- **Displaying the entire data of Field Control Unit such as, flow rate/accumulated flow, and total time of operation, balance time in the form of tables and graphical screens**
- **Displaying Field Control Unit's events and alarms and ability to report them utilizing SMS technology.**
 - **Display the communication healthiness of field units.**
 - **The user shall be able to change valve operation timings, from the graphical screens**
 - **The user shall be able to operate valve from the graphical screens**
- **Shall be able to call the Downloading and Uploading data from the Field Control Units**
 - **Shall allow the quantity of water as per the Demand set by the operator.**
- **Shall have a program to design and display an event report for each VTC in the water network.**
- **Shall have a program to calculate the predicted flow load, over the hydraulic system.**
 - **Shall have a program for displaying sensors data historical trends and alarms.**
- **Shall have an Off-Line program for the Field Units in addition to the current runtime unit's program.**

B: Field Control Units:

- Shall have Logic board incorporating microcontroller/microprocessor and data storage components.
 - Shall run on solar power or long life lithium battery.
- Shall be with I/O port required for on-site sensor connection. I/O boards may be expanded/ replaced on-site. These may be inputs such as water meters, reservoir level, pressure meters, or general digital inputs, or outputs such as valves, pump starts, general relays, etc.
- Communication Ports - enabling the Field Unit to communicate with the Remote Control Centre, and/or each other, and on-site programming/diagnostic tool (such as laptop).

- Shall be able to operate not only the local I/Os (on board I/O connections), but remote I/Os as well.
- Shall be able to update the Remote Control Centre database upon request (by the remote Control Centre) or by exception. The Field Unit shall be able to report to the Remote Control Centre every defined alarm which occurs in the field.
- Shall be capable of functioning in a stand-alone mode (no Remote Control Centre), as well as a part of a system with a Remote Control Centre.
- Shall be able to perform Store & Forward functionality - receive information from other sites, store it in memory, and then transmit (forward) the data to another site.
- Shall be able to support both local I/O's and Remote I/O's modules. The remote I/O modules shall be equipped with radio technology, allowing the Field Unit full access and control, as if they are locally connected.
- Shall be able to report by exception (known as burst) to the Control Center upon **any Change-Of-State (COS)**
- Shall be equipped with a multi-tasking Operating System, specially designed for a real time environment.

C: Radio / GPRS communication Network

The Radio/GPRS communication network shall be able to make the communication link between the remote control Centre and VTC/ Reservoir with conventional (865-867MHz licenses free) frequency or using GPRS network.

The communication protocol shall be able to support multiple logical channels per physical port, enabling simultaneous Central-to-Field Control Unit and Field Control Unit -to-Field Control Unit sessions.

The communication protocol shall be able to support the following messaging methods: Burst (also known as Contention) - this is transmission upon change of state. Polling (also known as Interrogation) - automatically or manually request for data updating. Report by Exception - the unit shall only report data that have changed since the last poll.

4. ISOLATION WAFER TYPE BUTTERFLY VALVE

Wafer Type BFV should be provided to Inlet and outlet of PFCMD

Material of Construction

- Body : Ductile Iron GGG40
- Disc : Ductile Iron GGG50
- Shaft : Stainless Steel 410
- O-Ring : NBR

Plug : Stainless Steel 410
Bushing : Bronze
Washer : Stainless Steel 410
Half Washer : Stainless Steel 410
Bolts : Stainless Steel

TEST PRESSURE:

a) SEAT TEST: 16 Kg/cm²

b) BODY TEST: 24

Kg/cm²

5.ENCLOSURE

Enclosure to be made up of Reinforced Polyester with Door having vandalism alert.

VOLUME – II

Section - 4

SETTING OUT OF WORKS, DESIGN CRITERIA, OBLIGATORY REQUIREMENTS AND SPECIFICATIONS

4.01 General & Approach to Work Site

The general site site particulars is shown in the Drawings enclosed in the Volume – IV Tender Document. The scope of topographic survey for the contractor consist of establishing bench mark stations, carrying out traverses, topographic survey for provision of Major & Minor Sewers, development of surface level roads, design of drainage system for the surface level roads and integration of the drainage system to the natural outfall.

4.02 Topographic Survey, Bench Marks & Setting out of Works

- a. The contents of the topographic survey drawing covering topographic details, bench marks and coordinates is for reference. The Department does not take responsibility about the correctness of the details in the drawing.
- b. Contractor shall carry out detailed topographic survey by carrying out horizontal and vertical traverse followed by capturing of topographic survey details. Contractor shall establish one Permanent Control Point at the project site connected with atleast three inter-visible points. Contractor shall also establish atleast two Bench mark stations in all the arms of the junctions, with the distance between two bench mark stations not exceeding 400m. Control Point and Bench mark station shall be in precast RCC Pillar with a minimum dimensions with length and width of 150mm and total depth of 600mm with 400mm standing height above the top of existing road / ground level.
- c. Contractor shall conduct horizontal traverse for the project using Total Station of 1 sec least count connecting stations in the form of loop and the traverse closure shall be better than 1 in 20000 accuracy and the misclosure error shall be distributed. In case, the traverse closure is above 1 in 20000, the contractor shall re-conduct the traverse until the closure is within the permissible value of 1 in 20000 or better. Vertical traverse shall be conducted using Auto Level from Survey of India benchmark which shall be transferred to the permanent control point of the project. Vertical data recordings shall be based on double tertiary measurements of the three cross hair readings of the instrument. The closure error shall be checked for the permissible limits of $12 \times \sqrt{K}$ in millimeters, where K is the distance in Km. The error shall be distributed within to all the bench marks in the loop. In case, the error is more than the

permissible limits, then the survey shall be re-conducted.

- d. Contractor shall be solely responsible for the correctness of the traverses data. The reduced levels shall be painted on all the bench marks.
- e. The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the positions, levels and dimensions and alignments of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. Setting out of piers / abutments / RE wall edges and other obligatory points / locations as desired by Employer / Employer's representative shall be secured at ground with nails and painted the point with circle along with identification. The Contractor shall give at least 24 hours notice to the Employer / Employer's Representative of his intention to set out or give levels.
- f. If at any time during the progress of the work, any error may appear or arise in the positions, levels, dimensions of alignments of any part of the work, the Contractor shall at his own expenses, rectify such errors to the satisfaction of the Employer / Employer's Representative at no additional cost and time.
- g. All duties concerning establishment of a set of bench marks, permanent stations for setting up total stations, centre line pillars, etc. for performing all the functions necessary at the commencement and during the progress of work till the physical completion of all the items of the work in his scope, shall be carried out by the Contractor at his own cost.
- h. The centre line and edges of Major Bridge / Road, and the foundations shall be established by total station and the centre line marks shall be engraved on smoothly finished masonry or concrete pillars of such dimensions and constructed at such intervals and places as may be directed by the Employer / Employer's Representative and shall be maintained in proper manner throughout the period of construction. The Contractor shall submit a drawing showing the Major Bridge / Road alignment and wall locations within 15 (fifteen) days from the date of signing of agreement.
- i. The contractor shall also keep proper record of such permanent Bench marks established denoting therein their correct levels.
- j. The work of establishment of all such Bench Marks shall be carried out by only experienced staff of the Contractor with the help of precise instruments suitable for this type of work. The instruments used shall be checked for their accuracy and for permanent adjustments before the commencement of the work

and also at frequent intervals during the progress of the work.

- k. All such Bench marks established by the Contractor shall be subjected to check and approval of the Employer / Employer's Representative or his representative as and when required, and any variations noticed in the work as a result of improper establishment and maintenance of such Bench Marks shall be rectified at the Contractor's risk and expense.

4.03 Design Criteria

The overall layout of the drawing for the proposed Under Ground Drainage Scheme is given in Drawing No. ----- . The contractor shall prepare detailed alignment design for horizontal and vertical geometry as per the design criteria specified in following sections.

a) Sewers

Sl No	Parameters	Design Criteria
1	velocity	Minimum (0.6 m/s) and maximum (1.2 m/s) velocity shall be as per CPHEEO Manual
2	Material of pipes	Less than 300mm dia – SWG/AC/PVC pipes 300mm dia and above - RCC/AC/GRP pipes
3	Cement	Sulphate Resistant Cement shall be used for the manufacture of RCC pipes
4	Pipes	To be designed as per the actual site conditions
5	Depth of flow	Shall be as per CPHEEO Manual.

b) Pumps

Sl No	Parameters	Design Criteria
1	type	Non-clog type
2		
3		
4		

c) Sewage Treatment Plant

Sl No	Parameters	Design Criteria
1	type	Waste Stabilization Ponds/ any other proven technology
2	BOD	Effluent BOD shall be as per standards of river water i.e., <20 mg/lit for unrestricted usage
3		
4		

d) Manholes

Sl No	Parameters	Design Criteria
1	Bricks	Shall be made using Fly ash and cement.
2	Plastering	Shall be using sulphate resistant cement
3	Covers	SFRC covers shall be used
4	Steps	encapsulated steps shall be used

4.04 **Reference Codes for design**

The standards for sewer design to be adopted shall be as per the codal specifications (Refer to list in Technical Specifications) and as per CPHEEO manual on sewerage and treatment.

4.05 **General Requirements of UGD:**

- a. The general arrangement shall be as shown in the drawing No. -

- b. All the structural elements shall be elegantly harmonized in respect of shapes, sizes, lines and levels.
- c. All the lines of the Major Sewers shall be continuous without any break.

Note : The decision of the Employer / Employer's Representative shall be final in respect of (b) and (c) above.

- d. The preliminary Geo-Technical investigation report enclosed in the Volume – IV of the tender document are for guidance only. The nature of the strata need re-confirmation from the EPC's contractors end.
- e. The centre to centre distance between the manholes in the sewers portion shall be as per CPHEEO Manual and relevant BIS codes.
- f. -----

4.06 Hydraulic Data for the Sewer Portion of UGD:

- 1) The design Discharge shall not be less than -----.
- 2) -----

4.07 Restrictions on Type of Structures for Major Sewers

The following types of structural arrangements shall not be permitted:

4.08 Description of Work and Obligatory Provisions for Proposals for UGD

a) Hydraulic Data :

- b) Alignment and location

The alignment, longitudinal section are as shown in the Drawing No. -----

- c) Layout of Major Sewers

The geometric designs, structural arrangements, are substantially obligatory. The layout of Major Sewers shall also satisfy the following criteria as indicated in the enclosed drawing/supplementary data.

- i) Any other criteria as shown on the drawing / supplementary data.

d) Road level on the Major Sewers and roadways particulars

4.09 **Detailing**

All detailing shall be as per standard specifications by -----

4.10 **Design of Sewers and Sub-mains**

Dead Load and Superimposed Dead Load: to be designed to withstand all external loads

Live Loads

f) Permissible Stresses

All permissible stresses for

g) Durability

Sulphate Resistant Cement/Ordinary Portland cement, 53 Grade conforming to I.S: 12269 or 43

Grade conforming to I.S: 8112 shall be permitted.

4.10 **Programme of submission and approval of design and drawings for Water Supply Scheme:**

The programme for submission of designs and drawings is as listed out below:

Details	Time from award of work
Award of work	0
1. Filtration Plant	15 Days
2. E L S R 's	30 Days
3. Pipe lines & Pumping machinery etc	30 Days

GENERAL REQUIREMENTS OF UNDER GROUND DRAINAGE SCHEME

4.18

4.19 TRAFFIC SIGNAGE

The traffic signage for the proposed Major Sewers and surface level roads shall be as per latest MORT&H and IRC : 67 codal provisions. The contractor shall prepare a detailed traffic signage drawing for Major Bridge and surface level roads showing type of road signs along with locations and placement angle. However, the following minimum traffic signs shall be provided in each arm of the junction:

- 1) Mandatory Signs
 - a. Speed limit sign for road
 - b. No parking / standing
 - c. Compulsory keep left sign
- 2) Cautionary Signs
 - a. Narrow Road ahead
 - b. Road widens ahead
 - c. Hazard marker signs at channellising islands and median as per IRC:79 and clause 805 of MORT&H specification
 - d. Road delineators at channellising islands and median as per IRC:79 and clause 805 of MORT&H specification

All road signs including overhead signs shall be retro reflectorised type made of encapsulated lens reflective sheeting as per clause 801.3 of MORT&H specifications.

The location plan, information to be written on the sign boards, placement, text size and colour shall be got approved after the award of the work and before execution of actual work at site.

All details of the work connected to traffic signage needs prior approval of Employer / Employer's Representative-in Charge before execution.

4.20 Traffic Diversion

The Contractor may adopt a suitable scheme for construction which shall be got approved from Traffic Department. The responsibility of obtaining the permission for scheme to be adopted from concerned authorities rests with the contractor. The necessary barricading for work site, signages, maintaining night watchman, warning light, etc. as directed till the completion of the works are deemed to be part of Contractor's work. The entire length of the Major Bridge must be provided with barricading on both sides. The contractor shall

maintain the diversion road in good motorable condition till the completion of the project.

4.21 Submission of Design and Drawings

- a) The design should be submitted in sufficient details and as lucidly as possible so as to enable quick proof checking by the Consultants. The designs and drawings will be proof checked and commented generally within 15 days of submission. All the design calculations after incorporating the comments of the proof checking consultants along with corresponding construction drawings marked “Good for Construction” shall be submitted, got approved by the proof consultants for use at site within 7 days thereafter.
- b) **If the designs and drawings are not submitted within the time frame, then a penalty at the rate of Rs. 5,000/- (Rupees Five thousand only) per day shall be charged for every day of delay.**
- c) Any other component which required redesigning on account of exigencies of the site like redesigning the foundations for utilities, etc., during the duration of the works shall be approved as expeditiously as possible. Such designs should be submitted within 10 days of taking a decision to redesign the component.
- d) Analysis and design as far as possible shall be done using computer with recognized software. The contractor shall submit with design, the detailed description of method of analysis with explanatory notes and submit sample manual calculations for adequate number of typical cases. The Computer Programme as submitted will be further tested by comparison with solutions of worked examples.
- e) Drawings and designs shall be in metric units. Calculations shall be neat and clear, preferably typed and printed and supplemented by full explanatory notes and sketches wherever required. All construction drawings of initial submissions and final approval shall be in Autocad only.
- f) If during the scrutiny of detailed design calculations and working drawings, any changes therein which are found necessary in the opinion of the Employer / Employer’s Representative, the same shall be incorporated without altering the lumpsum quotations. It is entirely the responsibility of the contractor to submit properly prepared and completed designs in good time to enable the Employer / Employer’s Representative to approve them in time.
- g) Bar bending schedule of reinforcement, shop drawings of prestressing tendons and other elements and average quantity of reinforcement per Cum. of concrete quantity (and also

percentage with respect to gross cross sectional area of the component) should also be shown on the relevant drawings.

- h) Eight sets of prints of approved working drawings including one set on reproduction tracing, floppy diskette of the Autocad/Felixcad drawing and 4 sets of approved design calculations shall then be supplied by the contractor which will be formally authenticated by the Employer / Employer's Representative (one set of design calculations and working drawings shall be returned to the contractor after verifying and the remaining shall be retained by the Employer / Employer's Representative). The design calculations and drawings shall be submitted in plastic files and plastic folders free of cost.
- i) After completion of each stage of work, 3 sets of record plans and one set of final design calculations based on the work as actually executed on site, shall be supplied by the Contractor in bound volumes, to the Employer / Employer's Representative.
- j) Approval to drawings and designs and design calculations by the Employer / Employer's Representative shall not in any way relieve the Contractor of his responsibility for the correctness, soundness and structural stability and safety of the structure.
- k) The approved drawings and the design calculations of the Major Bridge shall be the property of the Department.
- l) The Contractor's designer or consultant shall attend all the review meetings conducted by Employer / Employer's Representative from time to time without any extra cost and shall also remain present as and when required during the checking of designs for clarifications if required.

