KERALA RURAL WATER SUPPLY AND SANITATION AGENCY

Name of Project: Supplying and Laying of HDPE,PVC , and GI pipes in Gravity main , Distribution system and Providing house connection in Muthappanpuzha, Kozhikode

NOTICE INVITING

TENDER

VOLUME – II

Tender No	:	KRWSA-KNR/110/2021
Tendered PAC	:	Rs.3307439/-
Last date of online submission of tenders	:	**16/06/2021, 05.00 PM**
Date of tender opening	:	**18/06/2021, 2.00 PM**

KRWSA

OFFICE OF THE REGIONAL PROJECT DIRECTOR
KERALA RURAL WATER SUPPLY AND SANITATION AGENCY REGIONAL PROJECT MANAGEMENT UNIT
KANNUR

KERALA RURAL WATER SUPPLY AND SANITATION AGENCY

A. **SCOPE OF WORK**

Name of Work :Supplying and Laying of HDPE,PVC , and GI pipes in Gravity main , Distribution system and Providing house connection in Muthappanpuzha, Kozhikode

1. GENERAL INFORMATION

This project is to implement - **Supplying and Laying of HDPE,PVC , and GI pipes in Gravity main , Distribution system and Providing house connection in Muthappanpuzha, Kozhikode**

2. CONCISE SCOPE OF WORK

The scope of work includes Supplying and Laying of HDPE,PVC , and GI pipes in Gravity main , Distribution system and Providing house connection in Muthappanpuzha, Kozhikode

.

3. General Technical Specification

9V .II. (1) . MATERIALS

All materials required for the works shall be procured and supplied by the Contractor himself. The materials shall be of good quality and conforming to relevant BIS spécification .The materials which are classified for ISI marking should be supplied with ISI marking only.

I. Cement and Steel.

I.I. The entire quantity of cement and Steel required for the work will be procured by the Contractor . The Contractor is responsible for all transport and storage of the materials and shall bear all related cost. The Employer shall be entitled at any reasonable time to examine the cement and Steel supplied by the contractor.

1.2. The cement procured by the contractor shall comply with the requirements of IS 269/1976 with the latest révision thereof for ordinary port land cement and IS 8112/1989 with the latest révision thereof for
43 grade ordinary Portland cement. It shall be of the best normal setting quality unless specially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. Each bag shall bear
ISI Certification mark and as per spécification no. 10 of TNBP volume 1.

1.3.The Steel bars shall comply with the requirements set forth in the IS 432

Part 1, IS 1139, IS 1786 as the case may be with the latest révision thereof and the test as described for

ultimate tensile strength, bond test and élongationtests All reinforcing Steel shall be clean

and firee from oil, grease, loose scales or rust or other coatings of any

characterwhich would reduce or destroy the band. Each band containing the bars shall bear the ISI Certification marks.

1.4.The Cement/steel shall be tested in nearby laboratories of Polytechnic or Engineering College by the Employer. Two samples should be taken by the Engineer in charge in the presence of the contractor or his authorized représentatives or the technical personnel employed by the Contractor as in the Agreement. The contractor shall without extra cost, provide samples and cooperate in the testing of the cement./steel. One sample shall be got tested and the other sample shall be retained by making clear identification in the sample by the Engineer in charge so as to identify at a later date. **The cost of such test shall be borne by the contractor.**

1.5.All cement shall be procured in bags and shall be stored in a dry place for which the contractor shall be responsible . Consignment of bagged cement shall be property stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in proximately in the chronological order in which it is received ,but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be used unless it has been retested at the expenses of the contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 180 days from the date of initial sampling shall be rejected.

1.6.Cement which has become caked or perished shall on no account be used on the works and shall be rejected, although the Engineer may hâve passed any consignment if he finds that any détérioration in the quality thereon has taken place.

1.7.A record of the quantity of cement/steel procured with the name of dealer, bill number and date shall be maintained by the contractor . This should be produced for examination by the Engineer in charge at any time. The âge of the cement shall be reckoned from the date of manufacture and it shall be verified by the Engineer in charge.

1.8. The rejected consignment of cement and Steel should be removed from the site within two days.

2. Aggregates.

2.1 Sand for use in masonry and plaster works shall confirm in relevant spécification in TNBP (Spécification No. 7) and I.S.2116/1985, I.S.1542/1977.**Due to restriction in mining river sand M-Sand approved by the Engineer in Charge can be used.**

2.2 The course and fine aggregates for concrète shall conform to I,S,383/1970 and as specified in the relevant clauses of I.S.456/1978. Other aggregates free from deleterious materials shall be used at the concurrence and approval of the Engineer after sufficient tests hâve been carried out at the contractors cost.

2.3. The maximum quantities of deleterious materials in the aggregates , as determined in accordance with I. S. 2386/(Part 11/1963 shall not exceed the limits given in table 1 of I. S. 383. Unless other wise specified ail course aggregate in R CC shall be graded aggregate of 20 mm nominal size . All aggregates shall be stored in hard impervious surface to ensure exclusion of ail foreign materials and as per IS 4082/1977 and spécification no 5 of TNBP Volume 1.

3. Water required for Construction.

3.1. The water used in the construction shall be of potable quality and shall be testedatthe contractor's cost. The contractor has to make his own arrangements at his cost for water required for construction, testing, filling, etc., either from local bodies or from elsewhere by paying the charges directly and arranging tanker etc., as per necessity. No claim for extra payment on account of non availability of water near by extra lead for bringing water shall be entertained. All required piping arrangements and pumping if required for water shall be made by the contractor at his cost. Water formortar mixing and curing of concrète shall be free from harmful mater or other substances that may be deleterious to concrète or Steel and taken from a source approved by the Engineer. Water for mixing and curing shall conform to the provisions in the clause 4.3 of IS 456/2000

4. Admixtures.

Only where a bénéficiai effect is produced shall any admixture be used and that too after test has been carried out to convince the Engineer that no harmful effect will be produced by the use of such admixture and after approval by the Engineer. The admixture shall conform to IS 9103/1972.

5. Form work and Centering

5.1.1 Steel/wooden form centering shall be used. If wooden form work is used, it shall consist of planks not less than 40mm thick and strong props. This shall be provided complying with clause 10 of IS 456/1978 and spécification no. 30.8. of TNBP. The timber for form works shall be best hard wood and got approved by the Engineer in charge. This shall be deemed to be included in the items of contract even otherwise specified.

6. Separator (Cover Block)

6.1.1 For bottom cover of beams, slabs etc., separators of pre cast cement mortar blocks of suitable size with wire embedment as directed shall be used and tied to the reinforcement. Between layers of reinforcements, separators consisting of pièces of bars of suitable diameter shall be used. The required cover shall be provided as per clause 24-4 ofIS 456/2000

7. Pipes, Specials and Valves.

7.1 General.

7.1.1. All types of pipes required for the works should be of good quality conforming to relevant BIS and should be procured from reputed manufacturer. Each pipe should bear the trade mark of the manufacturer, the nominal diameter ,class, weight, batch number and the last two digits of the year of manufacture suitably and legibly marked on it. The Engineer shall hâve the right to conduct any test to ascertain the quality of the pipes supplied by the contractor. The contractor should make all necessary arrangements for testing the pipes. Ail the charges and expenses towards the testing shall be borne by the contractor. The materials which are classified for ISI marking should be supplied with ISI marking only.

