



PHE DBR

**VOL – V**

CONSTRUCTION OF PROPOSED CENTRE OF  
EXCELLENCE OF FIRE TESTING TRAINING AND  
RESEARCH LABORATORY AT IIT, PATNA

## Table of Contents

|   |    |
|---|----|
| 1. Description of Project .....   | 2  |
| 1.1. LOCATION: CENTRE OF EXCELLENCE OF FIRE TESTING TRAINING AND RESEARCH LABORATORY AT IIT, PATNA .....          | 2  |
| 1.2. RAINFALL AND CLIMATE: .....  | 2  |
| 1.3. Plumbing Services (Water Supply and Sanitary Installation): .....  | 2  |
| Code & Regulations be followed for design.....  | 2  |
| 1.4. Basis of calculation:.....   | 3  |
| 1.5. Storm Water Design Parameters.....   | 4  |
| 1.6. Scope of contractor (designing & built): .....   | 4  |
| 1.7. General:.....  | 4  |
| 1.8. SPECIFICATION:.....  | 5  |
| 1.9. APPROACH TO PLANNING .....   | 5  |
| 1.10. SYSTEM REQUIREMENTS.....  | 6  |
| 2. WATER REQUIREMENT .....  | 7  |
| 3. SOIL/WASTE DISPOSAL .....  | 11 |
| 3.5.1. CP & SANITARY FIXTURES (Samples to be approved post sampling by the E/I or higher authority from BCD)..... | 15 |
| 2. CONNECTIONS TO VARIOUS MECHANICAL EQUIPMENT SUPPLIED BY OTHER AGENCIES.....                                    | 37 |
| 3. COMMISSIONING & GUARANTEE .....  | 39 |
| i. SCOPE OF WORK.....   | 39 |
| ii. PRE COMMISSIONING .....   | 39 |
| iii. FINAL ACCEPTANCE TESTS.....  | 40 |
| iv. REJECTION OF INSTALLATION / PLANT .....   | 40 |
| v. WARRANTY AND HANDOVER .....  | 41 |
| vi. HANDING OVER OF DOCUMENTS.....  | 41 |
| 4. MAKE LIST .....  | 42 |

## 1. Description of Project

1.1. LOCATION: CENTRE OF EXCELLENCE OF FIRE TESTING TRAINING AND RESEARCH LABORATORY AT IIT, PATNA

1.2. RAINFALL AND CLIMATE:

|   |    |                        |
|---|----|------------------------|
| Bihta has a humid subtropical climate with extremely hot summers from late March to June, the monsoon season from late June to late September and chilly winter nights and foggy or sunny days from November to February. | -- | May, June December,    |
| Hottest Months Coldest Months   | -- | January                |
| Rainy Season  | -- | June to September      |
| Average Annual Rainfall   | -- | 1,145.8mm (45.11 inch) |
| Average rainy days (Annual)   | -- | 54.2 Days              |
| Temperature   | -- | Max. 46 C and Min. 10C |

1.3. Plumbing Services (Water Supply and Sanitary Installation):

Code & Regulations be followed for design

- a. National Building code of India - 2016
- b. Local by laws for fire.
- c. CPHOO Manual for Water supply & Treatment
- d. CPHOO Manual for Sewerage & Sewerage Treatment
- e. SP 35 - Handbook on water supply and drainage with special emphasis on plumbing
- f. BIS 1172 - Code of basic requirements for water supply drainage and sanitation
- g. Uniform Code of Plumbing Latest Edition.
- h. Manual on water supply and treatments published by Central Public Health and Environment Engineering Organization Ministry of Urban Development, Govt. of India.
- i. Manual of sewerage and sewage treatment published by Central Public Health and Environment Engineering Organization Ministry of Urban Development, Govt. of India.
- j. Relevant BIS Codes.
- k. Good Engineering Practice.
- l. BIS 13039:2014 External Hydrant system
- m. BIS 15105 : 2016 Design & Installation of sprinkler system
- n. BIS 12469 :- Firefighting pumping system
- o. Generic requirement even though not mentioned in DBR for proper functionality of building has to be adhered.