4.32 **Documentation, instrumentation, etc.**

- a) All drawings shall be made in latest version of Autocad and the soft copies on CDs and six copies of prints of all approved drawings and "as built" drawings shall be supplied by the Contractor free of cost as per the agreed programme.
- b) Floppy diskettes CDs and six copies of all design calculation shall be submitted as per agreed programme.
- c) "Maintenance Manual" describing access arrangements, important obligatory precautions from the point of view of structural safety, and procedure for minor and major repairs of each component of the Major Bridge, renewals of finishes and treatments periodically shall be supplied by the Contractor free of cost.
- d) A "Quality Assurance Manual" covering designs and drawings, mix-designs, materials, testing, soil and rock properties, statistical quality control, etc. shall be prepared by the

Contractor free of cost well before starting the work.

- e) A “Construction manual” covering various aspects of construction methods, difficulties faced and how they are overcome during execution etc., shall be supplied by the contractor free of cost at the time of finalisation of work.
- f) The Contractor shall install fixtures and fastenings provided by the Department for housing any instrumentation that may be useful for the Department at his cost.
- g) Fixing arrangement for internal and external lighting shall be got approved from Employer / Employer’s Representative and executed.

4.33 **Specifications for Design and Codes to be followed**

4.34 Order of precedence in case of conflicts

In case of conflicts between the different partners of the tender. The following order of precedence shall prevail.

- i. Design Criteria as specified in the Tender
- ii. Special conditions of contract
- iii. General conditions of contract
- iv. Standard Codes of practice

4.35 **Disputes**

In case of disputes arising between the Contractor and the authority approving the designs, the matter may be referred to the Employer / Employer’s Representative. The decision of the Employer / Employer’s Representative shall be final and binding on the contractor.

Sl. No.	Description
A) CIVIL WORKS:	
Division – 1	... General Specifications
Division – 2	... Site Work
Division – 3	... Earth Work Excavation
Division – 4	... Masonry
Division – 5	... Plastering and Pointing
Division – 6	... Concrete
B) WATER SUPPLY	
Division – 7	... Materials Required for Pipeline Works
Division – 8	... Laying and Jointing of Pipelines
Division – 11	... Pumping Machinery
Division – 17	... Specification for Centrifugal Cast (Spun D.I Pipes) for Water, Gas and Sewage

Section – 4

TECHNICAL SPECIFICATIONS

DIVISION – 1

GENERAL SPECIFICATIONS

The I.S. Codes shall be those indicated or subsequent amendments thereon

SL. No.	Description	I.S. No.
LIST OF INDIAN STANDARDS		
I. CEMENT		
1.	Ordinary and Low Heat Portland Cement.	269 – 1976
2.	Pozzolana Portland Cement.	1489 – 1976
3.	43 Grade or 53 Grade Cement	8112-12269 Respectively
II. AGGREGATES		
1.	Aggregates, Coarse & Fine from Natural resources for concrete.	383 – 1970
2.	Sand for Masonry Mortar	2116 – 1965
3.	Methods of tests for aggregates for concrete	2386 - 1963
	Part – I Particle size and shape	2386 – 1963 (Part – I)
	Part – II Estimation of deleterious Materials & Organic impurities	2386 – 1963
	Part – III Soundness	2386 – 1963
4.	Specification for test sieves. Part – I: Wire Cloth test sieves.	460 – 1978 (Part – I)
III. BRICKS		
1.	Common burnt clay building bricks	1077 – 1976
IV. STEEL		
1.	Mild steel and medium tensile steel bars and hard drawn steel wire, concrete reinforcement. Part – I Mild Steel & Medium tensile Steel Bars.	432 – 1982

Sl. No.	Description	I. S. No.
2.	High strength deformed steel bars and wires for concrete reinforcement.	1786 – 1985
3.	High Tensile Steel for PSC Pipes.	1784 – 1986 (Part-I)
4.	Hand Drawn Wire	432 – 1953
5.	Bending and Flexing of Bars for Concrete reinforcement.	2502 – 1963
6.	Recommendations for detailing of reinforcement in reinforced concrete works.	5525 – 1969
V. CONCRETE		
1.	Plain and reinforced concrete, code of practice for.	456 – 2000
2.	Laying in Situ cement concrete flooring	2571 – 1970
3.	Sampling and analysis of Concrete	IRC : 15-2002
4.	Code of practice for liquid retaining structures	3370 – 1967
5.	Code of practice of concrete roads	IRC : 15 – 2002.
VI. MASONRY		
1.	Brick Masonry	2212 – 1962
2.	Construction of Stone Masonry	1597 – 1967
VII. PIPES AND FITTINGS		
1.	Asbestos cement pressure pipes.	1592 – 1980
2.	Concrete pipes with and without reinforcement.	458 – 1988
3.	P.S.C. Pipes (including fittings)	1343 – 1960
4.	Method of tests for concrete pipes	458 – 1988, 3597 – 1985
5.	Materials for M.S. Specials	226 – 1976 & 2062 – 1980
6.	Specifications for M.S. Specials for P.S.C. Pipes-	
7.	Specifications for Steel cylinders reinforced Concrete Pipes	1916 – 1963
8.	Methods of tests of concrete pipes	3597 – 1985

Sl. NO.	Description	I.S. No
9.	Centrifugally Cast (Spun) iron pressure pipes for water gas and sewage including fittings.	1536 – 1976 784 – 1978
10.	Specifications for Centrifugally Cast (Spun) D.I. Pipes for Water, Gas and Sewage.	8329 – 1980
11.	D. I. Fittings for pipes for water, gas and sewage.	9523 – 1980
a.	D.I. AIR Valves	3896 -1985 (Part – II) 1538-1985
b.	D.I. Valves	14846-2000
c.	Surge Protection Valves	14846-2000
d.	DI Pipes	8329-2000
c.	DI Specials	9523-2000
d.	DI Laying & Jointing	12288-1987
e.	DI Rubber Rings	5382-1985
12.	MS Pipes	3589 -2001
a.	MS Flanges	1538-1993
b.	MS Specials	1538-1993
13.	Dimensional requirements of rubber gaskets for Mechanical joints and push on joints for the use with C. I. D.I. Pipes.	12820 – 1989
14.	C.I. Specials for Mechanical and push on flexible for pressure pipe lines for water gas and Sewage.	13382 – 1992
15.	Horizontally cast iron double flanged pipes for Water, gas and sewage.	7181 – 1986
16.	Cast iron fittings for pressure pipes for Water, gas and sewage.	1538 – 1976
17.	Cast iron detachable joints for use with Asbestos cement pressure pipes.	8794 – 1988
18.	a) Rubber rings for jointing C.I. Pipes, RCC Pipes and A.C. Pipes.	5382 – 1969
	b). Rubber rings for jointing PSC Pipes. Rubber rings for jointing AC Pipes with AC couplings.	5382 – 1985 10292 – 1986
19.	Pig Lead	782 – 1978
20.	Hemp Yarn	6587 – 1966
21.	Rubber insertion to be used in jointing C.I.D.F. Pipes.	638 – 1955
22.	Bolts & Nuts to be used in jointing C.I.D.F. Pipes	1363 – 1967

Sl. No	Description	I.S. No
(i) VIII. WATER SUPPLY FITTINGS		
1.	Sluice valves for water works purposes (50 to 300 mm dia size)	14846-2000
2.	Sluice valves for water works purposes (300 to 1200 mm dia size)	14846 - 2000
3.	Surface boxes for sluice valves.	3950 – 1966
.	Manhole covers and frames, cast-iron.	1726 – 1974
(ii) IX. LAYING OF PIPES		
1.	Laying of Asbestos Cement Pressures Pipes	6530 – 1972
2.	Laying of Concrete Pipes. 1	783 – 1959
3.	Laying of Cast-Iron Pipes.	3114 – 1965
4.	Laying of PSC Pipes.	126 of APSS & 783 – 1985
5.	Laying of D.I. Pipes	3114 – 1965
(iii) X. MACHINERY		
1.	Batch type concrete mixer.	1791 – 1968
2.	Sheep foot roller	4616 – 1968
(iv) XI. SAFETY		
1.	Safety code for excavation works.	3764 – 1966
2.	Safety Code for scaffolds and ladders	
	Part – I – Scaffolds.	3696 – 1966 (Part – I)
	Part – II – Ladders.	3696 – 1966 (Part – I)

Sl. No.	Description	I.S. No
XII.	EARTHWORK AND FORMATION OF S.S. TANKS	
	Method of test for soils for suitability of soils For embankment of S.S. Tanks.	2720 – 1975 Part II to XII, XV, XVII, XX, XXIX, XXXV, XXXVI and 1 228 – 1988
2.	Code of Practice for Drainage System for Earth and rock fill dams.	9429 – 1980
3.	Filters Materials Requirements.	9429 – 1980 & 10379 – 1982
4.	Earth work and formation of embankment for S. S. Tanks.	Sec. 3 of APSS Sub-Sec. 301,303 to 307
	Morrum (Gravel) backing to rough stone dry packing and gravelling to top and side APSS slope of bunds 150mm thick.	Sub-Sec. 621 of Sect. VI of
6.	Rough stone dry packing aprons and revetments.	Sub-Sec. 621 of Sec. 6 of APSS
XIII.	FILTRATION PLANTS	
1.	Guide lines for flauculator devices.	7208 – 1992
2.	Guide lines for rapid mixing devices.	7090 – 1985
3.	Recommendations for handling and dousing devices for chemicals for water treatment	9222 – Part I 1990
4.	Requirements of Chlorination equipments.	10553 – 1983 (Part – I)
5.	Requirements of Settling Tank (Clarified Equipment for Water Treatment Plant)	Part – IV 10313 – 1982
6.	Requirement for Water Filtration Equipment	8419 – 77 (Part – I & II)

SITE WORK**2.1 Intimation about commencement of work:**

Before commencing the works and also during progress the bidder shall give due notice to the concerned authorities, the Municipality, the Roads and Buildings and Electricity Board, Telephone Department, the Traffic Department attached to the Police, other Departments and companies as may be required to the effect that the work is being taken up in a particular locality and that necessary diversion of traffic may be arranged for. The bidder shall cooperate with the Departments concerned and provide for necessary barricading of roads, protections to existing underground mains, cables etc.

2.2 Cross Drainage:

The bidder shall handle all flows from natural drainage channels intercepted by the work under these specifications, perform any additional excavation and grading for drainage as directed and maintain any temporary construction required to bypass or otherwise cause the flows to be harmless to the work and property. When the temporary construction is no longer needed and prior to acceptance of the work, the bidder shall remove the temporary construction and restore the site to its original condition as approved by the Engineer-in-Charge. The cost of all work and materials required by this paragraph shall be included by the bidder in the unit prices quoted in the section 6 of Vol. III (bill of quantities) and no separate payment will be made for the same.

2.3 Stacking of Excavated Material:

Where the location of the work is such and does not permit the deposition of excavated earth while digging trenches for laying pipes, the excavated earth should be conveyed to a convenient place and deposited there temporarily, as directed by the Engineer-in-Charge. Such deposited earth shall be reconveyed to the site of work for the purpose of refilling of trenches, if such deposited soil is suitable for refilling. The unit rate for trench work of excavation and refilling shall include the cost of such operations.

2.4 Disposal of Surplus Earth:

The rate for excavation of trench work, shall include charges of shoring, strutting, any of these contingent works. While bailing out water care should be taken to see that the bailed out water is properly channelised to flow away without stagnation or inundating the adjoining road surfaces and properties.

2.5. Shoring, Strutting and Bailing out Water :

The rate for excavation of trench work, shall include charges of shoring, strutting, bailing out water wherever necessary and no extra payment will be made for any of these contingent works. While bailing out water care should be taken to see that the bailed out water is properly channelised to flow away without stagnation or inundating the adjoining road surfaces and properties.

EARTH WORK

3.1 EARTH WORK - GENERAL:

3.1.1 Earth work diagrams and Data:

To the extent that they exist plans and earth work data prepared for the Government's (that is Government of Andhra Pradesh) studies of earth work for construction of the related works will be available for Inspection by the bidders in the Office of the concerned Engineer-in-Charge.

Such information is made available solely for the convenience of bidders. The Government does not represent that this information is accurate or complete. Bidders are cautioned that this information is subject to revision and that the Government disclaims responsibility for any interpretations, deductions or conclusions which may be made therefrom. It is not intended that this earth work information will limit or prescribe the excavation and handling procedure of the contractor, and the Government reserves the right to utilise and distribute earth work materials during the progress of work as best serves the interest of the Government.

3.1.2 Compacting Earth Materials:

Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening and compacting operations shall be such that the materials will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, voids, lamination or other imperfections. The compaction shall be carried out in accordance with the relevant clauses of I.S 4701 – 1982.

EXCAVATION:

Classification of Excavation:

Except as other-wise provided in these specifications, material excavated will be measured in excavation to the lines shown on the drawings or as provided in these specification, and all materials so required to be excavated will be paid for at the applicable prices bid in the schedule for excavation. No additional allowance above the price bid in the schedule will be made on account of any of the material being wet. Bidders and the contractors must assume all responsibility for deducting and concluding as to the nature of the materials to be excavated and the difficulties of making and maintaining the required

excavation. The Government does not represent that the excavation can be performed or maintained at the paylines described in these specifications or shown on the drawings.

Excavation for removal of debris and deposited earth on berms while forming roads is to be carried out as specified in relevant clauses of 154701-1982 as compared before lying of berms with the same setting of roads.

Excavation for Structures:

General:

Excavation for the foundation of structures shall be to the elevation shown on the drawings or as directed by the Engineer-in-Charge. In so far as practicable, the material 3-2

removed in excavation for structures shall be used for back fill and embankments. Otherwise it shall be disposed off as specified in paragraph 2.4.

Foundations for Structures:

The Contractor shall prepare the foundations at structure/sites by methods which will provide firm foundation for the structures. The bottom and side slopes of common excavation upon or against which the structure is to be placed shall be finished to the prescribed dimensions and the surfaces so prepared shall be moistened and tamped with suitable tools to form firm foundation upon or against which to place the structure. The Contractor shall prepare the foundation for the structures as shown on respective drawings. The natural foundation material beneath, the required excavation shall be moistened if required and compacted in place.

Separate payment will not be made to the contractor for Moistening and compacting the foundation of structures. The contractor shall include cost thereof in the price bid per cubic meter of the item of the Bill of quantities for preparation of foundations.

Whenever unsuitable material is encountered in the foundation for a structure the Engineer-in-Charge will direct additional excavation to remove the unsuitable material. The cost of such additional excavation shall be paid at the unit price bid in the Bill of quantities for earth. The additional excavation shall be refilled by selected bedding material and compacted.

(c) **Over Excavation:**

If at any point in common excavation the foundation material is excavated beyond the lines required to receive the structure, or if at any point in common excavation the natural foundation material is disturbed or loosened during the excavation process, it shall be

compacted in place or where directed, it shall be removed and replaced as follows. In excavation soils, the over excavation shall be filled in by selected bedding material and compacted. In excavation in rock it shall be filled with M5 grade cement concrete. Any and all excess excavation or over excavation performed by the Contractor for any purpose or reason except for additional excavation as may be prescribed by the Engineer-in-Charge and whether or not due to the fault of the contractor shall be at the expense of the contractor. Filling for such excess excavation or over excavation shall be at the expense of the contractor.