7.1.2. If on examination of any sample from any portion of the supply, the material is found to be sub standard and not fully in accordance with the relevant spécification, the entire consignment shall be rejected. In case of doubt whether the materials confirm to the spécification or not, the decision of the Executive Engineer shall be final.

7.2 D.I. Pipes

7.2.1 D.I. pipes shall be procured from the reputed manufacturer and the pipe shall conform to IS 8329/2000. The pipes shall be lined with cement mortar and bear ISI mark. The test certificate fumished by the manufacturer should be produced.

7.2.2 The successful contractor shall obtain after executing agreement an MOU from the manufacturer agreeing to supply IS Marked pipes strictly complying to the spécifications, guaranteeing the pipes for a maximum period of two years. The MOU should also contain willingness of manufacturer to conduct Factory inspection of the pipes.

7.2.3 **The Engineer shall hâve the right to test the pipes (post delivery) at Labs approved by KRWSA for the quality and conformity with spécification wherever felt necessary. The Contractor shall replace the pipes if quality test fails.**

7.2.4 The successful contractor shall get the pre-delivery inspection at factory got conducted by the KRW SA approved inspection agency.

7.3 GI pipes.

7.3.2 G I pipes should be procured by the contractor from reputed manufacturer or from their authorized dealers and should conform to IS 1239/part 1, namely the inner and outer diameter, length, weight and galvanization. The pipes which are found to be not conforming to relevant specification shall be rejected by the Engineer-in-charge. Guarantee shall be obtained from manufacturer for two years.

7.4 CI D/F pipes.

7.4.1. The CI D/F pipes procured for use in the work should conform to the relevant BIS spécification and suitable for use in the work.

7.5. Valves.

7.5.1 The Contractor should procure reputed make of sluice valves, scour, reflux valves, non return valves,

pressure release valves and air valves from the manufacturer or his authorized dealer and they should conform to the relevant BIS spécification and suitable for use in the work . The valves shall bear ISI marks. Pressure release valves will be provided so as to minimize high residual heads and equalize the pressure in the System to near uniform pattern . Pressure rating for valves shall be PN. 1

7.6 DI/CI/GI Specials and Fittings shall be in conformity with relevant B.I.S. spécification The Specials and fittings should be in conformity to the relevant BIS spécification.

7.6. Testing of Pipes

7.6.1 The manufacturer test certificate, third party inspection certificate by agency approved by KRWSA should be produced by the contractor for the pipes used in the work. The engineer shall hâve the right to test the pipes, wherever felt necessary for its quality. All testing charges should be borne by the contractor .

7.6.2 Testing of materials to be used in works, for the quality of finished items shall generally be done by the contractor at his own cost in the laboratory approved by the Employer by providing requisite materialtransport of test specimen and other assistance required thereof.

V 12). CIVIL WORKS.

1. General.

The scope of work for the contractor under the contract for civil works include all civil constructions works, including excavation, foundation, buildings, trenches all water retaining structures including sumps, weir, together with ducts and piping etc. and clearing of the site after completion of the work. The limits; of the contract, the provision of space, shall be the same as shown on the tender drawings and as description in the works description of the tender documents.

The civil works shall be carried out in accordance with the National Building Codes, the Kérala PWD (B&R) spécifications and explanatory notes, and TamilNadu Building practice (TNPB) . In case of any variation between the PWD spécifications and spécifications given here, the latter shall prevail. In case where the PWD spécification and the spécifications given ;below are silent about any aspects in respect of any item, the work shall be carried out as per the relevant. IS codes of practice in the latest version and as per sound engineering practice.

The excavation items will include; ail lifts, latéral leads within limits of work, labour for dewatering, shoring wherever necessary, backfilling around completed structures and disposai of surplus ;soil as directed by Engineer-in Charge. If any road is dug up for any purpose whatsoever, the contractor shall reinstate it to the standard required by the Engineer-in-Charge or the Statutory Body, at no extra cost with the same materials.

Where any provision of the TNBP is répugnant to or at variance with any provision under BIS or description of work, technical spécifications and conditions of contract, the provisions of the latter shall be deemed to supercede the provision of the TNBP

The contractor shall programme his construction activities in such a manner that ail inlet and outlet arrangements are ready for testing purposes to avoid any delays.

1.1. Design & Drawings

The contract being a Turnkey contract, the contractor shall design and construct ail civil works in accordance with the standard spécification. Ail design calculations, drawings for the plant components including site plan, general lay outs, architectural drawings with isométrie views will be submitted for the approval of the Engineer-in-Charge. The contractors shall alter/modify/the design based on the directions of the engineer and the decision of engineer is final and binding on the contractor. Spécial attention shall be given to the climate of the project area before planning the constructional structures. Not withstanding any approval by the Engineer/Consultant, contractor is solely responsible for the performance and structural safety/stability of the equipment/structures under the contract.

1.2 Foundations:-

Soil particulars available at site are enclosed. The contractor shall design the foundations for structures as per the site conditions. The designs shall be got approved firom the Engineer-in-Charge. Tests on Steel (mild and high tensile (TOR) as per IS: 1786 to establish the ultimate tensile strength, yield stress, percentage élongation and Chemical composition.

In additional to the above tests, the Engineer-in-Charge or his représentative, shall request any other tests to be carried out from time to time as per the Indian standards or the Kérala PWD spécifications,at no extra cost. Ail cost of testing materials, collection, préparation & testing of samples during execution shall be borne by the contractor and the contract price shall include ail such charges.

1.3 Check for Reinforcement and concreting

Ail reinforcement shall be checked and recorded prior to pouring of concrète, by a représentative of the Engineer-in-Charge. Similarly, the entire concrète pouring work shall be done in the presence of an engineer's représentative . The contractor shall therefore, give a notice of minimum three days to the Engineer-in-Charge or his représentative, such that the works can be checked by him or his représentative.

Main standards for Civil Works

Some of the important IS codes referred during execution of the work are as follows:

IS:3764 - Safety code for excavation works
IS:3720 - Methods of tests for soils Concrète Works

IS:280 - Mild Steel wire for general engineering purposes

IS: 269/8112 - Portland cement/OPC-Grade 43
IS:383 - Coarse and fine aggregate

IS:432 - Medium tension Steel bards and hard drawn Steel wire.

IS: 456 - Code of Practice for plain and reinforced concrète.

IS: 516 - Methods of testing for strength of concrète

IS:1199 - Method of sampling and analysis of concrète

- Fabric reinforcement

IS:1566 IS:1786 - High strength deformed bars for concrète reinforcement

IS:2062 - Structural Steel

IS:2386 - Methods of tests for aggregates of concrète

Tamil Nadu Detailed Building Practice (spécification No.23 to the extent applicable)shall be followed for earthwork excavation.

IS:2506 IS 3370	Code of practice for bending and fixing of bars for concrète reinforcement
for the storage of **1.4 Building works**	- Code of Practice for concrète structures liquids.

IS 1567 -Code of Practice for construction of stone
-Method of Measurement

masonry General IS:1200

2. Earth work.

2.1. Spécification.

2.2. Conveyance.

The surplus excavated earth, blasted rubble etc., shall be conveyed and deposited in the Panchayath lands, within 150m of work site and as directed by the Engineer in charge.