1.4. Basis of calculation:

- a. Type: Educational use campus.
- b. Population data – As per calculation sheet.
- c. Water supply design parameter: Water consumption – As per calculation sheet.
- d. Water efficient fixture will be used for reducing water consumption.
- e. Minimum pressure considers in designing of water supply system will be 1.25 Kg/cmsq and Maximum pressure restricts to 2.5kg/cmsq in line.
- f. Storage of water: 1-day water requirement for Underground tank (UGT) & 1/2 day of water required for Over head tank (OHT).
- g. For water supply design calculation **Hazzan William's** equation should be used.
- h. **Sewerage design parameter:**
  - i. Sewage flow
    - i. 80% of domestic & 100% of flushing water requirement. (Except water used for gardening & Irrigation).
    - ii. Peak factor – 3 x Average flow
    - iii. Subsoil infiltration 25% of sewage av flow
    - iv. Minimum velocity – 0.75m/sec
    - v. Maximum velocity – 3m/sec
    - vi. Minimum dia of sewer pipe shall be 150 mm dia for branch line and 225 mm dia for main line.
  - j. Flow condition of pipe-
    - i. Pipe up to 225 dia – flow ½ full run
    - ii. Above 225mm dia – 1/3 full run.
  - k. Manholes: The manholes are to be constructed with brick masonry as per standard specifications of NBC 2016 and shall have details as follows:
    - i. Type 'A'- Rectangular of size 900x800 mm up to 900mm depth.
    - ii. Type 'B'- Rectangular of size 1200x900 mm from 900 mm & up to 2.45 m depth.
    - iii. Type 'C'- Circular Manhole of Size 910 mm dia for depth up to 1.67m. Circular Manhole of Size 1220 mm dia for depth above 1.67m & depth up to 2.30m. Circular Manhole of Size 1520 mm dia for depth above 2.30m.
    - iv. Rectangular road gully chamber of size 500 x 450 mm.

Spacing of Manholes

- v. Manhole shall be provided in all the junctions, change of directions, change in diameters and as per connection requirement from every units.

- vi. Distance between manholes should be maintained as per the NBC-2016 for different dia of pipes.
- vii. Kitchen Effluent: Proper Oil and Grease trap (Modular type) to be consider before disposal to main sewer line.
- 1. For drainage design calculation Manning's Formula should be used.

#### **1.5. Storm Water Design Parameters**

Rain fall data consider @ 100mm/hr designing the Rain water Harvesting and 50mm/hr design for external storm water design. However, The EPC contractor shall verify and in case, the rain fall intensity is higher, same shall be adopted.

Minimum Pipe diameters for Rainwater Pipes from Terraces shall be 110mm and maximum 160 mm dia.

All construction specifications with respect to the manhole sizes etc. will be respected and followed and as per NBC-2016/BCD//CPWD specification.

The complete campus storm water drainage system designed with underground RCC pipe line with clay brick catch basin and manholes etc.

#### **1.6. Scope of contractor (designing & built):**

The EPC Contractor shall provide all sanitary engineering services and specification in relation to:

High standards of materials and workmanship.

Leak proof plumbing.

Reliable and dependable engineering systems.

Plan the system in such a way as to minimize the energy requirements.

Create minimum nuisance and disturbance to the environment.

#### **1.7. General:**

- i. The EPC Contractor shall carry out design, supply, installation, testing & commissioning of the water supply, sanitary installations and drainage system and integration with the existing system, all complete.
- ii. The water supply system shall be gravity based and water supply system for domestic water supply shall consist of interconnecting pipes, valves etc. as required for new buildings. For continuous water supply at adequate pressure, complete water supply system shall be designed. The sanitary installations systems and drainage systems shall be designed as per relevant BIS

Codes and in conformance with the NBC-2016/BCD//CPWD specification and the guidelines given in the DBR.

- iii. The work shall in general conform to the Latest NBC-2016/BCD//CPWD specification.
- iv. All plumbing related drawings (Water supply, drainage, sewerage) shall has to be vetted by NIT/IIT before submission to BCD for final approval.

#### 1.8. SPECIFICATION:

##### **Plumbing Services (Water Supply and Sanitary Installation):**

- i. Survey of the Site to know the topography
- ii. Source development i.e. bore well & connection from municipal line
- iii. Pumping system to all required place
- iv. Water distribution system through hydro-pneumatic system
- v. Hot water system
- vi. Sewage disposal system.
- vii. All internal toilet including its soil & waste pipe and water supply pipe
- viii. Strom water management
- ix. Rain water harvesting
- x. Preparation of all drawing for PHE Services
- xi. Taking approval of the design and drawing before start of work.
- xii. Taking approval of drawing and design from concern authority / consultant.
- xiii. Carrying our ground water survey and taking approval of digging bore - well from concern authority.

#### 1.9. APPROACH TO PLANNING

The Plumbing services for the project shall be designed keeping in view the following:

- 1.9.1 Requirement of adequate and equal pressure of hot and cold water in laboratories and public toilets and other designated areas. Cold water makeup supply to water bodies shall also be ensured for laboratories as per its requirement and direction given by Engineer in Charge.
- 1.9.2 The domestic water storage tank capacity shall be adequate to ensure availability of water for 1 & ½ days required (1 day in UGR & ½ days in OHR).