(d) **Measurement for payment:**

Excavation for structures will be measured for payment, for box cutting with vertical sides of foundation dimensions. The contractor will have to make his own arrangement for shoring, strutting, provision of adequate slopes for the sides to prevent slips etc., and no separate charge will be paid for any incidental charges arising either during excavation of foundation or construction of the structure.

(e) **Payment:**

Payment for excavation for structures will be made at the unit price per cubic metre bid therefor in the Bill of quantities for excavation for structures. The unit price bid in the bill of quantities for excavation for structures shall include the cost of all labour and materials for coffer dam and other temporary construction, of all pumping and dewatering, of all other work necessary to maintain the excavation in good order during construction, of removing such temporary construction where required and shall include the cost of disposal of the excavated material.

3.3 **BACKFILL:**

3.3.1 **Back Fill Around Structures:**

(a) **General:**

The item of the schedule for backfill around structures including pipe portions of structures includes all backfill required to be placed under these specifications.

(b) **Materials:**

The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval of Engineer-in-Charge. In so far as practicable backfill material shall be obtained from material removed in required excavations for structures. But when sufficient suitable material is not available from this source, additional material shall be obtained from approved borrow-areas. The borrow pit excavation shall be in accordance with clause-9.1 to 9.3 of I.S 4701-1982.

Backfill material shall contain no stones larger than 80 millimeters in diameter. If the excavation for the foundation of the structure is in swelling soils, a layer of cohesive non-swelling soil conforming to I.S..9451-1980 should be interposed between the swelling soil of the structure and compacted to atleast 95% standard proctors density.

(c) **Placing Backfill:**

Backfill shall be placed to the lines and grades shown on the drawings as prescribed in this paragraph or as directed by the Engineer-in-Charge. All backfill shall be placed carefully and spread in uniform layers not exceeding 150 mm, so that all spaces about rocks and clods will be filled. Each layer shall be watered and well compacted before the succeeding layer is laid, care being taken not to disturb the constructed structure. Backfill shall be brought up as uniformly as practicable on both sides of walls and all sides of structure to prevent unequal loading. Backfill shall be placed to about the same elevation on both sides of the pipe positions of the structures to prevent unequal loading and displacement of the pipe.

(d) **Measurement and Payment:**

Excavation refill required to be placed about structures that is within the pay line limits for excavation for the structures, will be measured in place for payment as backfill about structure provided that where the contractor elects not to excavate material which is outside the limits of the actual structure or pipe, but within the pay line limits of

excavation, all such material will be included in the measurement for payment of backfill.

The unit price bid therefor in the Bill of quantities for excavation of foundation of structure shall include cost of backfilling about the structure upto ground level. No separate payment will be made for backfill of foundation.

Refill of excavation performed outside the established paylines for excavation for structures shall be placed in the same manner as specified for the adjacent backfill and such refill shall be placed at the expense of the contractor.

MASONRY

4.1 MATERIALS:

4.1.1 Stone for Masonry:

(a) General:

The stones used for stone masonry shall conform to the relevant specifications of Clause 4.1 of I.S 1597 (Part-I) 1967 code of practice for construction of stone Masonry Part-I Rubble Stone Masonry.

The stone of the required quality shall be obtained from the quarries specified in the lead chart appended to the Schedule. The common types of natural stones which are generally used are Granite and other ingenuous rocks, and shall be free from defects like decay, cavities, cracks, flaws, sand, holes, soft seams, veins, patches of soft or loose materials or any other deleterious materials like iron oxide Organic Impurities etc. They shall be free from rounded, worn or weathered surfaces or skin or coating which prevents the adherence of mortar. All stones used shall be clean of uniform colour and texture, strong, hard and durable.

The percent of water absorption shall not exceed 5% by weight as determined in accordance with I.S. 1124-1974.

The approval of the quarries by the Engineer-in-Charge shall not be constructed as constituting approval of all or any of the stones collected from the deposits; and the bidder will be held responsible for suitability of the stones used in the work.

(b) Cost:

The cost of collecting the stones for masonry will not be paid for separately and their cost including the cost of quarrying, transporting, stacking, royalty seigniorage charges shall be included in the unit price per cubic metre bid therefor in the relevant item in the bill of quantities.

4.1.2 Brick for Masonry

General:

Bricks used for brick masonry shall conform to the relevant specifications of I.S. 1077-1986 common burnt clay building bricks.

Bricks shall be hand or machine moulded. They shall be sound, hard, homogeneous in texture well burnt and shall give a clear ringing sound when struck. They shall be clean, free from warping, distortion, cracks, chips, flaws, stones and nodules of free lime. Unless otherwise

specified the sizes of the bricks shall be 190 x 90 x 90 mm. The compressive strength shall not be less than 40 Kg/Cm². The percentage of water absorption shall not be more than 20 per cent by weight after 24 hours immersion in cold water.

(b) **Cost:**

The cost of collecting the bricks for masonry will not be paid for separately and their cost including the cost of transporting, stacking, royalty seigniorate charges shall be included in the unit price per cubic metre bid therefore in the relevant item in the bill of quantities.

4.1.3 Sand for Masonry:

General:

Sand shall generally conform to specifications given in paragraph 6.2.5 except that the sand for mortar shall conform to the grading of sand given in clause 4 of I.S.2116-1189 as detailed below in Table 4(b).

Table 4(b): Grading of Sand for use in Masonry Mortars:

I.S. Sieve Designation	Percentage passing by Mass
4.75 mm	100
2.36 mm	90 to 100
1.18 mm	70 to 100
600 Micron	40 to 100
300 Micron	5 to 70
150 Micron	0 to 15

A sand whose grading falls out-side the specified limits due to excess or deficiency of coarse or fine particles may be processed to comply with the standard by screening through a suitably sized sieve and/or blending with required quantities of suitable size and particles.

The procurement of sand for masonry shall conform to the specifications given in paragraph 6.2.5.

Cost:

The cost of sand for masonry will not be measured and paid separately and the cost of sand including the cost of stripping, transporting and storing and royalty charges shall be included in the unit price per cubic metre bid therefor in the relevant item of work in the bill of quantities for which this and is required.

4.1.4 Cement:

General:

As per clause 4 of I.S. 456-1978 for the purposes of these specifications, cement used shall be any of the following with the prior approval of the Engineer-in-Charge Ordinary Portland (OPC) – GRADES 43 & 53 Conforming to BIS : 811 : 12269 respectively (or) portland pozzolana cement conforming to I.S. 1489 relevant amendments upto date.

The provisions of this paragraph apply to cement for use in cast-in-place concrete required under these specifications. Portland cement required for items such as concrete pipes, precast concrete structural members and other precast concrete products, for grout and mortar and for other item is provided for in the applicable paragraphs of these specifications covering the items for which such portland cement is required.

The water used in making and curing of concrete, mortar and grout shall be free from objectionable quantities of silt, organic matter, injurious amounts of oils, acids, salts, and other impurities etc., as per I.S. specification No.456-1978.

The Engineer-in-Charge will determine whether or not such quantities of impurities are objectionable.

Such determination will usually be made by comparison of compressive strength, water requirement, time of set and other properties of concrete made with distilled or very clean water and concrete made with the water proposed for use. Permissible limits for solids when tested in accordance with I.S. 3025-1964 shall be as tabulated below.

Permissible limit for Solids:	Maximum permissible limit
1. Organic	200 mg/litre
2. Inorganic	3000 mg/litre
3. Sulphates (as SO ₄)	500 mg/litre
4. Chlorides (as CL)	2000 mg/litre for plain concrete work and 1000 mg/litre for R.C.C. work
5. Suspended matter	2000 mg/litre

If any water to be used in concrete, mortar or grout is suspected by the Engineer-in-Charge of exceeding the permissible limits of solids, samples of water will be obtained and tested by the Engineer-in-Charge in accordance with I.S. 3025-1964.

4.2 MORTAR

Preparation of Mortar:

Unless otherwise specified, the cement mortar used in Masonry works shall be cement mortar mix MM5 (1:5) grade using minimum 288 Kgs. of cement per cubic metre of mortar.

Mixing shall be done thoroughly preferably in a mechanical mixer. In such cases, the cement and sand in the specified proportions shall be mixed dry thoroughly in the mixer operated manually or by power.

Water shall be added gradually and wet mixing continued atleast for 3 minutes. Water should not be more than that required for bringing the mortar to the required working consistency of 90 to 130 milli metres as required in clause 9.11 of I.S. 2250-1981. The mix shall be clean and free from injurious kind of soil, acid, alkali, organic matter or deleterious substances.

Time of use of Cement Mortar:

Cement mortar shall be used as soon as possible after mixing and before it has begun to set, within 30 minutes after the water is added to the dry mixture.

Mortar unused for more than 30 minutes should not be used and shall be removed from the site of work. The cost of such wasted mortar shall be borne by the bidder. The use of retempered mortar will not be permitted to be used for the masonry.

Tests of Mortar:

Mortar Test cubes shall be cast for the mortar used on the work and shall be tested in accordance with Appendix-A of I.S.2250-1965 code of practice for preparation and use of Masonry Mortars. Such cubes shall develop a compressive strength of atleast 50 Kgs/square centimetre for MM5 (1:5) Grade cement mortar mix, 75 Kgs/square centimetre for MM 7.5 (1:4) grade cement mortar mix and 30 Kgs/square centimetre for MM-3 grade cement mortar mix.

Mortar not conforming to the specifications will be rejected, and the cost of such wasted mortar shall be borne by the bidder.

Measurement and Payment:

Cement Mortar will not be measured and paid separately and its cost, including cost of materials, transporting and placing shall be included in the unit price per cubic metre bid therefore in the bill of quantities of the contractor for the relevant finished item of work or which cement mortar mix mentioned in the above paragraph is required.

4.2.5. **Dismantling of Structures:**

During course of excavation of drainage works certain dismantling of brick masonry / R.R. masonry retaining walls in CM C.C M10 grade levelling course are to be carriedout. These have to be carriedout as specified under section 202 of A.P.S.S, and as per directions of Engineer-in-Charge and site cleared before facing up actual execution.

DIVISION-5
PLASTERING & POINTING

5.1 SECTION – MATERIALS:

5.1.1 Sand for Mortar for Plastering and Pointing:

(a) General:

The sand for preparation of Mortar for plastering and pointing shall conform to the following gradation, shown in Table 5(A).

TABLE 5 (A)

**REQUIREMENTS OF GRADING FOR SANDS FOR EXTERNAL
PLASTERING AND RENDERING**

I.S. SIEVE	Percentage by weight passing I.S., Sieve	
	Class – A	Class - B
Designation		
4.75 MM	100	100
2.36 MM	90 to 100	90 to 100
1.18 mm	70 to 100	70 to 100
600 Microns	40 to 85	40 to 95
300 Microns	5 to 50	10 to 65
150 Microns	0 to 10	0 to 10

For the purpose of indicating the suitability for use, the sand is classified as Class A and Class B in accordance with the limits of grading. Class 'A' sands shall be used generally for plastering and pointing, and when they are not available, Class 'B' sands may be used with the approval of Engineer-in-Charge.

The procurement of sand for Mortar for plastering and pointing shall conform to the specifications given in paragraph 6.2.5.

(b) **Cost:**

The cost of sand for mortar for plastering and pointing will not be measured and paid separately, and the cost of sand including the cost of stripping, transporting and storing and royalty charges shall be included in the unit price per Cubic metre bid therefor in the relevant item of work in the Schedule 'A' for which this sand is required.

5.1.3 **Cement:**

The specifications and conditions specified for supply for cement in paragraph 4.1.4 shall be applicable here also.

Portland pozzolana cement conforming to I.S. 1489-1976 shall be used for preparation of mortar for plastering and pointing work. Ordinary portland cement – Grades 43 & 53 may also be used in the event of non-availability of P.P.C.

5.1.4 **Water:**

The specifications and conditions specified for procurement of water in paragraph 4.1.5 shall be applicable here also.

5.2 **SECTION – MORTAR:**

5.2.1 **Preparation of Mortar for Plastering work:**

Unless otherwise specified, the cement mortar used in plastering work shall be in cement mortar mix of MM. 7.5 (1:4) grade, using minimum 360 Kgs. of cement per cubic metre of mortar.

The other specifications and conditions enunciated in paragraph 4.2.1 shall apply for this mortar for plastering work also.

5.2.2 **Preparation of Mortar for Pointing:**

The cement mortar used in pointing work shall be cement mortar mix of M.M 7.5 grade, using 480 Kgs. of cement per cubic metre of mortar.

The other specifications and conditions enunciated in paragraph 4.2.1 shall apply for this mortar for pointing work also.

5.3 **SECTION – PLASTERING WITH CEMENT MORTAR MIX. MM 7.5 GRADE 20 MM THICK:**

Preparation of Surface:

The roughening of the background improves the bond of plaster. All joints shall be thoroughly raked. After roughening the surface, care shall be taken to moisten the surface sufficiently before plastering as otherwise rashly exposed surface may tend to absorb considerable amount of water from the plaster. The surface shall be wetted evenly before applying the plaster. Care shall be taken to see that the surface is not too dry as this may cause lack of adhesion or excessive suction

of water from the plaster. A fog spray may be used for this work. As far as possible, the plaster work shall be done under shade.

5.3.2 Laying of Plastering with Cement Mortar Mix MM.7.5 grade 20 mm thick:

The mortar used for plastering shall be stiff enough to cling and hold when laid. To ensure even thickness and true surface, plaster shall be applied in patches of 150 mm x 150 mm of the required 20 mm thickness at not more than 2 metres intervals horizontally and vertically over the entire surface to serve as guides. The surface of these guides shall be truly in the plane of the furnished plaster surface and truly plumb. The mortar shall then be applied to the surface to be plastered between the guides with a trowel. Each trowel full of mortar shall overlap and sufficient pressure shall be used to force it into thorough contact with the surface. On relatively smooth surfaces, the mortar shall be dashed on with the trowel to ensure adequate bond. The mortar shall be applied to a thickness slightly more than that specified, using a string, stretched out between the guides. This shall then be brought to a true surface by working with a long wooden float with small sawing motion. The surface shall be periodically checked with a string stretched across it. Finally the surface shall be rendered smooth with a small wooden float, over working shall be avoided. All corners, arises, and junctions shall be brought truly to a line with any necessary rounding or chamfering.

If it is necessary to suspend the work at the end of the day, it shall be left in a clean horizontal or vertical line not nearer than 150 millimetres for any corner or arises or on parapet tops or on copings etc. When recommencing the work, the edges of the old work shall be scraped clean and treated with cement slurry before the new plaster is laid adjacent to it. After the first coat is done, it shall be kept undisturbed for the next 24 hours and thereafter kept moist and not permitted to dry until the final rendering is applied.

After the plaster has sufficiently hardened cement slurry with cream like consistency shall be applied as thinly and evenly and rubbed to a fine condition.

The finished surface shall be cured with water for a period of 10 days.

5.4 SECTION - POINTING TO STONE MASONRY WITH CEMENT MORTAR MIX MM.7.5 GRADE

The joints in the masonry shall be raked out to a depth not less than the width of the joint or as directed when the mortar is green. Joints are to be brushed clean of dust and loose particles with a stiff brush. The area shall then be washed and the joints thoroughly wetted before pointing is commenced.

5.4.2 **Flush Pointing with Cement Mortar Mix MM. 7.5 Grade for Rubble Masonry:**

The pointing to be done shall be flush pointing with cement mortar mix MM. 7.5 grade. The mortar shall be pressed into the raked out joints according to the types of pointing required. The mortar shall not be spread over the corners, edges or surface of the masonry. The pointing shall then be finished as detailed below. The mortar shall be finished off flush and level with the edges of the stones, so as to give a smooth appearance. The edges shall be neatly trimmed with a trowel and a straight edge.