2.3. Stacking.

Where the location of the work is such and does not permit the déposition 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 soil shall be reconvened to the site of work for the purpose of refilling of trenches, if it is suitable for refilling. The unit rate for trench work of excavated and refilling shall include the cost of such operation.

2.4 . Disposai of surplus Earth.

The excavated soil which is surplus to that required for filling and after allowing for settlement will hâve to be removed, spread and sectioned at places shown on the site during excavation for purpose of widening or leveling the road. Sectioning is to be done as detailed in TNBP, It is to be understood that no extra payment will be made for this and the unit rate for trench work of excavation and refilling shall made for this and the unit rate for trench work of excavation and refilling shall include the cost removal of surplus earth to disposai site approved by the Engineer in charge, its spreading and sectioning at the bidder's expense.

2.5 Shoring, Strutting and Baling 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 baling out water, care should be taken to see that the bailed out water is properly canalized to flow away without stagnation or inundating the adjoining road surfaces and properties.

3. Concrète.

3.1. Spécification.

Concrète for use in the works shall generally comply with TNBP(specification No.30)and the relevant BIS. The concrète mix shall be in specified proportions satisfying the maximum aggregate size, water cement ratio and required cube strength and workability as per IS 456-1978. Such concrète must be adequately vibrated to form solid mass without voids. The entire concreting works should be done only with the prior approval and in the presence of Engineer-in-charge.

3.2. Mixing Concrète.

The concrète shall be proportioned as far as cement and aggregates are considered by volume. The amount of water required being measured either by weight or volume the adjustments must be made to frequent intervals at the discrétion of the Engineer or his assistant to account for the moisture content of the aggregates. The mixing operation shall be performed only in a mechanical concrète mixer and shall continue until the whole batch of uniform consistency and colour. The mixing of concrète shall be done in accordance with clause 8 and 9 of IS 456-2000.

3.3. Transporting, Placing and Compacting Concrète.

3.3.1. Transportation, placing and compaction of concrète mix by mechanical vibrators shall be done in accordance with clause 12 of IS 456-2000. It is impérative that ail concreting operations be done rapidly and efficiently with minimum rehandling and adéquate manpower shall therefore be employed to ensure this.

3.3.2. The forms shall be first cleaned and moistened before placing concrète.

3.3.3. The mix should not be dropped firom such a height as it may cause ségrégation and air entrainment. When the mix is placed in position, no further water shall be added to provided easier workability.

3.3.4. No concrète mix shall be used for the work if it has been left for a period exceeding its initial setting time before being deposited and vibrated into its final position in the member.

3.3.5. While one concrète is being placed in position it shall be immediately spread and ramped sufficiently and suitable to attain dense and complété filling of ail spaces between and around the reinforcement and in to the corners of form work for ensuring a solid mass entirely free from voids.

3.3.6. Construction joints required in any of the structural members shall be provided generally complying with clause 12.4 of IS 456-2000 and as directed by the Engineer-in-charge.. The efficiency of tempering and consolidation will be judged by complété absence of air pockets, voids and honey combing after removal of form works.

3.4.0 Curing.

3.4.1. Curing shall be done to avoid excess shrinkage or harmful effect to the members generally complying with clause 12.5 of IS 456-2000.

3.4.2. The method adopted shall be effective and any spécial method used must be approved by the Engineer and be subject to complété supervision.

3.4.3. Any deficiency in concreting such as cracking, excessive honey combing exposure of reinforcement or other fault which entail replacement of the defective part by fresh concrète and whatever remedy reasonable required without hampering the structural safety and architectural concept, ail at the cost of contractor.

3.5. Removal of Form Work.

3.5.1. Removal of form work shall be done as per TNBP and BIS and as directed by the engineer in such a manner that no damage is caused to the structures. The stripping time shall not be less than that indicated in clause 10.3 of IS 456-2000.

3.6. Testing of Concrète

3.6.1. During the progress of construction sampling, préparation of test specimens, curing and testing of concrète shall be conducted in accordance with IS 1199 and IS 516, to détermine whether the concrète being

produced compiles with the strength requirements as specified. At least one slump test shall be carried out for every compressive strength test carried out or as directed by the Engineer. Six No. 15 cm cubes shall be made for each cubic meter or portion thereof or for each proper grade of concrète. This number may be increased at the discrétion of the Engineer. Six specimens shall preferably by prepared from different batches, three being tested after 7 days and the remaining three being tested at 28 days; The contractor shall provide, at his own expense, ail apparatus, labour and arrange for testing at a laboratory, approved by the Engineer in Charge.

3.6.2. In addition to the above tests, any other test which may if desired by the Engineer-in-charge be carried out from time to time as per relevant spécifications at the cost of contractor. In case the concrète does not meet the strength required, ail corrective measures shall be taken at once at the contractor' s cost.

3.6.3. The inspection and testing of structures shall be done in accordance with clause 16 of IS 3370 volume I water Retaining Structures

3.6.4. Acceptance of Concrète

The concrète tested in accordance with "Testing of Concrète" clause above shall meet the criteria for acceptance of concrète as per IS 456. The strength of concrète shall be the average strength of three specimens tested at 28 days and conform to strength requirements for different grades of concrete. If the advance 7 days tests show crushing strengths that are too low, corrective measures shall be taken at one at the Engineer's direction, without waiting for the results of the 28 days tests.

3.6.6 Failure to meet strength requirements

In case where concrète tested fails to meet the test requirements, the Engineer-in-charge shall hâve the right to require any one or ail the following additional tests. These shall be carried out by the contractor at his own expense. The Engineer in charge shall be the final authority for interpreting the results and shall décidé upon the acceptance or otherwise.

- Curing and load testing of the concrète member concerned represented by the test which failed.
- Replacement of any portions of the structure. No payment shall be made for the dismantling of the concrète, relevant framework or reinforced shall be made. Embedded
- ofixtures and reinforcement of adjoining structures damaged during dismantling shall be made good to the contractor at his own expenses.
- Extended curing of the structure of the concrète represented by the specimen.
- Collection and testing of a core specimen form the hardened concrète. The location number and size of such specimen shall be taken as directed by the Engineer.
- Any other test i.e., ultrasonic and/or rebound hammer tests to be decided by the Engineer, at the contractor' s own cost.

4. Masonry

Ail masonry works such as RandomRubble/Brickwork must be done as per TNBP Spécification and Bid schedule spécification.

5. Plastering.

5.1 Plastering would be12mm,15mm and20mm thickcementplaster .either plain or waterproof as per spécification may be provided.

5.2 **The plastering items shall be executed in thickness and cement mortar of proportion as detailed in respective items in the BOQ. Similarly the plastering shall be either ordinary or waterproof as specified in respective item in the BOQ.**

5.3 In case of water proof plaster standard approved water prooftng compound shall be mixed in cement mortar in required percentage as directed and then the plaster is applied.

5.4 **The finishing shall be either smooth or rough as may be directed by the Engineer unless otherwise specifically mentioned in the BOQ.**

5.5 Neat finish wherever directed by the Engineer shall be done at no extra cost.

5.6 Curing and watering shall be one as directed and plaster shall be in alignment and level. Any substandard work is liable to be rejected and shall hâve to be re-done at contractors cost.

5.6.1 Sand to be used shall be of approved quality only. Cost of ail scaffolding shall be included in the rates quoted in the BOQ.