The pointing shall be cured for seven days.

5.5 SECTION – MEASUREMENT AND PAYMENT:

Plastering:

The measurement of plastering will be in units of square metres, and it shall be paid at the relevant unit price bid per ten square metres of Plastering in the schedule Bill of Quantities which unit price shall include the cost of materials, their conveyance, charges for preparation of mortar including mixing charges and charges for performing the plastering work as illustrated in this division, including curing.

Pointing:

The measurement for pointing will be in units of square metres, and it shall be paid at the relevant unit prices per ten square metres bid in the schedule Bill of quantities which unit price shall include the cost of materials, their conveyance, charges for preparation of mortar including mixing charges and charges for performing the pointing work as illustrated in this division, including curing.

DIVISION-6
CONCRETE

6.1 CONCRETE STRUCTURES:**6.1.1 Concrete in Structures:**

- (a) Concrete in structures shall conform to the requirements of Paragraph 6.2
- (b) Measurement and payment for concrete in structures will be made as prescribed in paragraphs 6.3 & 6.4.

6.1.2 Construction of Structures:

Cast-in-place concrete for the structures shall conform to the requirements of section.

The structures shall be built to the lines, grades and dimensions shown on the drawings. The dimensions of each structure as shown on the drawings will be subject to such modifications as may be found necessary by the Engineer-in-Charge to adopt the structure to the conditions disclosed by the excavation or to meet other conditions. Where the thickness of any portion of a concrete structure is variable, it shall vary uniformly between the dimensions shown.

Where necessary, as determined by the Engineer-in-Charge, the Contractor will be furnished additional detailed drawings of the structures to be constructed. The bidder will not be entitled to any additional allowances above the prices bid in the schedule by reason of the dimensions fixed by the Engineer-in-Charge or by reasons of any modifications or extensions of a minor character to adopt a structure to a structure at site, as determined by the Engineer-in-Charge.

The cost of furnishing all materials and performing all work for installing timber, metal and other accessories for which specific prices are not provided in the schedule, shall be included in the applicable prices bid in the schedule for the work to which such items are appurtenant.

6.2 GENERAL CONCRETE REQUIREMENTS:**6.2.1 Composition :****(a) General :**

Concrete shall be composed of cement, sand, coarse aggregate, water and admixtures (if any) as specified, all well mixed and brought to the proper consistency.

(b) **Nominal maximum size of Aggregates:**

In coarse aggregates to be used in concrete shall be as large as practicable, consistent with required strength, spacing of reinforcement and embedded items, and placement thickness. The size of the coarse aggregate to be used will be determined by the Engineer-in-Charge and may vary incrementally according to the conditions encountered in each concrete placement. Nominal maximum size of aggregate for concrete in structures shall be as indicated in the relevant drawings appended to the contract documents. Smaller coarse aggregate than specified shall be used where in the opinion of the Engineer-in-Charge that proper placement of concrete is impracticable with the size of the aggregate specified in the drawings.

(c) **Mix Proportions:**

The proportions of various ingredients to be used in the concrete for different parts of the work will be established by proper mix design by the Engineer-in-Charge during the progress of the work. In proportioning concrete, the quantity of both cement and aggregate should be determined by mass as per clause 9.2 of I.S. 456-1978 water shall be either measured by volume in calibrated tanks or weighted. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked. Adjustments shall be made as directed to obtain concrete having suitable workability, impermeability, density, strength and durability without use of excessive cement. The acceptance or rejection of concrete shall be as per the acceptance criteria laid down in clause 15 of I.S. 456-1978.

The mix design and average concrete strength shall be adjusted according to the cube strength test results conforming to clauses 14.2, 14.3, 14.4, 14.5 of I.S. 456-1978. The bidder shall not be entitled for any additional allowances above the prices bid in the schedule due to adjustments of the mix proportions.

The net water cement ratio exclusive of water absorbed by the aggregate shall be sufficiently low to provide adequate durability in concrete. The water-cement ratio for various grades of concrete shall be as determined and ordered by the Engineer-in-Charge.

(d) **Consistencies:**

The slump of concrete at the placement shall be as follows:

Reinforced Cement Concrete:

Sl. No	Placing Condition	Degree of Workability	Value of Workability
1.	Concreting of lightly reinforced sections without vibration or heavily reinforced sections with vibration	Medium	25 mm to 75 mm slump for 20 mm aggregate
2.	Concreting of heavily reinforced section without vibration	High	75 mm to 125 mm slump for 20 mm aggregate

- ii) For plan concrete work, slump requirements mentioned in item - (i) above are applicable.

If the specified slump is exceeded at the placement, the concrete is unacceptable. The Engineer-in-Charge reserves the right to require lesser slump whenever concrete of such lesser slump can be consolidated readily into place by means of vibration specified by the Engineer-in-Charge. The use of any equipment which will not readily handle and place concrete of the specified slump will not be permitted.

To maintain concrete at proper consistency, the amount of water and sand batched for concrete shall be adjusted to compensate for any variation in the moisture content or grading of the aggregates as they enter the mixer. Addition of water to compensate for stiffening of the concrete after mixing but before placing will not be permitted. Uniformity in concrete consistency from batch to batch will be required.

6.2.2 Concrete Quality Control Measures and Concrete Quality Assurance Test Programme.

- (a) Concrete Quality Control Measures: The bidder shall be responsible for providing quality concrete to ensure compliance of the bid requirements.
- (b) Concrete Quality Assurance Programme: The concrete samples will be taken by the Departmental Engineers and its quality will be tested in the departmental laboratory as per the relevant Indian Standard Specifications I.S. No. 516-1959 and I.S. 1199-1959.

Tests: The Government will obtain samples and conduct tests as specified in I.S. 456-1978, I.S. 1199-1959 and I.S. 516-1959.

Test Facilities: The bidder shall furnish free of cost samples of all ingredients of concrete for testing and obtain approval from the Engineer-in-

Charge. He should also supply free of cost, the samples of all the ingredients of concrete for conducting the required tests.

6.2.3 **Cement:**

General:

Shall conform to paragraph 4.1.4.

6.2.4 **Water:** Shall conform to paragraph 4.1.5

6.2.5 **Sand (Fine Aggregate) :**

General:

The term sand is used to designate aggregate most of which passes 4.75

milli metre I.S. Sieve and contains only so much coarser material as permitted in Clause 4.3 of L.S. 383-1970. Sand shall be predominantly natural sand which may be supplemented with crushed sand to make up deficiencies in the natural sand gradings.

All sand shall be furnished by the bidder from any source approved by Engineer-in-Charge.

Sand as delivered shall have a uniform and stable moisture content. Determination of moisture content shall be made as frequently as possible, the frequency for a given job being determined by the Engineer-in-Charge according to weather conditions (I.S. 456-1978).

Quality:

The sand shall consist of clean, dense, durable, un-coated rock fragments, as per I.S.383-1970. Sand may be rejected if it fails to meet any of the following quality requirements.

Organic impurities in Sand: Colour no darker than the specified standard in clause 6.2.2 of I.S 2386 (Part-II) 1963. (Indian Standard method of test for aggregates for clearance Part-II estimation of deleterious materials and organic impurities).

Sodium Sulphate Test for Soundness: The sand to be used shall pass a Sodium of Magnesium Sulphate accelerated test as specified in I.S. 2386 (Part-V) 1963 for limiting loss of weight.

Specific Gravity: 2.6 minimum

Deleterious Substances:

The amounts of deleterious substances in sand shall not exceed the maximum permissible limits prescribed in Table I Clause 3.2.1 of I.S. 383-1970 (Indian Standard specification for coarse and fine aggregate from natural sources for concrete when tested in accordance with I.S. 2386-1963.

c) **Grading:**

The sand as batched shall be well graded and when tested by means of standards sieves shall conform to the limits given in Table-4 of I.S. 383-1970, and shall be described as fine aggregates, grading zones-I, II, III and IV. Sand complying with the requirements of any of the four grading zones is suitable for concrete. But, sand conforming to the requirements of grading Zone-IV shall not be used for reinforced cement concrete work.

6.2.6 **Coarse Aggregate:**

General:

For the purposes of these specifications, the term “Coarse Aggregate” designates clean well grade aggregate most of which is retained on 4.75 mm I.S. Sieve containing only so much finer material as permitted for various types described under clause 2.2 of I.S 383-1970. Coarse aggregate for concrete shall consist of uncrushed, crushed and partially crushed stone.

Coarse Aggregate for concrete shall be furnished by the Contractor from the sources approved by the Engineer-in-Charge.

Coarse Aggregate as delivered shall generally have uniform and stable moisture content. In case of variations, clause 9.2.3 of I.S 456-1978 shall govern during batching.

Quality:

The Coarse aggregate shall consist of natural occurring (crushed or uncrushed) stones, and shall be hard, strong, durable, clear and free from veins and adherent coating, and free from injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious materials.

Coarse aggregate for concrete shall be separated into various nominal maximum sizes specified in the relevant drawings. Separation of the coarse aggregate into the specified sizes shall conform to the grading requirements specified in Table-2 of I.S. 383-1970, when tested in accordance with I.S 2386-(Part-I) 1963 (Method of test for aggregates for concrete Part-I Particle size and shape).

Coarse aggregate for mass concrete may be separated as previously herein specified. Separation of the coarse aggregate into the various sizes shall be such that when tested in accordance with I.S. 2386 (Part-I) 1963 shall conform to the requirements specified in Table-3 of I.S. 383-1970.

Sieves used in grading tests will be standard mesh sieves conforming to I.S. 460 (Part-I) – 1978 (Specification for test sieves Part-I wire cloth test sieves).

6.2.7 **Mixing:**

General:

The concrete ingredients shall be thoroughly mixed in mechanical mixers designed to positively insure uniform distribution of all the component materials throughout the concrete at the end of the mixing period. Mixing shall be done as per clause 9.3 of I.S. 456-1978. The mixer should comply with I.S. 1971-1968 (I.S. Specifications for batch type concrete mixers).

The concrete as discharged from the mixer, shall be uniform in composition and consistency from batch to batch. Workability shall be checked at frequent intervals as per I.S. 1199-1969. Mixers will be examined regularly by the Engineer-in-Charge for changes in conditions due to accumulation of hardened concrete or mortar or to wear of blades. The mixing shall be continued until there is a uniform distribution of the materials so that the mass is uniform in colour and consistency and to the satisfaction of the Engineer-in-Charge. If there is segregation after unloading, the concrete should be remixed.

Any mixer that at any time produces unsatisfactory mix, shall not be used until repaired. If repair attempts are unsuccessful, a defective mixer shall be replaced. Batch size shall be atleast 10% of, but not in excess of the rate capacity of the mixer unless otherwise authorised by the Engineer-in-Charge.

Concrete Mixers:

Water shall be admitted prior to and during charging of mixer with all other concrete ingredients. After all materials are in the mixer, each batch shall be mixed for not less than the time specified by the Engineer-in-Charge. The minimum mixing time shall be 2 minutes. The minimum mixing time specified is based on average mixer performance.

The Engineer-in-Charge will adjust the minimum mixing time as required by the observations of the mix delivered from mixer. Excessive over mixing which require addition of water to maintain the required concrete consistency will not be permitted.

6.2.8 **Forms:**

General:

Forms shall be used wherever necessary, to confine the concrete and shape it to the required lines. The bidder shall set and maintain concrete forms so as to insure completed work is within the applicable to clearance limits prescribed in clause 10 of I.S 456-1978. If a type of form does not consistently perform in an acceptable manner, as determined by the Engineer-in-Charge, the type of form shall be

changed and method of erection shall be modified by the bidder subject to approval by the Engineer-in-Charge.

Plumb and string lines shall be installed before, and maintained during concrete placement. Such lines shall be used by the bidder's personnel and by the Engineer-in-Charge and shall be in sufficient number and properly installed as determined by the Engineer-in-Charge. During concrete placement, the bidder shall continuously monitor plumb, and string line, form positions and immediately correct deficiencies.

Forms shall have sufficient strength to with stand the pressure resulting from placement and vibration of the concrete and shall be maintained rigidly in position. Where form vibrators are to be used, forms shall be sufficiently rigid to effectively transmit, energy, form the form vibrators to the concrete, while not damaging or altering the positions of forms. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms and at the top of walls placements to produce levelled edges on permanently exposed concrete surfaces. Interior angle of intersecting concrete surface and edges of construction joints shall not be levelled except where indicated on the drawings.

Suitable struts or stiffeners or ties shall be used for the form work wherever necessary. All supports, shall be braced and cross braced in two directions. All splices and braces shall be secured by bolting unless specially intended otherwise. All struts shall be firmly supported against settlement and slipping by suitable means as directed. All supports shall be cut square at both ends and firmly supported against settlement and slipping. When the form work is supported on soils, planks, sleepers etc., shall be used to properly disperse the loads. In case, the supports rest on already completed beam or slab, suitable props shall be provided under the latter.

The form work shall be of well seasoned timber or steel. When timber forms are used, they shall be lined with M.S sheet or other suitable smooth faced non-absorbent material as specified. Supports may be of timber or steel. Suitable wedges in pairs to facilitate adjustment and subsequent releasing of forms shall be provided preferably at the upper end of the supports. The details of the proposed form work and supports shall be submitted to the Engineer-in-Charge and got approved before erection.

In case of columns, retaining walls or deep vertical component, the height of the column shall facilitate any placement and compaction of concrete and suitable arrangement may be made for securing the form to the already poured concrete for placing the subsequent lifts. No steel ties or wires used for securing this form work shall be left exposed on the face of the finished work.

Suitable inserts for blockouts for electrical and other service fixtures where necessary shall be provided in the required locations as specified.

Cleaning and Oiling of Forms:

At the time the concrete is placed in forms, the surfaces of the forms shall be free from encrustation of mortar, grout or other foreign materials. Before concrete is placed, the surface of the forms shall be oiled with a commercial form oil.

Removal of Forms:

The stripping of form work shall conform to clause 10.3 of I.S. 456-1978. The bidder shall be liable for damage and injury caused by removing forms before the concrete has gained sufficient strength. Forms on upper sloping faces of concrete such as forms on the water sides of warped transitions, shall be removed as soon as the concrete has attained sufficient strength to prevent sagging. Any needed repairs or treatment required on such sloping surfaces shall be performed at once and be followed immediately by the specified curing.

To avoid excessive stresses in concrete that might result from swelling of forms, wood forms for wall openings shall be loosened as soon as the loosening can be accomplished without damage to the concrete. Forms shall be removed with care so as to avoid injury to the concrete, and any concrete so damaged shall be repaired in accordance with paragraph 6.2.16.

Cost:

The cost of furnishing all materials and performing all work for constructing forms, including any necessary treatment or coating of forms shall be included in the applicable prices bid in the schedule for the items of concrete for which the forms are used.

6.2.9 Concrete Surface Irregularities:

Surface Irregularities:

General:

Bulges, depressions and offsets are defined as concrete surface irregularities. Concrete surface irregularities are classified as “abrupt” or “gradual” and are measured relative to the actual concrete surface.

Abrupt Surface Irregularities:

Abrupt surface irregularities are defined herein as offsets such as those caused by misplaced or loose forms, loose knots in form Lumber, or other similar forming faults. Abrupt surface irregularities are measured using a straight edge held firmly against the concrete surface over the irregularity and the magnitude of the offset is determined by direct measurement.

Gradual Surface Irregularities:

Gradual surface irregularities are defined herein as bulges and depressions resulting in gradual changes on the concrete surface. Gradual surface irregularities are measured using a suitable template conforming to the design profile of the concrete surface being examined. The magnitude of the gradual surface irregularities is defined herein as a measure of the rate of change in slopes of the concrete surface.

The surface irregularities shall not exceed 6 mm for bottom slab and 12 mm for side slopes when tested with a straight edge of 1.5 metres in length. The magnitude of gradual surface irregularities on concrete shall be checked by the bidder to insure that the surfaces are within the specified tolerances. The Engineer-in-Charge will also make such checks to hardened concrete surfaces as determined necessary to ensure compliance with these specifications.

Repair of Hardened Concrete not within specified tolerance:

Hardened concrete which is not within specified tolerances shall be repaired to bring it within those tolerances. Such repair shall be in accordance with paragraph 6.2.16 and shall be accomplished in a manner approved by the Engineer-in-Charge. Concrete repair to bring concrete within the tolerances shall be done only after consultation with a representative of Engineer-in-Charge regarding the method of repair. The Government shall be notified as to the time when repair will be performed.

Concrete which will be exposed to public view shall be repaired in a manner which will result in a concrete surface with a uniform appearance. Grinding of concrete surface exposed to view shall be limited in depth such that no aggregate particles are exposed to view shall be limited in a depth such that no aggregate particles are exposed more than 1.5 millimetres at the finished surface. Where grinding causes exposure of aggregate particles greater than 1.5 millimetres at the finished surface. Concrete shall be repaired by excavating and replacing the concrete.

Prevention of Repeated failure to meet tolerances:

When concrete placements result in hardened concrete that does not meet the specified tolerances, the bidder shall submit to the Government an outline of all preventive actions such as modification to forms, modified procedure for setting screeds, and different finishing techniques to be implemented by the bidder to avoid repeated failures.

The Government reserves the right to delay concrete placement until the bidder implements such preventive actions which are approved by the Engineer-in-Charge.123

6.2.10 **Reinforcing Bars:**

General:

Reinforcing bars shall be placed in the concrete as shown in the drawings or as directed.

Materials:

Unless shown otherwise on the drawings, the reinforcement to be used shall be or High Yield strength deformed (H.Y.S.D) bars of grade Fe-415 conforming to I.S.

1786-1979 (IS. Specifications for High Yield strength deformed steel bars and wires for concrete reinforcement).

Placing:

Reinforcement shall be bent and fixed in accordance with the procedure specified in I.S. 2502-1963 (code of practice for bending and fixing of bars for concrete reinforcement). All reinforcement shall be placed and maintained in the position shown in the drawings, splices shall be located where shown on the drawings provided that the location of the splices may be altered subject to the written approval of the Engineer-in-Charge.

Subject to the written approval of the Engineer-in-Charge, the bidder may for his convenience, splice bars at additional locations other than those shown on the drawings.

All additional splices allowed shall be at the expense of the bidder. In order to meet design and space limitation. On splicing, some bent bars may exceed usual clearance cutting and bending of such bars from stock lengths may be required at the site.

Unless otherwise prescribed, placement dimensions shall be to the centre lines of the bars. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed, but before being covered with concrete.

Before reinforcement is embedded in concrete, the surfaces of the bars and the surfaces of any supports shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease or other foreign substances which in the opinion of the Engineer-in-Charge, are objectionable. Heavy flaky rust that can be removed by firm rubbing with burlap, or equivalent treatment is considered objectionable.

As specified in Clause 11.3 of I.S. 456-1978 unless otherwise specified by the Engineer-in-Charge, reinforcement shall be placed within the following tolerances:

- a) For effective depth 200 mm or less - ± 10 mm

b) For effective depth more than 299 m - ± 15 mm

The cover in no case be reduced by more than one third of specified over or 5 mm whichever is less.

Reinforcement shall be securely held in position so that it will not be displaced during the placing of the concrete and special care shall be exercised to prevent any disturbance of the reinforcement in concrete that has already been placed. Welding of bars shall be done as directed by the Engineer-in-Charge and in conformity with the requirements of clause 11.4 of I.S 456-1978. Chairs, hangers, spacers and other supports for reinforcement shall be of concrete, metal or other approved material. Concrete over shall be as shown on the drawings.

(d) **Reinforcement Drawings:**

The Government will supply drawings of reinforcement details and bar bending schedules for adoption.

(e) **Measurement and Payment:**

Measurement for payment of reinforcement bars will be based on the weight of the bars placed in the concrete in accordance with the drawings supplied by the Government when conformance with these specifications drawings has been determined at the time of embedment. Except as otherwise provided below, payment for furnishing and placing reinforcing bars will be made at the unit price per one kilogram bid in the bill of quantities for furnishing and placing reinforcing bars which unit price shall include the cost of reinforcing bars, attaching wire ties or other approved supports and of cutting, bending, cleaning, securing and maintaining in position reinforcing bars as shown on the drawings.

6.2.11 **Preparation for Placing:**

General:

No concrete shall be placed until all form work, installation of items to be embedded, and preparation of surface involved in the placement have been approved.

All surfaces of forms embedded materials shall be free from curing compound, dried mortar from previous placement, and other foreign substances before the adjacent or surroundings concrete placement is begun.

Prior to beginning concrete placement, the bidder shall make ready, a sufficient number of properly operating vibrators and operators, and shall have readily available additional vibrators to replace defective ones during the progress of the placement. The Engineer's representative at the placement may require that the bidder delay the

start of the concrete placement until the number of working vibrators available is acceptable.

- (b) **Foundation Surface:** All surfaces upon or against which concrete is to be placed shall be free from frost, ice, water, mud and debris.

Rock surfaces shall be free from oil, objectionable coatings, and loose, semidetached and unsound fragments. Immediately prior to placement of concrete, surfaces of rock shall be washed with an air water jet and shall be brought to a uniform surface dry conditions.

Earth foundation surfaces shall be wet to a depth of 15 cm. or to impermeable material whichever is less before concrete is placed.

- (c) **Construction Joint:**

Construction joints are defined as concrete surface upon or against which concrete is to be placed and to which new concrete is to adhere but which have become so rigid that the new concrete can not be incorporated integrally with that previously placed. The provision of construction joints shall conform to clauses 12.4.1 and 12.4.2 of I.S. 456-1978.

When the work has to be resumed on a surface which has hardened such surface shall be roughened. It shall be swept clean and thoroughly wetted. For vertical joints neat cement slurry shall be applied on the surface before it is dry. For horizontal joints the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in concrete mix. This layer of cement slurry or mortar shall be freshly mixed and applied immediately before placing of the concrete.

Where the concrete has not fully hardened all balance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgment of particles of aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry. On this surface, a layer of concrete not exceeding 150 mm in thickness shall first be placed and shall be well rammed against old work, particular attention being paid to corners and close spots, and work thereafter shall proceed in the normal way.

6.2.12 **Placing:**

General:

The Bidder shall notify the Engineer-in-Charge before batching begins for placement of concrete. Placing shall be performed only in the presence of an authorised

Engineer's representative. Placement shall not begin until after all preparations are complete to the satisfaction of the Engineer-in-Charge.

All surfaces upon or against which concrete is to be placed shall be prepared in accordance with paragraph 6.2.11.

Retampering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted.

Concretes shall not be placed in standing water except with written permission of the Engineer-in-Charge and the method of placing shall be subject to approval. Concrete shall not be placed in running water and shall not be subjected to running water until after the concrete has hardened.

Concrete shall be deposited as nearly as practical in its final position and shall not be allowed to flow in such a manner that the lateral movement will cause segregation of the coarse aggregate from the concrete mass. Methods and equipment employed in depositing concrete informs shall minimize clusters of coarse aggregate. Clusters that occur shall be scattered before the concrete is vibrated.

Forms shall be constantly monitored and their position adjusted as necessary during concrete placement in accordance with paragraph 6.2.8.

All concrete shall be placed in approximately horizontal layers. The depth of layers shall not exceed 25 cm. The Engineer-in-Charge reserves the right to require lesser depths of layers where concrete cannot otherwise be placed and consolidated in accordance with the requirements of these specifications. All construction joints which intersect exposed concrete surface shall be made straight and level to plumb as shown otherwise on the drawings.

The placing of concrete shall be in accordance with clause 12.2 of I.S.456-1978.

If concrete is placed monolithically around openings having vertical dimensions greater than 60 cm. or if concrete in decks, floor slabs or other similar parts of structures is placed monolithically with supporting concrete, the following requirements shall be strictly observed.

Concrete shall be placed upto the top of the formed openings at which point further placement will be delayed to accommodate settlement of fresh concrete. If levels are specified beneath nearly horizontal structural members such as decks, floor slabs, beams and girders, such bevels being between the nearly horizontal members and the vertical supporting concrete below, concrete shall be placed to the bottom of the levels before delay of placement.

The last 60 cm or more of concrete placed below horizontal members of levels shall be placed with a 50 mm or less slump and shall be thoroughly consolidated.

In placing concrete on unformed slopes so steep as to make internal vibration of the concrete impractical without forming, the concrete shall be placed ahead of non-vibrating slip form screed extending approximately 0.75 metres back from its leading edge. Concrete ahead of the slip form screed shall be consolidated by internal vibrators so as to insure complete filling under the slip form.

A cold joint is an unplanned joint resulting when a concrete surface hardens before the next batch is placed against it. Cold joints will be allowed only in the event of equipment breakdown or other unavoidable prolonged interruption of continuous placing. If such unavoidable delays in placing occur which make it appear that unconsolidated concrete may harden to the extent that alter vibration will not fully consolidate it, the Bidder shall immediately consolidate such concrete to a stable and uniform slope. If delay of placement is then short enough to permit penetration of the underlying concrete, placement shall resume with particular care being taken to thoroughly penetrate and reverberate the concrete surface placed before the delay. If concrete cannot be penetrated with vibrator, the cold joint shall be then treated as a construction joint.

Care shall be taken to prevent cold joints when placing concrete in any part of the work. The concrete placing rate shall insure concrete is placed while the previously placed adjacent concrete is plastic so that the concrete can be made monolithic by normal use of vibrators.

Concrete shall not be placed in rain sufficiently heavy or prolonged to wash mortar from concrete. A cold joint may necessary result from prolonged heavy rainfall.

The bidder shall not be entitled to any additional payment, over the unit prices bid in the schedule for concrete, by reason of any limitation in the placing of concrete required under the provisions of this paragraph.

b) **Transportation:**

The transportation of concrete to clause 12.1 of I.S.456-1978.

c) **Consolidation:**

The consolidation of concrete shall conform to clause 12.3 of I.S. 456-1978

Concrete shall be consolidated by vibrators. The vibration shall be sufficient to remove the undesirable air voids from the concrete, including the air voids trapped against the forms. After consolidation, the concrete shall be free of rock pockets and honey bomb areas and

shall be closed snugly against all surfaces of forms and embedded materials. All concrete shall be properly consolidated before it hardens.

Except as hereinafter provided, consolidation of all concrete shall be by immersion type vibrators. Immersion type vibrators shall be operated in nearly vertical position and the vibrating head shall penetrate and reverberate the concrete in the upper portion of the underlying layer. Care shall be exercised to avoid contact of the vibrating head with embedded items and with formed surfaces which will later be exposed to view. Concrete shall not be placed upon either plastic concrete until the previously placed concrete has been thoroughly consolidated.

6.2.13 **Finished and Finishing:**

The requirements for finishing of concrete surface shall be as specified in this paragraph, paragraph 6.2.9 or as otherwise indicated on the drawings. The bidder shall notify the Engineer-in-Charge before finishing concrete. Unless inspection is waived, in each specific case, finishing of concrete shall be performed only when a Engineer's representative is present. Finished concrete which is not within the specified tolerances shall be repaired in accordance with paragraph 6.2.16.

Interior surface shall be sloped for drainage where shown on the drawings or as directed. Surfaces which will be exposed to the weather, and which would normally be level, shall be sloped for drainage.

Floating may be performed by use of hand or power driver equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Joints and edge shall be tooled where shown on the drawings or as directed.

6.2.14 **Protection:**

The bidder shall protect all concrete against damage until final acceptance by the Engineer-in-Charge.

The Bidder shall provide protection to prevent erosion to fresh concrete whenever precipitation either periodic or sustaining is imminent or occurring.

When precipitation appears imminent, the bidder shall immediately make ready at the placement site all materials, which may be required for protection of fresh concrete. The Engineer-in-Charge may delay placement of concrete until adequate provisions for protection against weather are made.

All fresh concrete surfaces shall be protected from contamination and from foot traffic until the concrete has hardened. Hardened concrete surfaces which have to receive finish shall be protected against damage from foot traffic and other construction activity by covering with protective mats, ply-wood, or by other effective means. Methods of protection shall be subject to approval by the Engineer-in-Charge.

Concrete curing membranes shall be kept intact, and other curing materials and process shall be maintained as necessary to assure continuous curing for a minimum specified curing time. Protection of curing membranes and other curing methods shall be as described in paragraph 6.2.15.

6.2.15. **Curing :**

a) **General :**

The Bidder shall furnish all materials and perform all work required for curing concrete. The curing of concrete shall conform to clause 12.5 to I.S. 456-1978 and clause 5.8. IS. 3873 – 1978.

Concrete shall be cured by water curing.

The unformed top surfaces of bridges or culvert decks shall be cured for 28 days with damp sand cover or curing mat cover. The sand or curing mats shall not be kept so wet as to allow water to drain from them and stain other concrete. The sand or curing mats shall be removed after the expiry of the curing period.

All concrete surfaces shall be treated as specified to prevent loss of moisture from the concrete until the required curing period elapsed or until immediately prior to placement of other concrete or back fill against those surfaces. Only sufficient time to prepare construction joint surfaces and to bring them to a surface dry condition shall be allowed between discontinuance of curing and placement of adjacent concrete.

Forms shall be removed within 24 hours after the concrete has hardened sufficiently conforming to clause 10.3 of I.S. 456-1978, to prevent structural collapse or other damage by careful removal. Where required, repair of all minor surface imperfections shall be made immediately after form removal and prior to curing. Minor surface repair shall be completed within 2 hours after from removal and shall be immediately followed by the initiation of curing by the applicable method specified herein. Concrete surfaces shall be kept continuously moist after from removal until initiation of curing.

b) **Materials:**

Concrete cured with water shall be kept wet for atleast 28 days from the time the concrete has obtained sufficient set to prevent detrimental effects to the concrete surfaces. The concrete surfaces to be cured shall be kept wet by covering them with water-saturated material by using a system of perforated pipes, mechanical sprinklers or porous-hose, or by other methods which will keep all surfaces continuously (not periodically) wet. All curing methods are subjected to approval of Engineer-in-Charge.

c) **Cost:**

The cost of furnishing all materials and performing all work for curing concrete shall be included in the price bid in bill of quantities for the concrete on which the particular curing methods are required.

6.2.16. **Repair of Concrete:**

a) **General:**

Concrete shall be repaired in accordance with clause 5.7 to I.S. 3873-1978. Imperfections and irregularities on concrete surface shall be corrected in accordance with paragraph 6.2.9 and clause 5.7. of I.S. 3873-1978.

b) **Types of Repair:**

All repairs shall be made with concrete. Repairs to concrete surfaces and addition were required shall be made by cutting regular opening into the concrete and placing fresh concrete to the required lines. The chipped openings shall be sharp and shall not be less than 70mm in depth. The fresh concrete shall be reinforced and chipped and trawled to the surface to the surface of the openings. The mortar shall be placed in layers not more than 20 mm in thickness after being compacted and each layer shall be compacted thoroughly. All exposed concrete surfaces shall be cleaned of impurities, lumps of mortar or grout and unsightly stains.

c) **Cost:**

The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the Bidder.

6.3. **Measurement of Concrete:**

Measurement for payment of concrete required to be placed directly upon or against surfaces of excavation will be made to the lines for which payment for excavation is made.