6 Flooring.

6.1. 75mm thick cement concrète 1:4:8 shall be provided for flooring , the size of métal shall not be more than 40mm and it shall be properly graded. A thin coat of very fine plaster shall be provided on top to give a smooth finish. The marking of false grooves to surfaces as directed includes the cost of labour.

7 Doors and Windows.

7.1.1 Sizes shown on drawings are clear openings in masonry and not the shutter's size. These sizes shown on drawings are, therefore, inclusive of required frame sizes and doors Windows, etc., and shall be manufactured, accordingly . If sizes bigger than shown in drawings are manufactured, as instructed specifically in writing they shall be measured and paid for accordingly.

7.1.2 The work shall be executed as per the size of frame thickness of shutter type viz. Plain planked panelled, glazed etc., and fixture, etc., as described in tender item. Iron bars for Windows and ventilators are to be provided if specifically mentioned in the tender item at Contractor's cost. Spécifications in TNBP shall be applicable.

7.1.3 The design of shutters and quality of wood shall be got approved form the Engineer-in-charge before manufacture. The joints shall be perfect.

7.2 Part of wood embedded in masonry shall be painted with the tar. The frames of doors, Windows, ventilators, etc., shall hâve proper hold - fasts embedded in masonry.

7.5. Whenever iron bar is to be provided as per tender item the rate thereof is included in tender item. The painting shall be done as prescribed in tender item. No painting, however, shall be permitted till the wood work is approved by the Engineer-in-charge.

7.6 Any substandard work not conforming to the specifications are liable to be outright rejected and Engineer in charge's decision in such case shall be final and binding on the Contractor.

7.7 The mode of measurement shall be on area units as mentioned in BoQ.

8 Painting.

8.1. The work shall be carried out as per the description of the tender item and as directed by Engineer- in-charge.
It shall be white washing, distempering and/or snowcem painting.

Shade and make shall be as directed by the Engineer and for décorative purpose. Engineer may ask for different shades to be provided for different components or different parts of the same component which the Contractor shall hâve to do within his tendered rate only at no extra cost to the Employer. Cost of priming coat as directed, scaffolding etc., shall be included in the tender rate. The work shall be executed as per the spécifications of TNBP for painting.

In general, ail items of works must be done as per TNBP spécifications and bid schedule pecifications.

V(3). PIPE LAYING WORKS

1. General

1.1 The earthwork for the pipe laying work shall generally conform to the details given below.

Si. No.	Dia. Of pipe in millimeter	Depth of bottom of pipe below ground level in centimeter	Width of trench in centimeter.
1.	25mm PVC CL5	60	30
2.	32mm PVC CL5	90	30

In case of any decrease in size of trench proportionate déduction shall be made after working out cost for each work. To facilitate this the contractor will fumish unit rate for each work he has included the rate for laying in the priced BoQ. In unavoidable circumstances the engineer may permit the contractor to lay pipeline in the same trenches provided a clear spacing of 15cm is maintained. In such cases déduction shall be made for the reduced quantity of earth work.

The BoQ for pipes for pumping main and gravity main in respect of DI is for running meter for supply and laying which includes ail specials , rubber washers, bolts, nuts, flanges, adapters and such other item required for the fulfillment of the project execution to the satisfaction of the employer. Before procurement and immediately after mobilization arrangement for the work, the Contractor will inspect the site, fix the alignment as per the direction of Engineer, préparé a list of ail specials required for the concerned line duly furnished in the drawing and submit to the Engineer for approval. The Contractor will proceed with procurement only after such approval. The contractor will also submit the list of specials required for fixing of sluice valves ,scour valves, NR valves etc after site inspection.

1.2 Wherever necessary, sand cushioning of minimum 15cm thickness from the bed shall be given as per IS Standards and as directed by the Engineer in charge. The pipe should be laid true to the alignment line and grade Wherever necessary, appropriate bends should be used. The pipes laid must be jointed properly and carefully by using approved type of jointing materials.

1.3 After the pipes are laid and jointed, the pipelines are to be subjected to hydraulic pressure test as detailed in the relevant BIS Spécification for various types as indicated below.

D.I. Pipes Clause of IS 12288/1987

In portion of pipeline, where the pipes hâve developed cracks or sweating, such pipes with jointing materials shall be removed and relaid with new pipes at the contractor's cost and the pipe line shall be 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 arrangements for the procurement of the required equipments for testing of pipes which shall be subjected to such test as the Engineer-in-charge deems fit to ensure the accuracy of the gauge.

1.4 Refilling shall be done with proper compaction with excavated earth. In no case the contractor shall be allowed to refill the trenches in hard excavated portion to be refilled by the boulders or excavated stuffs. This portion of trench shall be refilled by the soft strata from excavated stuff from distance place at no extra cost. The refilling shall be done in 15 cm thick layers duly watering and compacting each layer. The refilling may be done up to a height of 20 to 30 cm than the natural ground level to allow that sinking afterwards. If the refilling gets sunk below the natural ground level at anytime till the completion of the work, the contractor at his cost should make good the refilling to the required level as may be directed by the Engineer in charge. In case of sloping grounds contractor will provide cross bunds to prevent érosion of soil at his own cost.

1.5 In case of pipe trenches, the Engineer may reduce the width and depth of trench wherever a hard strata is met with, if he feels adéquate and just sufficient to lay the pipe line and repair in order to reduce the hard rock quantity. In such case the contractor will be paid as per the actual measurement.

1.6 If the work is in a residential area, the contractor should carry out the excavation carefully to avoid collapse of any structure.

1.7 Valves shall be provided with valve pits with proper cover to bear the loads coming on it as per bid documents and departmental drawings and spécification

1.8 Adéquate protective measures should be taken against surge pressure. Thrust blocks and anchor blocks should be provided at ail bends and appropriate places as per design.

1.9 Water required for testing the pipeline shall be arranged by the contractor at his cost.

1.10 The Contractor on receipt of work order shall hâve a MOU with the manufacturer agreeing to supply the pipes with guaranteed performance and also agreeing for inspection at the factory either through 3rd party or directly by the employer.

2. Laying of Cast Iron Pipes / D.I. Pipes

2.1 The laying and jointing of cast iron pipes shall be carried out as follows:

Before laying the pipes, the contractor shall carefully brush them to remove any soil, stones or other materials which may be therein. An even and regular bed having been prepared and joint pit excavated to form a recess under the socket of each pipe of no greater depth and width than to enable the pipe jointing to be property done. Each pipe shall then be carefully lowered and placed singly in the trench and shall rest in the solid ground. In places where the soil is not hard, cement concrète bed blocks or timber piles hâve to be provided under the pipes if directed by the Engineer in charge.

2.2 Pipes not Truly Laid

Any pipe or pipes laid, which on inspection are found to diverge from the true Unes and levels shall be removed and re laid to the true Unes and levels and the old jointing properly cleared off the pipes and fresh joints made by the contractor at his expense. Any pipes damaged in removal shall be replaced by the contractor at his cost.

2.2 Cutting

Where necessary and as ordered by the Engineer in charge, the Contractor shall eut the pipes and fix and joint common collars for jointing spigot ends. The eut ends of the pipe shall be made truly at right angles with the axis of the pipe.

2.3 Covering up Open Ends

The Contractor shall take particular care to ensure that the apertures and open ends of pipes are carefully covered whenever the workmen are not actually employed therein.