Measurement for payment of all concrete will be made to the neat lines of the structures, unless otherwise specifically shown on the drawings prescribed in these specification. The unit of measurement will be cubic metre. In measuring concrete for payment, the volume of all openings, embedded pipes and metal work, each of which is larger than 0.1 square metre in cross section will be deducted.

6.4. **Payment for Concrete:**

Payment for concrete in the various parts of the work will be made at the applicable, unit prices bid therefore in the schedule, which unit price shall include the cost of furnishing all materials and performing all works required for the concrete construction, except that payment for furnishing and placing reinforcing bars will be made at the respective unit prices bid therefore in the schedule.

DIVISION-7

MATERIALS REQUIRED FOR PIPELINE WORKS

7.1 Pipes :

The Pipes required to be supplied for the works shall conform to the following I.S. specifications depending upon the nature of material for pipe specified in the bid document.

I.S. 1592 of 1980 for A.C. Pressure Pipes.

I.S. 458 of 1988 for R.C.C. Spun Pipes.

I.S. 1536 of 1976 for C.I. Spun Pipes.

I.S. 7181 of 1986 for C.I. double flanged pipes.

I.S. 12709 – 1994 for G.R.P. pipes.

I.S. 4984 – 1995 for HDPE pipes.

I.S. 784-78 and 1343-80 for manufacture of P.S.C. pipes. The specification for M.S. specials for P.S.C. pipes shall conform to IS-7322-74. The specification for steel cylindrical reinforced concrete pipes shall conform to I.S. 1961-63. The rubber ring for P.S.C. joints shall confirmed to I.S. 5382-85.

The pipes supplied shall be subjected to all the tests specified in the relevant I.S. specifications before delivering at site and the manufacturer's test certificate to this effect shall accompany each consignment delivered at site. In addition, the pipes shall be got tested by the Inspectorate of Director General of Supplies and Disposals at the manufacturer's factory site and the relevant test certificate shall also be produced along with each consignment. The charges for conducting the tests shall be borne by the bidder only and these charges are not reimbursable by the employer. For PSC pipes the test indicated in clause of I.S. 784-59, 458-88 and 3597-85 are to be followed.

A list of firms that are on the approved list of suppliers to the Department will be Supplied on request. The bidder is at liberty to procure the pipes from any of the firms in the approved list of suppliers but the responsibility for the pipes conforming to the relevant I.S. specifications shall solely rest with the bidder only.

The bidder's rates for relevant items shall include not only the cost of pipes and taxes thereon and testing charges but also the charges for transportation to site and all subsequent handling and other incidental charges.

7.2. Cast-Iron-Specials:

7.2.1. The C.I. specials to be supplied for use on the work shall conform to I.S. 1538 of 1976.

7.2.2. The M.S. special required for use on P.S.C. pipes are to be manufactured as per IS: 1916-63 the material for manufacture of M.S. specials should continue to IS:226-75, 2062-80.

7.2.3. The caste-iron specials required on the job are indicated in the relevant plans contained in Vol-IV of bid documents. While sufficient care is taken by the Employer to furnish as accurately as possible the specials required, the bidder is advised to inspect the alignments and satisfy himself about the sufficiency or otherwise of the special indicated, before quoting for the work. Any additional specials required on the work not arising out of any changes made by the employer in terms of Section 2, CI. 28.1 of Vol.1 shall be provided by the bidder at no extra cost.

7.2.4. A list of firms which are on the approved list of suppliers to the Department will be issued on request. The bidder is at liberty to procure the specials from any of the firms in the approved list of suppliers but the responsibility for the specials conforming to the relevant I.S. specifications shall solely rest with the bidder only. The other conditions contained in paragraphs 7.1.4. above shall be applicable to the C.I. specials also.

7.3. Sluice Valves:

The C.I. sluice valves to be supplied for use on the work shall conform to I.S. 780 of 1969 and I.S. 2906 of 1969 and contain the I.S. certification mark. The valves shall be of non-rising inside screw type; provided with C.I. cap or wheel as the case may be and valve key rod.

The other conditions contained in paragraphs above shall be applicable to the sluice valves also.

7.4. Air Valves:

7.4.1. The air valves to be supplied for use on the work shall conform to the description of air valves maintained in Section B of Glenfied and Kennedy catalogue for water works purposes unless otherwise specified, only double air valves shall be supplied and installed on the pipelines. The size of valve to be used shall be related to the diameters of pipelines as indicated below:

Diameter of Pipe (in mm)	Size of D.A.V. to be use (in mm)
Upto 100	40
125 to 200	50
225 to 350	80
400 to 500	100
600 to 900	150
1000 to 1200	200

7.4.2. The other conditions contained in paragraphs 7.1.4. shall be applicable to the air valves also.

7.5. C.I. Detachable Joints:

The C.I. detachable joints to be supplied for jointing A.C. – pressure pipes shall conform to I.S. 8794 of 1988.

A list of firms which are on the approved list of suppliers to the department is given in Appendix 'C'. The bidder is at liberty to procure the C.I. detachable joints from any of the firms in the approved list of suppliers, but the responsibility for their conformity to the I.S. specifications and giving a water tight joint shall solely rest with the bidder only.

The other conditions contained in paragraphs 7.1.4. shall be applicable to the C.I. detachable joints also.

7.6. Rubber Rings:

The rubber rings to be used for the jointing of various types of pipes shall conform to the following I.S. specifications.

I.S. 5382 of 1969 : For C.I. Pipes, R.C.C. Pipes, A.C. Pipes with C.I.D. joints.

I.S. 10292 of 1986 : For A.C. pipe with A.C. Couplings.

I.S. 5382 of 1969 : For P.S.C. Pipes.

7.7. Pig Lead:

The Pig Lead to be used for jointing the C.I. Spun Pipes shall conform to I.S. 782 of 1978.

7.8. Hemp Yarn:

The Hemp Yarn to be used in jointing of various types of pipes shall conform to I.S. 6587 of 1966.

7.9. Rubber Insertion:

The Rubber Insertion to be used for jointing Cast - Iron double flanged pipes shall conform to I.S. 638 of 1955.

7.10. Bolts and Nuts:

The Bolts and Nuts to be used for jointing the C.I. double flanged pipes shall conform to I.S. 1363-1967.

C.I. Surface Boxes :

The C.I. Surface boxes to be used shall conform to I.S. 3950-1966.

7.12. C.I. Manhole Framers and Covers:

The C.I. Manhole frames and coves to be used shall conform to I.S. 1726 of 1974.

DIVISION-8
LAYING AND JOINTING OF PIPELINES

8.1 Pipes :

The contract envisages civil works namely excavation of earth, laying, jointing and testing of pipelines and construction of masonry pits including fixing of valves such as sluice valves, scour valves, double air valves and surface boxes and auxiliary specials required for different types of pipe viz., A.C. pressure pipes, concrete pipes with socket and spigot ends and C.I. spun pipes with socket and spigot ends of flanged ends of different dias.

8.2. Materials:

The materials used shall conform to the relevant specifications mentioned in Division-7.

The surplus materials if any, left over due to additional purchase against possible breakages etc. will not be takeover by the department and payment will be restricted to the materials actually used on work.

8.3. Trench Work:

The trenches shall be so dug that the pipes may be laid to the required alignment gradient and depth. The width of trench above pipeline level shall be as small as possible but provide sufficient space necessary for jointing pipes. The walls of trenches shall be cut according to the slopes mentioned in relevant I.S. specifications. The trenches shall be kept free from water while laying and jointing the pipes and specials.

The relevant clauses that govern the trench work and preparation of base for laying of various types of pipes are as detailed below:

1. A.C. Pressure pipe - Clause 4 of IS 6530 of 1972. -
2. R.C.C. pipes - Clause 9 of IS 783 of 1959. -
3. C.P. pipes and D.I. pipes.
4. P.S.C. pipes class - 3 of I.S. 783-85 and section 126 of A.P.S.S.

8.4. Handling and Laying of Pipes:

Reasonable care shall be exercised in Loading, Transporting and Unloading of pipes and specials. The pipes shall be lowered into the trench carefully and shall be laid true to alignment and gradient as specified and as per instructions of the Engineer-in-Charge.

The sections of the pipe shall be jointed together in such a manner that there shall be as little unevenness as possible a long inside of the pipes. Necessary precautions shall be taken while laying as per the relevant I.S. specifications for the type of pipes used, as mentioned below:

A.C. Pressure Pipes – Clause 5 of IS 6530 of 1972.

R.C.C. pipes – Clause 9 of IS 783 of 1959.

C.I. pipes & D.I. pipes – Clause 3 of IS 3114 of 1965.

PSC pipes Clause 9 of IS 783 of 85 section 126 of APSS.

8.5. **Jointing:**

Before commencing jointing, the pipes shall be cleaned, the joints and the ends of the pipes shall be cleaned, preferably with a hard wire brush to remove loose particles. Where jointing is done using rubber ring, care should be taken to see that the rubber ring does not get twisted or deformed while pushing the ring into position. The jointing for various types of pipes shall conform to the requirements of the relevant I.S. specifications as detailed below:

1. A.C. Pressure Pipes : Clause 6 of I.S. 6530 of 1972.
2. R.C.C. Pipes : Clause 10 of I.S. 783 of 1959
3. C.I. pipes & D.I. pipes : Clause 5 of I.S. 3114 of 1965.
4. PSC Pipes : Clause 10 of I.S. of 1985.
5. I.S. 12709 – 1994 for G.R.P. pipes.
6. I.S. 4984 – 1995 for HDPE pipes.

8.6. **Anchor and Thrust Blocks:**

Thrust blocks, suitably designed shall be provided wherever necessary to transmit hydraulic pressure as laid down in the relevant I.S. specification. Where the hydraulic thrust is in an upward direction, anchor blocks of sufficient weight shall be provided, to which the pipes shall be secured with steel strips.

8.7. **Testing:**

After the pipes are laid and jointed as mentioned in 8.3. and 8.4. above, the pipe lines are to be subjected to hydrostatic pressure test. The procedure for conducting the hydrostatic pressure test is detailed in the relevant I.S. specifications for various types of pipes, as indicated below:

1. A.C. Pressure Pipes : Clause 11 of I.S. 5530 of 1972.
2. R.C.C. Pipes : Clause 11 of I.S. 783 of 1959
3. C.I. pipes & D.I. pipes : Clause 6 of I.S. 3114 of 1965.
4. PSC Pipes : Clause 11 of I.S. 783 of 1985.

In portions of the pipelines, where the pipes have developed cracks or sweating, such pipes shall be removed and re-laid with new pipes and the pipelines re-tested to the entire satisfaction of the Engineer-in-Charge. No extra payment will be made on this account. The bidder has to make his own arrangement for procurement of the required testing apparatus. The pressure gauge used with the testing apparatus shall be subjected to such test as the Engineer-in-Charge deems fit to ensure the accuracy of the gauge.

8.8. **Appurtenant Works:**

All the valves should be checked before fixing in position to verify whether they are closing and opening freely or not. Masonry pits for enclosing the sluice valves, scour valve, and double air valves are to be constructed after fixing the valves in position at the locations shown in the drawings contained in Volume-IV of bid documents. The earth work excavation, laying of plain cement concrete, construction of brick masonry and plastering, laying R.C.C. cover slabs shall conform to the relevant specifications contained in this volume. Fixing of valves and the specials shall conform to I.S. 3114 of 1965 and as specified in the drawings appended. The pits should be cleaned and surroundings leveled with excavated earth and the bid price shall include cost of all these operations.

8.9. **Refilling:**

After the pipelines are laid, jointed and tested in conformity to the relevant I.S. specifications and to the satisfaction of Engineer-in-Charge the pipeline trenches should be refilled with excavated earth in layers of 6 inches. The colds should be broken, sufficiently watered and consolidated. The surface should be brought to the original condition by using the excavated material to the extent possible and using additional quantities of gravel and metal as the case may be. The extra earth after bringing back to the original condition should be disposed off as stipulated in paragraph 2.4.

PUMPING MACHINERY

The pumping machinery of the prescribed type and capacity should be supplied erected and commissioned including maintenance for a period of 30 days working @ 8 hours per day at optimum conditions so as to perform the required characteristics. The scope includes getting approval to the lay out drawings etc. by Chief Electrical Inspector and incoming and outgoing power connections.

11.1.1. CENTRIFUGAL PUMPS:

The centrifugal pumps should be of reputed make preferably Kirloskar / Mather & Platt / Jyothi Best & Crompton (or) any other reputed make approved by Department conforming to relevant I.S. Specifications (1520-198) & ISO 9000 Certification.

The motor should be of reputed make conforming to I.S. 325-1978, preferably Crompton Greaves / G.E.C. / N.G.E.F. / Kirloskar Jyothi / Beacon (or) any other reputed make approved by Department.

Vacuum gauge on the suction side and pressure gauge on the deliver side of suitable range shall be fixed.

Suitable Valves:- Air Valve / Gate Valves / Surge Valves of Make VAG / Sigma Flow / ARI / AVK / Durga etc., any other reputed make confirming to Relevant Codes

Pumping Machinery ISO 9001 Certification Essential.**11.1.2. SUBMERSIBLE PUMPS:**

The submersible pump sets should be of reputed make preferably KSB / Calama / Flow well (or) any other reputed make approved by Department Conforming to relevant I.S. (8034-1989) specification or any higher standards.

The characteristic curves for the efficiency of motor, pump and combined system efficiency should be furnished to the Engineer-in-Charge before procurement of pumps.

11.2. ACCESSORIES:

The pumps should be supplied with all the necessary accessories duly mounted and inter connected on a suitable sized control panel made out of M.S. angle irons and M.S. sheets as given below. The accessories should be of reputed make and best quality and preferably as given below:

D.O.L / Star Delta / Auto transformer Starter of L & T / BCH / Siemens / Kirloskar Make (or) any other reputed make approved by Department.

Ammeter of MICO / AE make

Voltmeter of MICO / AE make.

Power factor metre of best quality.

Indicator Lamps.

H.R.C. Fuses.

Incoming and outgoing switches.

Dry running preventer Vaibha / Minilec / Safe guard.

Capacitor of B.E.L. make.

Single phase preventer Vaibhav / Minilec / Safe guard.

Water level guard.

PVC/Submersible cables of finolex / ICC / HC make for incoming, outgoing connections.

Required spares for motors, pumps, starters and switches for continuous operation for a period of three years shall be supplied.

Operating tools as detailed below for routine maintenance of the pumps and motors shall be supplied. The tools shall be mounted on T.W. board and shall be provided with a door with weld mesh and lock and key arrangement. Tools are : Ring spanner 3/16 "to 1" set double ended spanners. 3/16 "to 1" - set. pipe wrenches 18" long -1 pipe Wrenches 24" long-1", Insulated cutting plier (8",10") - 2 Nos, 2 Kg, hammer - 1 Kg. 1 No, nose plier 8"-1, flat rough file with handle 10"-1, half round smooth file with handle 10"-1, Round rough file with handle 10"-1, Adjustable spanner 6"-1, Adjustable spanner 10"-1.

11.3. **ERECTION:**

11.3.1. In the case of centrifugal pumps the pump set should be fixed on to the standard base plate fixed over concrete bed as per drawing and specified in division 6. The pumps should be erected on a perfect horizontal plane without any tilt. The pipes, specials, valves required for suction and delivery connections shall conform to I.S. specifications as specified in Division 7. The suction and delivery pipes should be fixed without any eccentricity duly cleaned. All the joints should be water tight without any loss of pressure.

The submersible pump (if required) should be erected to perfect plumb and safely clamped on the top. A non-return valve should be fixed on the delivery main along with a pressure gauge.