2.5 Jointing of DI Pipes

2.5.1. *With Spigot and Socket Pipes*

It is recommended that above ground installation of spigot and socket pipes be provided with one support per pipe, the supports being positioned behind the socket of each pipe.This results in a normal distance between supports of 4m.

Pipes should be fixed to the supports with mild Steel straps so that axial movement due to expansion or contraction resulting from température fluctuation, is taken up at individual joints in the pipe-line. In addition, joints should be assembled with the spigot end withdrawn 5 to 10mm from the bottom of the socket to accommodate these thermal movements. Pipes supported in this way are capable of firee deflection and axial movement at the joints which accommodate small movements of the pipe supports.

The designed anchorage shall be provided to resist the thrusts developed by internai pressure at bends, tees etc,

Where a pipe-line crosses a watercourse, the pipes are to be laid without blocking the went way constructions. Early consultation with river authorities will assist in evaluating the effect of river characteristics (for example, nature of bed, scour levels, maximum velocities, high flood levels, seasonal variations, etc) on design and construction. If if necesary, unsupported spans between 4 and 6m may be obtained by positioning the pipe supports relative to the pipe joints.

2.5.2 *Flanged Pipes*

The recommended maximum unsupported span is 8m. The supports shall be located at the centre of every second pipe.The supports of ail flanged pipe
work spans should be stable and unyielding due to movements in the pipe line. The straps should prevent any latéral movement or lifting of the pipe-lines but not restrict expansions and constriétions caused by température fluctuations.

2.6 Cutting of Pipes

The cutting of pipe for inserting valves, fittings, etc shall be done in a neat and workman like manner without damage to the pipe or lining so as to leave a smooth end at right angles to the axis of the pipe.

2.6.1 *By Hacksaw*

Hand or power operated hacksaw should be used with blades having teeth at apitch of 1mm.

2.6.2 *ByManually Operated Wheel Cutter*

Tthe type of cutting wheel used for cast iron pipes is not suitable for ductile iron pipe. Spécial wheel, as used for cutting Steel pipes, shall be used and eut ends are trimmed with a file.

2.6.3 *By Pipe-CuttingMachine*

Machines with cutter heads or abrasive wheels shall be used. Cutter head should hâve a front rake angle of 7° as used for Steel pipes.

2.7 End Préparation of Cut Pipes for Jointing

The burr left after cutting should be trimmed off by light grinding or by filing.

2.8 Wrapping

When ductile iron pipes are to be laid in aggressive soils, the pipes should be wrapped extemally with protective coatings, such as bitumen or coal tar sheathing protective tapes or by loose polyethylene sleeving, or in certain circumstances, concrète before laying. At joints, bends and valves, précautions should be taken to provide sufficient overlap of the wrapping sleeve so that no pipe-line is exposed to the aggressive soil.

2.9 Pipe-line Anchorage

Ail pipes-lines having unanchored flexible joints require anchorage at changes of direction and at dead ends to resist the static thrust developed by internai pressure. Dynamic thrusts caused by flowing water act in the same direction as static thrusts. This thrust is of sufficient magnitude at high velocities to warrant safety considération.Where possible, concrète anchor blocks should be of such a shape as to allow sufficient space for the remaking of the joints.

2.10 Joints and Jointing of Ductile Iron Pipes

Two main types of joints are used with ductile iron pipes and fittings:

a) Socket and spigot flexible joints:
    1) Push on joints; and
    2) Mechanical joints.
b) Rigid flanged j oint

2.10.1 *Flexible joint*

The spigot and socket flexible joint should be designed to permit angular deflection in direction and axial movement to compensate for ground movement and thermal expansion and contraction. They in corporate gasket of electrometric materials and the joints may be of at he simple push-on-type or the type where the steal is effected by the compression of a rubber gasket between a seating on the inside of the socket and the extemal surface of spigot. Joints of the latter type are referred to as mechanical joints. Both push- in-and mechanical joints are flexible joints. Flexible joints require to be extemally anchored at ail changes in direction such as at bends, etc, and at blank end to resist the thrust created by internai pressure and to prevent the withdrawal of spigots.

2.10.2 *Flangedjoint*

Flanged joints are made on pipes having a machined flange at each end of the pipe. The seal is usually effected by means of a fiat rubber gasket compressed between two flanges by means of bolts which also serve to connect the pipe rigidly . Gaskets of other materials, both metallic and non- metalic, are used for spécial applications.

2.10.3 *Jointingprocedure*

Procedure for jointing will vary according to the type of joint being used.
Basic requirements for ail types are:

a) Cleanliness of ail parts,
b) Correct location of components,
c) Centralization of spigot within socket, and
d) Strict compliance with manufactures j ointing instructions.

The inside of sockets and the outside of spigots should be cleaned and wire brushed for a distance of 150 to 225 mm. Glands and gaskets should be wiped clean and inspected for damage. When lifting gear is used to place the pipe in the trench , it should also be used to assist in centralizing the spigot in the socket.

Where the pipeline is likely to be subjected to movement due to subsidence variations, the use to flexible joints is recommended. A gap should be left between the end of the spigot and the back of the socket to a accommodate such movement.

2.11 Jointing of C.I.Pipes

The trench must be kept quite dry during jointing unless in any particular case the Engineer permits laying of the pipe in wet conditions. Plain spigot and Socket pipes shall be joined as follows.

a) LEAD JOINTS

Generally lead joints shall be used for all sizes. Provision of lead joints shall also be made at Street crossings, at closing joints and for ail specials and as determined by the Engineer depending upon the site condition.

The spigot of the pipe must be forced well home into its socket and must be centered, so that the joint may be of even thickness ail round.

As many laps of white hemp spun yarn as may be needed to leave the space required for the lead shall be driven to the bottom of the socket without being forced through the joint into the pipe but carefully driven home with a caulking tool. The proper depth of each joint shall be tested before running the lead by passing completely round it a wooden gauge, notched out to the correct depth of lead, the notch being held close against the face of the socket. The joints shall then be run with molten lead insufficient quantity so that after being caulked solid, the lead may project 3 mm beyond the face of the socket against the outside of the spigot but must be flush with outside edge of the socket.

For pouring lead in the joints, a ring of hemp rope covered with clay shall be wrapped around the pipe at the end of the socket leaving an opening at the top of the socket into which the lead can be poured.

The hemp rope shall be supported by clay packing so as to withstand the operation of lead pouring.

The lead used shall be carefully skimmed of ail scale, when melted in a cast iron pot or patent melting machine. Sufficient lead shall then be taken by a ladle and run hot into the joint, and the joint filled at one running. The joint shall then be caulked when cool by a suitable caulking tool and a 2 kg hammer and the joint left neat and smooth.

The weight of lead and hemp which shall be used in each joint shall be in conformity with the table given below or as specified by the Engineer.

Quantity of lead and spun yarn for different sizes of pipes

Nominal size of pipe (in mm)	**Lead / Joint (in Kg.)**	**Depth of Lead joint (in mm)**	**Spun yarn per joint (in Kg.)**
80	1.8	45	0.10
100	2.2	45	0.18
125	2.6	45	0.20

150	3.4	50	0.20
200	5.0	50	0.30
250	6.1	50	0.35
300	7.2	55	0.48
350	8.4	55	0.60
400	9.5	55	0.75
450	14.0	55	0.95
500	15.0	60	1.00
600	19.0	60	1.20
700	22.0	60	1.35
750	25.0	60	1.45
800	31.5	65	1.53
900	35.0	65	1.88
1000	41.0	65	2.05
1100	46.0	65	2.40
1200	50.0	70	2.60
1500	66.5	75	2.80
8Inches	4.54	2.00 Inches	0.29
9 "	5.10	2.00 "	0.31
10"	5.67	2.00 "	0.34
12 "	6.58	2.00 "	0.48
14 "	9.30	2.50 "	0.63
15 "	9.98	2.50 "	0.68
16 "	10.66	2.50 "	0.74
18 "	14.06	2.50 "	0.95
20 "	16.33	2.50 "	1.04
21”	17.92	2.50 "	1.08
24 "	20.41	2.50 "	1.21
27 "	23.13	2.50 "	1.33
30 "	25.86	2.50 "	1.46
33 "	28.35	2.50 "	1.65
36 "	31.58	2.50 "	2.40

Note:The quantities of lead and spun yarn given in the table are provisions and variation of 20 percent is permissible.

b) Flanged Joints

Flanged joint should be made by painting the facing of the flange with white lead freely and bolting up evently on ail sides. A thin fiber of lead wool may be very useful in making the joints water tight where facing of the pipes is not true.

When packing must be used, it should be of rubber insertion of approved thickness. The packing should be of the full diameter of the flange with proper pipe hole and boit holes eut out evenly on both the inner and outer edges. Where the flange is not fully faced, the packing may be of the
diameter of the packing strip only. Proper placing of the packing should be checked before another pipe is joined on.

c) Rubber Ring Joints

In the case of rubber ring joints or push on joints, the groove and the socket shall be thoroughly cleaned before inserting the rubber gasket. While inserting the gasket it shall be made sure that it faces the proper direction and that it is correctly seated in the groove. After cleaning dirt or foreign materials from the plain end, lubricant shall be applied in accordance with the pipe manufacturer's recommendations.

The Contractor shall make sure that the plain end is beveled as square as sharp edges may damage or dislodge the gasket and cause a leak. When the pipe is eut at site, the plain end shall be beveled with a heavy file or grinder to remove ail sharp edges.The plain end of the pipe shall be pushed into the socket of the pipe and while pushing, the pipe shall be kept straight. If any deflections are to be made in the alignment, it may be made after the joint is assembled.

A timber header shall be used between the pipe and crow bar or jack to avoid damage to the pipe while the plain end of the pipe is pushed into the socket either with a crow bar or jack, or lever puller.

2.12 Fixing Sluice Valve

The sluice valves to be fixed on the pipelines shall be examined, cleaned and placed in the positions as shown in the drawings. The valves shall be placed on the pipeline and valve chambers constructed according to drawings. The depth at which the valve is to be laid and the dimensions of concrète and masonry shall be varied when necessary under the orders of the Engineer.

As the pipes in some instances may be required to be fixed at a less depth than will permit the top of the valve spindle being below the level of the road (but this may only be incases where the position of the valve is to one side of the metalloid road) the walls of the valve chamber shall in such cases be carried upto such height at may be ordered, and the chamber shall hâve such covering as the Engineer may direct.

The valve shall be supported in the valve chamber so that no stress or strain occurs in the flange or other joints of the valve.

The valve shall be carefully protected from slime or dust by a suitable mat or gunny covering and the pit itself shall be cleared of ail unwanted material.

2.13 Fixing Scour Valve

Scour valves shall be fixed at places shown in the drawings or as directed by the Engineer, and the scour connections from the main shall be carried out completely as per drawings.

2.14 Fixing Air Valve

Air valves shall be fixed at the summits of pipe Unes or at places as may be directed by the Engineer. The air valve connections etc., shall be carried out as per drawing.

2.15 Works to be left Water tight

The Contractor shall construct the valve chambers and ail other Works so that they shall be water tight. Should any leakage appear, it shall be made good by him at his expense by removing and

reconstructing the portions of the Work so affected or by other method which will render the Work thoroughly water tight to the satisfaction of the Engineer.

2.16 Cleaning of Mains

During the execution of the work the contractor shall keep the interior surface of the mains free from cement, brick, soil or other superfluous matter and shall hand over the mains perfectly clean and free from deposit on completion.

2.17 Masonry chambers

Chambers for sluice valves, inspection, scour valves, air valves shall be constructed on the pipes in the positions as shown in the drawings or in such positions as the Engineer may direct. The work shall be done strictly in accordance with the detailed drawings or as ordered by the Engineer. The excavation shall not be made lower than necessary to admit of the earth being properly tampered. The bottom of the excavation shall be properly leveled, rammed and a bed of concrète laid thereon. When the concrète has sufficiently set the building brick walls shall then be proceeded with and ail iron work fixed in as the work proceeds. The inside of ail chambers shall be plastered with cement mortar 15 mm thick and the outside with cement mortar 12mm thick. The chamber shall be topped with pre-cast R.C.C. Slab 1:2:4 or cast iron surface box as ordered by the Engineer. The surface box or valve cover shall be fixed on the top of the R.C.C. slab by a layer of; cement mortar and sides of the surface box or valve cover covered over with cement concrète.

Where pipes pass through walls of chambers relieving arches shall be turned neatly over the upper half of the pipes or R.C.C. lintels shall be provided to avoid load of the walls transmitted to the pipes. Cast Iron steps shall be built in each chamber as the Work proceeds on being inserted to every 4 courses of brick work, horizontal distance center to center of each row being 30 cms.

The Contractor shall include in his rate for brick work cost for fixing steps, frame, cover etc., for completing ail chambers in accordance with the drawings and with the above spécifications.

2.18 Testing of Mains-hydrostatic Test

After laying and jointing the pipes and specials, the pipe Unes shall be tested for hydrostatic pressure in such length 100 to 150m as specified by the Engineer.

The test pressure shall be equal to 100% or such other higher percent as may be specified in excess of the pressure the pipe will hâve to withstand subsequently subject to a minimum test pressure of 1.5 times the working pressure.

The contractor shall make his own arrangements to procure, necessary equipments, apparatus etc., required for testing and shall provide necessary labour for filling with water the length of pipes to be tested, fixing ail apparatus and for carrying on the testing operations until the length of pipes specials and connections are finally passed by the Engineer.

The length to be tested shall be provided with two blank flanges fastened on in the usual manner by collar bands and bolts to the end pipes or if the length to be tested shall hâve a sluice value at each end, such blank flanges may be dispensed with.

The length of pipes to be tested shall first be filled in with water from a higher section of pipes already laid or with clean water shall be arranged at the contractor's expense with the approval of the Engineer.

Before the actual testing pressure is applied any air which has lodged in the length of pipes to be tested shall be got rid of, by screwing on at the highest part of the length of pipes or temporary air valve, or, by opening a temporary stop-cock or by other mean as the Engineer may direct.

The test pressure shall then be applied to the length of pipes under test by a hand or powered hydraulic test pump. The connection of the test pump to the length of pipes shall either be at the union connection provided at a blank flange or shall be at a temporary stop cock or fountain connections as the Engineer may in the circumstances direct.

The actual test shall be made by pumping water into the length of pipes under test, until the test pressure as specified above has been reached on the pressure gauge.