11.4. **EARTHLING:**

All electrical fixtures shall be suitably earthed in accordance with I.E. Act, 1910 and Rules there under as amended from time to time.

11.5. **TESTING AND COMMISSIONING:**

11.5.1. After completion of erection the pipe connections shall be cleaned and painted with two coats of anticorrosive paint.

The pump after erection should be commissioned and tested working for 8 hours/day for a continuous period of 30 days so as to perform the designed characteristics. It should deliver the required discharge at the designed delivery head only and the pressure head should not be higher than that which will be detrimental to the pumping mains.

11.6. **PIPE CONNECTIONS:**

Velocity of flow in suction and delivery pipes shall be limited to 1.5 to 2.0.

DIVISION-17

**CENTRIFUGALLY CAST (SPUN D.I. PIPES)
FOR WATER, GAS AND SEWAGE****17.1 Pipes :**

The pipes required to be supplied for the works shall confirm to the I.S. 8329:1994.

The pipes supplied shall be subjected to all the tests specified in Section 9 and 10 of IS 8329:1994 before delivery at site and the manufacturer's tests certificate to this effect shall accompany each consignment delivered at site. In addition the pipes shall be got tested by the Inspectorate of D.G.S & D at the manufacturer's factory site and the relevant test certificate shall also be produced along with each consignment. The charges for conducting the test shall be borne by the bidder only and these charges are not reimbursable by the employer.

17.1.3.Joints:

The type of joints shall be flexible push on Tyton joint with elastometric gasket and it should confirm to Sec. 5 of IS No. 8329:1994.

17.1.4. The size and mass of the pipes shall confirm strictly to clause 11 of I.S. 8329:1994.

The standard working length of the pipe shall confirm to clause 12 of IS 8329:1994.

A list of firms which are on the approved list of suppliers to the department is given in Appendix 'A'. The bidder is at liberty to procure the pipes from any of the firm in the approved list of suppliers but the responsibility for the pipes confirming to the relevant specifications shall solely rest with the bidder only.

The bidders rate for relevant items shall include not only the cost of pipes and Texas thereon and testing charges but also the charges for transportation to site and all subsequent handling and other incidental charges.

17.2. Specials:

The D.I./C.I. specials to be supplied for use on the work shall confirm to IS 9523:1980 and 1538:1986 respectively

The D.I./C.I. specials required on the job are indicated in the relevant plans contained in Vol4 of bid documents while sufficient care is taken by the employer to furnish and accurately as possible the specials

required, the bidder is advised to inspect the alignment and satisfy himself about the sufficiency or other wise of the specials indicated before quoting for the work. Any additional specials required on the work not arising out of any changes made by the employer in terms of Sec.2. Clause 28.1 of Vol.1 shall be provided by the bidder at no extra cost.

A list of firms which are on the approved list of suppliers to the department is given in Appendix 'B'. The bidder is at liberty to procure the specials from any of the firms in the approved list of suppliers but the responsibility for the specials confirmation to the relevant I.S. specifications shall solely rest with the bidder only. The other conditions contained in para 7.1.4 above shall be applicable to C.I. special also.

17.3. Sluice Valves:

The specification of sluice valves and other conditions for supply shall confirm to clause 7.3. Division Vol.2.

17.4. Air Valves:

The specification for air valves and other conditions for supply shall confirm to clause 7.4., Division 4 of Vol2.

17.5. Surface Boxes:

The specifications for surface boxes and supply shall confirm to clause 7.11. Division 7 of Vol 2.

C.I. Manhole frames and covers:

The specification for C.I. manhole frames and covers and their supply shall confirm to clause 7.12, Division 7 of Vol 12.s

BIDDING DOCUMENT -VOLUME II

SECTION	DESCRIPTION	PAGE NOS.
SECTION- 4	SETTING OUT OF WORKS, DESIGN CRITERIA, OBLIGATORY REQUIREMENTS AND SPECIFICATIONS	
SECTION - 5	MATERIALS, PLANT & MACHINERY	
SECTION - 6	SUPPLEMENTARY SPECIFICATIONS	
SECTION - 7	SPECIFICATIONS FOR REINFORCED EARTH / SOIL STRUCTURES	
SECTION - 8	SPECIFICATIONS FOR LANDSCAPING WORKS	
SECTION - 9	SCOPE AND SPECIFICATION FOR ELECTRIFICATION WORKS	
SECTION 10	LIST OF APPROVED MAKES	

VOLUME – II

SECTION - 5

MATERIALS, PLANT & MACHINERY

5.1 MATERIAL

a. General

All materials to be provided by the Contractors shall be in conformity with the specifications, laid down in the contract and the Contractor shall if required by the Employer / Employer's Representative furnish proof about their suitability and fitness to the entire satisfaction of the Employer / Employer's Representative.

b. Storage of materials

- i. All materials brought and kept at site of work by the Contractor or by his orders for the purpose of forming part of the works are to be considered to be the property of the Department and the same shall not to be removed or taken away by the Contractor or any other person without the written permission of the Employer / Employer's Representative, but the Employer / Employer's Representative shall not to be responsible for any loss or damage which may occur to or in respect of any such work or materials either by the same being lost or stolen or damaged by weather or otherwise including natural calamities (flood, earthquake, rains, riots, fire etc).
- ii. Materials required for the works shall be stored by the Contractor only at places, in standard profiles and in the manner as approved by the Employer / Employer's Representative. Storage and safe custody of all materials shall be the sole responsibility of the Contractor. Special care should be taken as per relevant specification for storage of bitumen etc.
- iii. Steel reinforcement shall be stored in such a way as to avoid distortion and to prevent deterioration by corrosion where directed by the Employer / Employer's Representative in charge, the reinforcing bars shall be given cement wash before stacking to prevent scale and rust at the expense of the Contractor and nothing extra shall be paid by the department for these accounts.

- iv. The Contractor shall construct suitable godown at the site of work for storing the material safe against damage due to sun, rain, dampness, fire, theft etc. He shall also employ necessary watch and ward for the purpose and no extra claim whatsoever shall be entertained on this account.
- v. Cement in bags shall be stored in separate godown with pucca floor and water proof roofs etc. The cement bags shall be stacked and stored in accordance with standard codes of practice.
- vi. From commencement till completion, all materials and works shall be under the safe custody of Contractor. The Contractor is solely responsible for and to make good all injuries, damages and repairs accrued to or rendered necessary to the same by fire, storm, rain, traffic or other causes and to hold the Employer / Employer's Representative indemnified from any claim for injuries to person or for structural damage to property occurring from any neglect, default, want of proper care or misconduct on the part of Contractor.
- vii. The Contractor shall be required to produce samples of all materials to be procured by him sufficiently in advance to obtain approval of the Employer / Employer's Representative. Subsequently the materials to be used in the actual execution of the work shall strictly conform to the quality of samples approved. In case of variation in quality, such materials shall be liable for rejection. The rejected material shall be immediately removed from the site of work by the Contractor at his own cost. If the Contractor fails to remove the rejected material from the site within 48 hours of their rejection, the Employer / Employer's Representative shall be authorised to remove the same at the risk and cost of the Contractor.

c. Quality control and Testing of Material

- i. The Contractor at his own expense shall establish field laboratory with necessary equipment to carry out tests such as grading of aggregate, fineness modulus of sand, bulking of sand, silt content in sand, tests on cement and concrete etc. at the site of work. The Contractor shall be required to provide appliances at site, such as weighing scale, graduated cylinder, standard sieves, thermometers etc in order to enable the Employer / Employer's Representative to conduct field tests, whenever required by him to ensure that the quality is consistent with the prescribed specification. Similarly well equipped laboratory for testing of bitumen and asphaltic work including earth work shall be

provided by the Contractor at site of work.

- ii. The materials such as water, sand, cement, aggregates, etc., to be used in the works like concrete, masonry, etc. shall comply with the requirements of the Employer / Employer's Representative and shall pass all the tests and analysis required by him or as per particular specifications as applicable or such recognised specifications as acceptable to the Employer / Employer's Representative.
- iii. All the necessary tests/the number of tests shall be conducted in the laboratory established at site by the Contractor or in any recognised laboratory approved by the Employer / Employer's Representative. The samples shall be taken for carrying out all or any of the tests stipulated in the particular specifications or as directed by the Employer / Employer's Representative or his authorised representative. The Contractor shall at his risk and cost make all arrangements and shall provide all such facilities as the Employer / Employer's Representative may require for collecting, preparing, forwarding the required number of samples for tests and for analysis as per the frequency of test stipulated in the contract specifications or as considered necessary by the Employer / Employer's Representative, at such time and to such places, as directed by the Employer / Employer's Representative.
- iv. The decision of the Employer / Employer's Representative regarding type of tests, their frequency, suitability of any of the materials to be used in the work shall be final and binding on the Contractor notwithstanding any other provision elsewhere in the tender documents.
- v. The Contractor or his authorised representative shall associate in collection, preparation, forwarding and testing of such samples. Even if he, or his authorised representative is not present or does not associate himself, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorised representative shall remain in contact with the Employer / Employer's Representative or his authorised representative for associating for all such operations.
- vi. The Contractor shall give not less than 7 days notice of all tests in order that the Employer / Employer's Representative may be present. Two copies of all test certificates shall be supplied by the Contractor to the Employer / Employer's Representative for approval, immediately after the completion of the tests. Test certificates shall invariably be supplied to the Employer / Employer's Representative before the materials or components

are used in the works, unless the Employer / Employer's Representative directs otherwise.

- ii. All materials which are specified to be tested at the place of manufacture shall satisfactorily pass the tests before being used in the works.

- viii. The contractor shall have all the minimum equipments/apparatus in the field laboratory but not limited to the following:
 - a) set of sieves as per IS for sieving sand and aggregate
 - b) Aggregate crushing strength apparatus

 - c) Graduated cylinder
 - d) Weighing scale
 - e) Cube moulds
 - f) Compression testing machine
 - g) Vibrators
 - h) Humidity Chamber
 - i) Lechatelier apparatus
 - j) Tension tester
 - k) Slump cone with tamping rod
 - l) Proctor compaction moulds, hammer, etc.
 - m) Rapid moisture meter
 - n) Weighing scale 0.1 gm accuracy
 - o) Weighing scale 10 kg
 - p) Core cutter, sand replacement units
 - q) Hot air oven
 - r) Pycnometer bottle and conical brass cap and washer
 - s) Liquid limit device
 - t) Proctor Compaction needle
 - u) Apparatus for testing of bitumen and asphalt work

d. **Other Materials**

Any material for which there is no relevant Indian Standard, shall be the best of their kind and to the approval of the Employer / Employer's Representative. Contractor shall at his own expense, submit to the Employer / Employer's Representative for approval, samples of any of the materials and components to be used. The quality of materials and components subsequently used in the works shall not be inferior to the approved samples.

5.2 **Quality control of concrete works**

- a. The Contractor at his own expense shall establish a field laboratory to carry out all preliminary tests, work tests and also to work out grading and proportioning of aggregates in order to obtain and maintain uniform quality of work. A compression testing machine of suitable capacity as indicated by the Employer / Employer's Representative shall be installed by the Contractor at his own expense to ascertain the strength of concrete at his own expense from time to time. The Contractor shall supply all materials, labour and testing machines for preparing and testing sample as required by the Employer / Employer's Representative. The concrete shall also be got tested in an independent laboratory approved by the Employer / Employer's Representative at the discretion of the Employer / Employer's Representative or his authorised representative.
- b. Number of concrete cubes shall be taken as per clause 1716 of MORT&H specifications for Road and Bridge Works (Fourth Revision) published by Indian Roads Congress, New Delhi reprinted in March 2002 or as directed by the Employer / Employer's Representative.
- c. These tests shall be carried out in accordance with the procedure as laid down in I.S 516 or other relevant specifications.
- d. The testing machine should also be recalibrated at regular intervals to detect errors periodically. The moulds for cubes shall also be checked at frequent intervals and are made to conform to the standard prescribed in I.S. 516.
- e. Permeability test shall be carried out as per 1716.5 of MORT&H specifications for Road and Bridge Works (Fourth Revision) published by Indian Roads Congress, New Delhi reprinted in March 2002.

5.3 **Construction Equipment**

- a. The methodology and equipment to be used on the project shall be furnished by the Contractor to the Employer / Employer's Representative well in advance of commencement of work and approval obtained prior to its adoption and use.
- b. The Contractor shall give a trial run of the equipment for establishing the capability to achieve the laid down specification and tolerance to the satisfaction of the Employer / Employer's Representative before commencement of work.
- c. All equipment provided shall be of proven efficiency and shall be operated and maintained at all times in a good working condition.
- d. No equipment or personnel will be removed from the site without prior permission of the Employer / Employer's Representative.
- e. No tools and plants will be supplied by the department and the Contractor will have to make his own arrangements at his expense.
- f. All construction tools, plant and machineries provided by the Contractor shall, when brought to the site, be deemed to be exclusively intended for the construction and completion of this work and the Contractor shall not remove the same or any part thereof (save for the purpose of moving it from one part of the site to another) without the written permission of the Employer / Employer's Representative.
- g. In case concrete is procured from Ready Mixed Concrete (RMC) plants, the contractor has to obtain prior approval of the Employer / Employer's Representative. Quality controlling at Batching Plant has to be carried out by the Contractor at his own cost.

VOLUME – II

SECTION - 6

Supplementary Specifications

6.1 Preamble

This section contains the specifications for proposed work and shall be read in conjunction with the various other sections forming the contract namely Notification Inviting Applications, Instructions to Tenderers, General Conditions, Special Conditions, Drawings and other related documents mentioned in this Tender Document together with any Addendum issued thereto.

6.2 General Specifications : As mentioned in Section-4 of Volume-II

6.3 Supplementary Specifications : As mentioned in Section-4 of Volume- II

VOLUME - II

SECTION - 7

SPECIFICATIONS FOR ELECTRIFICATION WORKS

VOLUME – II

SECTION – 8

LIST OF APPROVED MAKES

1. MCCB - MDS – Legrand/ABB/GE/L&T
2. Earth leakage relay - Prok DV or any other approved make
3. MCB - MDS/Schneider/ Indo Copp
4. Luminaire - Crompton / WIPRO / Approved equivalent
5. Landscape Luminaire - K-lite or any other approved make
6. Contactors - ABB / L&T / Siemens
7. Timer - L & T / MDS
8. 1.1 KV UG Cable - Universal/ASIAN/ NICCO
9. PVC insulated wiring cables - Finolex / Q-Flex / RR KABEL / VARSHA
10. Street light Poles - Shubham or any other approved fabricator
11. Feeder Pillar - Dynam/ Load controls / Indus Power Controls
12. Other items - Prior approval shall be taken

VOLUME - III

FINANCIAL BID

VOLUME - III

SL. NO.	DESCRIPTION	PAGE NOS.
1	FORM OF TENDER	
2	BILLING SCHEDULE FOR INTERIM PAYMENTS	
3	UNIT RATES	
4	REIMBURSABLE AMOUNTS	

VOLUME – III

SECTION – 9

**FORM OF TENDER (Price Bid)
(To be quoted by the Bidder)**

Name of Contract : **Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.**

To,
The Superintending Engineer
Public Health,
Nellore – 524 003

1. Having examined the Conditions of Contract, Specifications, Drawings and Addenda for the execution of the above named Works, we, the undersigned, offer to survey, design, execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract, Specifications, Drawings, Design Criteria, Scope of Work and Addenda for the sum of

Rs. (in words : Rupees)

or such other sum as may be ascertained in accordance with the said Conditions.