The pipe shall be judged to hâve passed the test satisfactory if the quantity of water required to restore the test pressure of 30m for 24 hours does not exceed 151itres /10mm of nominal bore for a length of 1 km.

When a flange joint is found to be leaking, care shall be taken that while tightening up the flanges, the neighboring joints are not affected.

If the length of pipe line under test is found to be satisfactory and no leaks or sweatiness are found at the pipe joints or at the joints of specials and connections then this length of pipe line will be passed by the Engineer.

But should any pipe, joint, spécial or connection be found to sweat or leak, the contractor shall make good at his cost such defective joint and the length of pipe line shall be re tested by the Engineer until ail pipes, joints, specials and connection are found to be satisfactory.

If any pipe or spécial leaks or bursts, the damaged portion shall be removed and new pipes or specials shall be laid and jointed at the contractor's cost.

2.19 Restoring Road Surface

The surface of the road or ground shall be finished off to the proper level with the same kind of materials the surface consisted of before the excavation commenced or by cement concrète, except in the case of superior roads and tarred roads in which case the restoration shall be done by the PWD for which restoration charges will be remitted by SLEC. Should any settlement occur after refilling is completed, and upto the end of the period of maintenance, it shall be made good at once and the surface restored to the satisfaction of the authority under whose jurisdiction such road or ground may be, **all at the cost of the contractor.**

2.20 Collection of Rubbish

The Contractor shall, at his cost, on the completion of the Work remove ail water and ail materials or rubbish of every description which may hâve been collected in the works find a deposit thereof and

anything which my hâve collected within the works, during the period of maintenance shall also be removed before the Works are finally accepted by the Employer.

3 Disinfections of Mains.

Upon completion of a newly laid main or when repairs to an existing pipe are made, the main shall be disinfected as directed by the Engineer. The mains shall be flushed prior to disinfection except when the tablet method is used.

After initial flushing, the hypochloride solution shall be applied to the water main with mechanically or electrically powered Chemical feed pump designed for feeding chlorine solutions. For small applications, the solution may be fed with a hand pump.

In the case of mains of a large diameter, water from the existing distribution System or other approved source of supply shall be made to flow at a constant measured rate into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at not less than 300 mg/I. The chlorine shall be applied continuously and for a suffi ci ent period to develop a solid column of 'Slug' of chlorinated water that will as it passes along the line expose ail interior surfaces to a concentration of at least 300 mg/I. for at least 3 hours. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect the appurtenances.

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the mains is not higher than the generally prevailing in the System or less than I mg/I. After final flushing and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriological quality and shall show the absence of coli form organisms. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples hâve been obtained. When the samples are satisfactory, the main shall be placed in service.

4 Earth work Excavation (LINEAR MEASUREMENT)

The Bidder should carefully inspect the site to assess the prevalence of different soil classifications and quote the rate for trench excavation for laying pipe line taking into account ail soil classifications that are likely to be encountered and no extra rate will be paid for excavation of trench on account of any variation in the classification of soil met with during actual execution. In case of reduced depth or width proportionate déduction shall be effected as per unit rate quoted.

V(8) DEFECT LIABILITY PERIOD

The defect Liability Period will be 12 months from the date of full satisfactory commissioning of the scheme. The contractor shall carry out ail repair works connected with the equipments of the water supply scheme executed by him during the above period.

V(9) REFERENCE TO SPECIFICATIONS/CODE OF PRACTICE

Ordinary Portland Cement (33 Grade)	269-1976
43 Grade Ordinary Portland Cement Pozzolona Portland Cement Hydrophobie Portland Cement Rapid Hardening portland Cement Low Heat Portland Cement Standard sand for testing of cement Methods of Test for Pozzolonic Materials Methods of sampling and test for water & waste water (Physical & Chemical) Methods of Sampling hydraulic Cement Methods of Physical tests for hydraulic Cement Methods of Chemical analysis of hydraulic cement Aggregates coarse & Fine from Natural resources For concrète.	8112-1989 1489-1991 8043-1978 8041-1990 12600-1989 650-1966 1727-1967 3025-1984 (Part 1 to 37) 3535-1986 4031-1988 (1 to 14) 4032-1985 383-1970 4082/1977
Sand for Masonry Mortar	2116-1965 1542/1977 2386-1963 (Part 1 to 8)
Methods of tests for aggregates for concrète Part 1-Particle size and shape Part II-Estimation of deleterious Materials & Organic impurities Soundness Methods for sampling of aggregates for concrète Spécifications for test sieves Wire cloth test Sieves Common Bumt clay building bricks Mild Steel and Medium tensile Steel bars and hard Drawn Steel wire, concrète reinforcement, Part-I-Mild Steel & Medium tensile Steel Bars Part-II-Hard drawn Steel wire	2386-1963 (Part-1) 2386-1963 (Part III) 2386-1963 (Part- III) 2430-1986 460-1978 (Part -1) 1077-1976 432-1982
High Strength deformed Steel bars and wires for Concrète reinforcement	1786-1985
High Tensile Steel for PSC Pipes Bending and flexing of bars for concrète reinforcement	1784-1986 (Part-I) 2502- 1969
Recommendations for detailing of reinforcement in reinforced concrète works	5525-1969
Method for tensile testing of Steel wire	1521-1972

Method of test for determining modulus of elasticity	2854-1964
Glossary of terms relating to cement concrète	6461-1972
Methods of test for strength of concrète Methods of	(Part 1 to 12)
testing bond in reinforced concrète Pull out test	516-1959
Methods of test for permeability of cement Mortar and	2770-1967
concrète	3085-1965
Methods of test for splitting tensile strength	
Of concrète cylinders	5816-1970
Code of practice for construction of	
Pile foundations (concrète piles)	2911 (Parti)
Driven cast-in-situ concrète piles	Sec-1-1979
Bored cast -in-situ piles	Sec-2-1979
Driven pre-cast concrète piles	Sec-3-1979
Bored pre-cast concrète piles	Sec-4-1984
Code of practice for construction of raft foundation	2950-1981
Design Aids for reinforced concrète	SP 16-1980
Explanatory Hand Book on Codes for earth w	SP 22-1982
Engineering	
Explanatory Hand Book on IS Code 456-19 Hand Book	SP24-1983
on causes and prévention of cracks in buildings	SP 25-1984
Hand Book on concrète reinforcement & detailing Brick	
Masonry	SP 34-1987
Construction of Stone Masonry Asbestos cement	2212-1962
pressure pipes Concrète pipes with and without	1957-1967
reinforcement P.S.C Pipes (including fittings)	1592-1989
	458-1988
Methods of tests for concrète pipes	784-1978
	458-1988
	3597-1985
	22-1976 &
Materials for M.S. Specials Spécifications for M.S.	2062-1980
Specials for P.S.C.Pipes. Spécifications for Steel cylinders	
reinforced Concrète pipes.	1916-1989
Methods of tests of concrète pipes	3597-1985
Specials for Steel cylinders reinforced concrète pipes	3597-1985
Cast iron specials for asbestos cement pressure	5531-1988
Pipes for water, gas & sewage	
Methods of test for asbestos cement products	5913-1989
Centrifugally Cast (Spun)Iron pressure pipes for	
Water, gas and sewage Including fittings.	1536-1989
Spécifications for Centrifugally Cast (Spun)D.I.Pipes	
for Water, Gas and Sewage.	8329-1990
D.I.Fittings for pipes for water,gas & sewerage	9523-1980