2. We acknowledge that the Volume I, Volume II, Volume III and Volume – IV form part of Tender.
3. We undertake, if our Tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the contract within 8 months as stipulated in the Tender.
4. We agree to abide by this Tender for the period of 120 days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
5. The contract is not complete and binding between us Unless and until a formal Agreement is prepared and executed for this Tender, together with your written acceptance thereof.
6. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated thisday of.....2010

Signaturein the capacity of

Duly authorized to sign tenders for and on behalf of

.....

Address.....

Occupation.

Volume - III

Section - 11

ANNEXURE - I

BILLING SCHEDULE FOR INTERIM PAYMENTS

(To be quoted by the Bidder)

1.1 Tentative Billing Schedule for Interim Payments :

Sl. No.	Item	Percentage payment
i)		
ii)		
iii)		
iv)		
v)		
vi)		
vii)		
viii)		
ix)		

x)		
xi)		
xii)		
xiii)		
xiv)		
xv)		
xvi)		
	TOTAL	100%

- NOTE: 1. For intermediate stage under each of the above items , payment can be made on a pro rata basis.
2. No payment shall be made for ancillary works which do not form part of the scope of work.

Dated thisday of.....

Signaturein the capacity of

Duly authorized to sign tenders for and on behalf of

.....

Address.....

Occupation.

Volume - III
Section - 11
ANNEXURE - II

BILLING SCHEDULE FOR INTERIM PAYMENTS

(To be quoted by the Bidder)

Unit Rates :

Sl. No.	Brief Description of Item with specifications	Unit	Rate	
			(In Figures)	(In Words)
a)				
b)				
c)				
d)				
d)				

Contractor

Superintending Engineer, PH, Nellore

The Superintending Engineer, Public Health, Nellore reserves the right to approve / reject the above quoted rates.

The Bidder shall accept the unit rates as per the following order of priority.

1. APSSR for the year 2014-15
2. As per prevailing Market rate analysis.

The bidders need to submit a detailed quantity and unit costs for all the items involved in the project as a support document for the lumpsum price quoted by them. The rate structure will be reviewed and approved by the Employer / Employer's Representative (Refer to Clause 11. iii). The approved unit rates will form the basis for payments for addition or reduction in scope of works .

Dated thisday of.....2013

Signaturein the capacity of

Duly authorized to sign tenders for and on behalf of

.....

Address.....

Occupation.

Volume - III
Section - 11
ANNEXURE - III

PRICE BID (To be quoted by the Bidder)

Name of the work: -----

S.No.	Details	Unit	Amount	
			(In Figures)	(In Words)
1				
A		LS		
B	NOT APPLICABLE			
		LS		
2.				
		LS		
3				
		LS		

Contractor

Superintending Engineer, PH, Nellore

VOLUME - IV

VOLUME – IV

SECTION	DESCRIPTION	PAGE NOS.
XII	MODEL FORMS	
XIII	SOIL INVESTIGATION AVAILABLE WITH DEPARTMENT (FOR GUIDANCE ONLY)	
XIV	DRAWINGS	

VOLUME - IV
SECTION - 12
MODEL FORMS

Data Sheet to be filled by the Bidder. If need be additional sheets can be added.

DATA SHEET -1
Bidder's Appreciation of the Project

VOLUME - IV
SECTION - 12
MODEL FORMS -2

Bidder's Organizational Setup for the Project

VOLUME - IV

SECTION - 12

MODEL FORMS-3

Drawings to be Submitted

VOLUME - IV

SECTION - 12

MODEL FORMS-4

Management of Design and Engineering Services

VOLUME - IV
SECTION - 12
MODEL FORMS-5

Construction Methodology of different structural components

VOLUME - IV
SECTION - 12
MODEL FORMS

VOLUME - IV
SECTION - 12
MODEL FORMS-6

Proposed Deployment of Key Personnel**Name of Tenderer**

Sl. No.	Name of Person	Designation/ Post Held/ Status	Academic Qualifications and Experiences in Similar Works.	Remarks

Signature of Tenderer

Contractor**Superintending Engineer, PH, Nellore**

VOLUME - IV

SECTION - 12

MODEL FORMS-7

Proposed Deployment Construction Equipment

S. N.	Name of Equipment	No. of Units	Kind and Make	Capacity	Age of Machinery	Present condition of Machinery	Present Location with name and address of organization where machinery is in use	Whether the machinery is hypothecated to any bank or institution
1	2	3	4	5	6	7	8	9

Name of Tenderer:

Signature of the Tenderer

Contractor

Superintending Engineer, PH, Nellore

VOLUME – IV

SECTION – 12

MODEL FORMS-8

Proposed Sub-contractors

VOLUME - IV
SECTION - 12
MODEL FORMS-9

Proposed Sourcing of Import Engineering Materials

VOLUME - IV
SECTION - 12
MODEL FORMS-10

Proposed Construction Schedule for the Project

VOLUME - IV
SECTION - 12
MODEL FORMS-11

Quality Control and Quality Assurance System

ANNEXURE - A

Name of the Work :Tirupati – Repairs, Renovation and Rehabilitation of the existing Water Supply Scheme with Sai Ganga Canal as source.

LIST OF KEY PERSONAL TO BE DEPLOYED

Graduate Engineers (CIVIL) - 2 Nos.

Diploma Engineers (CIVIL) - 2 Nos.

PROFORMA FOR BANK GUARANTEES

ANNEXURE - B

PROFORMA – I

Sample Form of Bank guarantee for Bid Security / EMD

‘WHEREAS,..... (Name of Bidder) (here in after called “the Bidder”) has submitted his Bid dated (date) for the construction of (Name of contract) (hereinafter called “the Bid”).

KNOW ALL PEOPLE by these presents that We (Name of bank) of (Name of country) having our registered office at (hereinafter called “the Bank”) are bound unto (name of employer) (hereinafter called “the Employer”) in the sum of for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

THE CONDITIONS of this obligation are:

(1) If after Bid opening the Bidder withdraws his Bid during the period of Bid validity specified in the Form of Bid.

OR

(2) If the Bidder having been notified of the acceptance of his Bid by the Employer during the period of Bid Validity
(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required: or

(b) fails or refuses to furnish these Performance Security, in accordance with the Instructions to Bidders

We undertake to pay the Employer up to the above amount upon receipt of his first written demand, Without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force upto and including the date days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE..... SIGNATURE OF THE BANK

.....

WITNESS.....

SEAL.....

(Signature, name, and address)

.....

.....

1. The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be same as shown in Clause 1 of the Tender Notice in Volume III of Bid Document.

2. 60 days after the end of the validity period of the Bid. Date should be inserted by the Employer.

PROFORMA - II

Sample Form of Bank guarantee for Performance Security

In consideration of the Public Health Engineering Department (hereinafter called " the Employer") having agreed to exempt (hereinafter called " the said Contractor ") from depositing with the Department in cash the sum of Rs..... (Rupeesonly) being the amount of Performance Security payable by the Contractor to the Department under the terms and conditions of the Agreement dated the day of 2010 and made between the Department of the one part and the Contractor of the other part (hereinafter referred to as "the said Agreement") for as security for due observance and performance by the Contractor of the terms and conditions of the said Agreement, on the Contractor furnishing to the Department a Guarantee in the prescribed form of a Schedule Bank in India being in fact these presents in the like sum of Rs..... (Rupees Only).

We Bank/Limited registered in India under Act and having one of our Local Head Office at Do hereby :

1. Guarantee to the Department:

- a) Due performance and observance by the Contractor of terms, covenants and conditions on the part of the Contractor in the said Agreement,

AND

- b) Due and punctual payment by the Contractor to the Municipal Corporation of Hyderabad. of all sums of money, losses, damages, costs, charges, penalties and expenses payable to the Department by the Contractor under or in respect of the said Agreement.

2. Undertake to pay to the Department on demand and without dispute or disputes raised by the Contractor(s) in any suit or proceeding filed in any

court of tribunal relating thereto the said sum Rs..... (Rupees only) or such lesser sum as may be demanded by the Department from us our liability hereunder being absolute and unequivocal and agree that –

3. a) The guarantee herein contained shall remain in full force and effect during the subsistence of the said Agreement and that the same will continue to be enforceable till all the dues of the Department under or by virtue of the said Agreement have been duly paid and its claims satisfied or discharged and till the Department certifies that the terms and conditions of the said Agreement have been fully properly carried out by the Contractor.
- b) We shall not be discharged or released from the liability under this Guarantee by reasons of :
- (i) Any change in the constitution of the Bank or the Contractor ;
 - (ii) Any agreement entered into between the Department and the Contractor with or without our consent ;
 - (iii) Any forbearance or indulgence shown to the Contractor;
 - (iv) Any variation in the terms, covenants or conditions contained in the said Agreement;
 - (v) Any time given to the Contractor ; or
 - (vi) Any other conditions or circumstances under which, in law, a surety would be discharged.
- c) Our liability hereunder shall be joint and several with that of the Contractor as if we were the principal debtors in respect of the said sum of Rs..... (Rupeesonly).
- d) We shall not revoke this guarantee during its currency except with the previous consent in writing of the Government.
- e) Notwithstanding anything contained herein before our liability under this guarantee is restricted to

Rs _____ (Rupees _____). Our guarantee shall remain in force upto

IN WITNESS WHEREOF the Common Seal of
.....has been hereunto affixed this
.....Day of..... 2010.

The common seal of was pursuant to the resolution of the Board of Directors of the Company dated the day of2010.. herein affixed in the presence ofwho, in token thereof, have hereto set their respective hands in the presence of -

1.
....
2.
...

PROFORMA - 3

BANK GUARANTEE FOR MOBILIZATION ADVANCE

To,
The Superintending Engineer,
Public Health,

1. In consideration of the Executive Engineer, Public Health -----
----- (hereinafter called "the Department"), having agreed to give interest bearing mobilisation advance to Rs. _____ (In Words: Rupees _____) as against the total amount of Rs. _____ (In Words: Rupees _____) to M/s. _____
_ hereinafter called the said contractor from the demand under the clause of the special conditions of contract agreement No. _____ Based on the letter of award No. _____ made between Department and M/s _____ an interest bearing mobilisation advance amounting to a maximum of 5% of the contract sum may be paid against 'Bank Guarantee' from any nationalised bank at 8.5% interest. Such Bank Guarantee should be from Branch of such bank in A.P. only. The mobilisation advance together with accrued interest shall be recovered in equal monthly installments by the time 90% of value of work is completed, the first installment commencing after 15% of the value of work is completed. In case of monthly installment not being recovered in full, the balance-unrecovered advance shall carry an interest of 14% p.a. Similarly if the advance is not fully recovered as above, the balance amount shall carry an interest of 14% p.a. till it is full recovered through R.A. Bills.

For the work of construction of Flyover at Greenland Junction (hereinafter called 'the said agreement') an interest bearing mobilisation advance can be granted on production Bank Guarantee for Rs..... (RupeesOnly), We State Bank of India the bank constituted under the State Bank of India Act, 1955 having its Central Office at, Hyderabad and amongst other places, a Branch at (hereinafter referred to as the Bank) at the request of the said contractor do hereby undertake to pay unconditionally and irrevocably the corporation an amount not exceeding Rs..... (RupeesOnly) and the interest due thereon from time to time against any loss or damage caused to or suffered or would be caused to or suffered by the corporation by reason of any breach by the said contractor of any of the terms and conditions continued in the said Agreement.

2. We, the Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Corporation stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Corporation by reason of breach by the Contractor(s) of any of the terms and conditions contained in the said Agreement or by reasons of the Contractor(s) failure to perform the said Agreement. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.....(Rupees Only).
3. We undertake to pay to the Department, any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any suit or proceeding pending before any court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there-under and the Contractor shall have no claim against us for making such payments.

4. We, the Bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Department, under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till the Executive Engineer, Public Health, ----- on behalf of the Department certifies that the terms and conditions of the said Agreement have been fully properly carried out by the said Contractor and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the date _____ we shall be discharged from all liability under this guarantee thereafter.
5. We, the Bank further agree with the Department that the Department shall have the fullest liberty without our consent and without our consent and without effecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Department against the said contractor and to enforce or forbear from enforcing any or the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor for any forbearance, act or omission on the part of the Department, or any indulgence by the Department to the said contractor or by any such matter or thing

whatsoever which under the law relating to the guarantees would, but for this provision, have effect of so relieving us from such liability.

6. This guarantee will not be discharged due to the change in the constitution of the bank or the Contractor.
7. This guarantee is furnished and is deemed to be furnished in ----- and the court's in ----- will have Civil Jurisdiction.
8. We, the Bank, lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Department in writing.

Notwithstanding anything contained herein before, our liability under the guarantee is restricted to Rs..... (Rupees Only) Our Guarantee shall remain in force till _____. Unless a claim under this guarantee is made before that date i.e. _____ all your rights under the said guarantee shall be forfeited and we shall be relieved and be discharged from all liability there-under.

AFFIDAVIT

I/We have submitted a bank guarantee for the work
.....(name of work.)

Agreement

No.....dated.....

.....from.....

.....(Name of the Bank with full address).

To the Superintending Engineer, Public Health, -----

.....(Name of Division) with a view seek exemption from

payment of security deposit/performance guarantee in cash. This bank

guarantee expires on.....

I / We undertake to keep the validity of the bank guarantee intact by getting it extended for time to time at my/our own initiative upto a period ofmonths after the recorded date of completion of the work or as directed by the Employer.

I/We also indemnify the Government against any losses arising out of non-encashment of back guarantee, if any.

Deponent

Signature of Contractor

Note: The affidavit is to be given by the Executant before a first class Magistrate.

ANNEXURE - C
MACHINERY REQUIRED

1. Cranes for erection of equipment pumping machinery, valves and vessels – 3 Nos.
2. JCB / Hitachi - 2 Nos.
3. Water Tanker – 2 Nos.
4. Tractor / Tippers – 35.
5. Concrete Hopper miller – 1 No.

ANNEXURE – D

LABORATORY EQUIPMENT at SITEs DURING CONSTRUCTION.

- | | | | |
|-----------|---|---|---------|
| I. | Slump Test Equipments | : | 2 Nos. |
| | ➤ 15cm X 15cm X 15cm Cubic Moulds | : | 24 Nos. |
| | ➤ Compressive Strength Testing Equipment | : | 2 Nos. |
| | ➤ I.S.I Sieves for sand and Metal | : | 2 Sets. |
| | ➤ I.S.I Servicing for Soils | : | 2 Sets. |
| | ➤ Necessary Measuring Equipment Required : | | 1 Set. |
| | ➤ Electric oven | : | 1 No. |
| | ➤ Field density measuring equipment | : | 1 No. |
| | ➤ Core cutter equipment. | : | 1 No. |
| | ➤ Simple balance/Electronic Equipment least count up to 0.01 Grams. | | |

II. FILTRATION PLANT – LABORATORY EQUIPMENT

1. Turbidity Meter / turbidity Rod
2. P.H Meter
3. Jar Test Equipment
4. Chloroscope
5. Pipettes
6. Burettes
7. Beakers
8. Electronic Weigh Balance.
9. Chlorinator equipment

ANNEXURE – E

REPORTING REQUIREMENTS :

The following Reports and Records in four sets are to submitted to the Engineer-in-Charge by the EPC Agency.

(The Reports and Records shall have to be decided according to the nature of the Project and will be approved by the IBM Committee.)

BIDDING DOCUMENT

VOLUME – IV

SECTION – 13

Soil Investigation available with Dept. (For Guidance only)

BIDDING DOCUMENT

VOLUME - IV

SECTION - 14

DRAWINGS

TIRUPATI WATER SUPPLY SCHEME WITH KP CANAL AS SOURCE

PLAN SHOWING EXISTING AND PROPOSED REPAIRS, RENOVATION & REHABILITATION OF EXISTING SYSTEM