Dimensional requirements of rubber gaskets for Mechanical joints and push on joints for the use With C.I.D.I.Pipes.	12820-1986

	13382-1992
C.I.Specials for Mechanical and push on flexible joints for pressure pipe Unes for water, gas &sewage Horizontally cast iron double flanged pipes for water. Gas and sewage	7181-1986 1538-1976 (Part 1 to 24)
Cast iron fittings for pressure pipes for water, gas And sewage	8794-1988
Cast iron détachable joints for use with Asbestos Cement pressure pipes	5382-1969
Rubber rings for jointing C.I.Pipes, R.C.C.Pipes & AC Pipes.	5382-1985 10292-1985
Rubber rings for jointing P.S.C.Pipes Rubber rings for jointing AC Pipes with AC couplings	
Pig Lead (caulking lead)	782-1978 6587-1966 638-1979
Hemp yarn	1363-1967
Rubber Insertion to be used in jointing CIDF pipes Bolts & Nuts to be used in jointing CIDF Pipes Unplasticized PVC Pipes for potable water supplies Injection moulded PVC Socket fittings with Solvent cement joints for water supplies.	4985-1988 7834-1987 (Part 1 to 8) 10124-1988 (Part 1 to 13) 12235-1986 (Part 1 to 11)
Fabricated PVC fittings for potable water supplies	780-1984
Methods of test for unplasticized PVC pipes for potable water supplies	2906-1984
Sluice valves for water works purposes (50 to 300 mm Dia size)	2401-1973 3950-1979
Sluice valves for water works purposes (300 to 1200 ;mm Dia size)	1726-1974 6530-1972
Water meter (15 mm)	783-1985 3114-1985 126 of
Surface boxes for sluice valves	APSS& 783-1985 12288-1987 7634-1975 (Part 3)
Manhole covers for sluice valves	
Laying of Asbestos Cement Pressures Pipes	
Laying of Concrète pipes	1791-1968
Laying of Cast-Iron Pipes	
Laying of PSC Pipes	4616-1968 3764-1966
Laying of DI Pipes	
Laying and jointing of unplasticized PVC Pipes	3696-1966 (Parti) 3696-1966 (Part-Il)
Batch type concrète mixer	5121-1969 7293-1974 Volume-I Volume-II
Sheep foot roller	
Safety code for excavation works	
Safety code for scaffolds and ladders	
Part-I Scaffolds	
Part II-Ladders	
Safety code for piling and other deep foundations Safety code for working with construction machinery Tamil Nadu Building Practice	

Government of India Manual on Water Supply and Treatment	Latest (Revised)
Gravel for packing	4091-1967
Hard drawn Steel Wire	1785-1983 (Part I and II)
Structural Steel	226-1975
Hard rolled mils Steel for concrète	1139-1966
Hard drawn Steel Wire	1566-1982
American Society for Testing of Materials	1566-1982
British Standard	2494-1955 Parti
Welding Electrodes	814-1970
Steel Sheets	225-1975
Guinitting	7322-1994
Welded Joints	3589-1966and 2041-1962
Tensile Test	223-1950
Mechanical and Electrical Works	
Turbine Pump	1710-1972
Submersible Pump	8030-1976
Submersible Motor	9283-1979
Earthing	3043-1966
Transformer	1180-1964
Generator	22 53-4722

B.BILL OF QUANTITIES

Sl. No.	Item Description	Quantity	Units
1	2	4	5
1	**GRAVITY MAIN**		
1.01	**Supply of HDPE pipes including specials**		
1.02	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 50mm Outer Dia.	9000.000	m
1.03	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 40mm Outer Dia.	800.000	m
1.04	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 32mm Outer Dia.	600.000	m
1.05	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m and filling back soil after laying pipe.(All classes of soil)	986.000	m3
1.06	Laying UPVC pipes with specials, solvent cement from the stacking place of work site, lowering into trenches already made,placing in position aligning the pipe to lines and levels and jointing the pipes and specials with solvent cement and testing the pipe line with water to the required test pressure,including hire charges for all tools,testing equipments,cost and conveyance of water etc.complete.		
1.07	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 50mm Outer Dia.	9000.000	m
1.08	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 40mm Outer Dia.	800.000	m
1.09	HDPE Pipe PE 100 (IS 4984/1995), 10kg, 32mm Outer Dia.	600.000	m
1.1	Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) :		
1.11	50 mm nominal bore	3.000	nos
1.12	40 mm nominal bore	3.000	nos
1.13	32 mm nominal bore	4.000	nos

1.14	Centering and shuttering including strutting, propping etc. and removal of form work for: Foundations, footings, bases for columns		
1.15	For anchor blocks	6.400	m2
1.16	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level: 1:2:4 (cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)		
1.17	For anchor blocks	0.640	m3
1.18	**RESERVOIR**		
1.19	Clearing jungle including uprooting of rank vegetation, grass, brush wood,trees and saplings of girth up to 30 cm measured at a height of 1 m aboveground level and removal of rubbish up to a distance of 50 m outside theperiphery of the area cleared.	10.000	m2
1.2	Applying one coat of water thinnable cement primer of approved brand and manufacture on wall surface	264.200	m2
1.21	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade:	264.200	m2
1.22	Lettering with black Japan paint of approved brand and manufacture:- Painting letters or figures 13cm,15cm or 18cm height (Block,Roman,Italic or Indian) with any kind of paint.Details of cost of 100 letters of 13cm,15cm or 18cm height.	4200.000	cm
1.23	**DISTRIBUTION NETWORK**		
1.24	**Supply of PVC pipes including specials**		
1.25	25mm pvc CL 5	1200.000	m
1.26	32mm pvc CL 5	2400.000	m
1.27	Providing and fixing G.I. pipes complete with G.I fittings including trenching and refilling etc. External work		
1.28	40mm GI medium	210.000	m
1.29	25mm GI medium	705.000	m
1.3	20mm GI medium	145.000	m

1.31	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift up to 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m and filling back soil after laying pipe.(All classes of soil)	648.000	m3
1.32	Laying UPVC pipes with specials, solvent cement from the stacking place of work site, lowering into trenches already made,placing in position aligning the pipe to lines and levels and jointing the pipes and specials with solvent cement and testing the pipe line with water to the required test pressure,including hire charges for all tools,testing equipments,cost and conveyance of water etc.complete.		
1.33	25mm pvc CL 5	1200.000	m
1.34	32mm pvc CL 5	2400.000	m
1.35	Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) :		
1.36	40 mm nominal bore	2.000	nos
1.37	32 mm nominal bore	2.000	nos
1.38	25 mm nominal bore	3.000	nos
1.39	Providing new connections to the households including earthwork excavation in hard soil and depositing on banks, taking connection from existing water main, laying house connection pipe 20mm PVC CL5 pipe for an average length of 5m underground and required length for providing class B multijet magnetic water metre, with u-trap, fitting air valve, Ball valve,supply and fixing suitable ferrocement/synthetic fibre made water metre protection box, 15mm brass body, water metre valve,Platform of size 60x60x10 using PCC 1:2:4 ,75mm PVC stand post with end cap,saddle piece etc complete as per the approved drawing including cost and conveyence of all materials	180.000	nos
1.4	GST Amount	1.000	Rs