1.9.3 Levels of roads / pavements and other services in the area.

1.9.4 Drainage and water supply provision for Landscape layout.

1.9.5 Water conservation using low flow fixtures as per PCB guide line.

#### 1.10. **SYSTEM REQUIREMENTS**

1.10.1 Domestic water supply through a set of centrifugal mono block pumping unit systems at pump room, to pump out the domestic water from UGR to individual OHR.

1.10.2 Sewage and sludge collection & conveyance system based on ASPE standard and applicable guidelines by NBC.

1.10.3 Storm / rain water drainage system from the roof terrace and various levels of the building, including balcony drains, planter drains and fountain drains to be discharged to Local Authority storm water drain.

## 2. WATER REQUIREMENT

2.1. Water requirement has been calculated for the Proposed Rajendra Bhawan, Governor's Secretariat and Guest House within the campus of Raj Bhawan

| Sl. No. | Block Name                                | Total Nos. of person | Water requirement                        |                               |  |                               | Total Flushing + Domestic water requirement | Flow to Sewer    |                   |                |
|---------|---|----------------------|--|-------------------------------|--|-------------------------------|---|------------------|-------------------|----------------|
|         |   |                      | Flushing water per person per day in Lit | Total Flushing water in Lits. | Domestic water per person per day in Lits. | Total Domestic water in Lits. |   | 85% for Domestic | 100% for Flushing | Total          |
|         |   |                      |  |                               |  |                               |   |                  |                   |                |
|         | <b>Total capacity of Staff = 100 Nos.</b> | 100                  | 20                                       | <b>2000</b>                   | 25   | <b>2500</b>                   | <b>4500</b>                                 | 2125             | 2000              | <b>4125</b>    |
|         | <b>Floating people = 50 Nos.</b>          | 50                   | 10                                       | <b>500</b>                    | 5  | <b>250</b>                    | <b>750</b>                                  | 213              | 500               | <b>713</b>     |
|         | <b>Total Water Requirement</b>            |                      |  | <b>2500</b>                   |  | <b>3000</b>                   | <b>5250</b>                                 |                  | 2500              | <b>4838</b>    |
|         | <b>TOTAL (SAY)</b>                        |                      |  | <b>2.5 KLD</b>                |  | <b>3.0KLD</b>                 | <b>5.2 KLD</b>                              |                  |                   | <b>4.8KL D</b> |

CONSIDERING PER PERSON PER DAY WATER REQUIREMENT AS PER NBC 2016

(See NBC 2016, Part-9, Section -1, Table -1, Clause - 4.1.2; Page - 12)



## 2.2. SUMMARY OF WATER CALCULATION FOR RAJENDRA BHAWAN, GOVERNOR SECRETARIAT AND GUEST HOUSE

| SL. No.  | DESCRIPITON                             | TOTAL in Lits. | TOTAL (SAY) |
|--|---|----------------|-------------|
| 1  | DOMESTIC WATER REQUIREMENT (COLD + HOT) | 3000           | 3.0 KLD     |
| 2  | FLUSHING WATER REQUIREMENT              | 2500           | 2.5 KLD     |
| 3  | TOTAL WATER REQUIREMENT FOR THE PROJECT | 5500           | 5.5 KLD     |
| 4  | FLOW TO SEWER                           | 4838           | 4.8 KLD     |
| To be decided as per design approval from BCD and per the decision of E/I. |   |                |             |

## 2.3. WATER STORAGE SIZING

Incoming water supply from Bore Well / Local Authority shall be brought to the Central underground water storage tanks. It is proposed that treated water storage equivalent to cumulative one day of water requirement shall be provided at this location.

**Calculation of Bore well Only for Fresh water/ Raw water (assuming No Municipal water available) and for firefighting.**

**Total Fresh water requirement = 5500 ltrs**

**Total water requirement = 75000+5500= 80,500 ltrs**

**Assumed that total water will be meet from Bore well**

**Yield of water assumed = 9000 LPH**

**No of Tube well required = 1 nos.**

The incoming Local Authority / Bore Well water supply line shall be led into Fire Reserve tanks from where it will be allowed to overflow in treated water storage tanks.

In addition, domestic water as well as flushing water storage tanks equivalent to half days of water requirement will also be provided on roof. The domestic water tanks will receive water supply from the main underground domestic water tanks.

**Under Ground Reservoir Capacity:-**

| Sl. No. | Description   | Capacity in Lits | Remark  |
|---------|---|------------------|---|
| 1       | Underground Domestic Water Storage Tank required      | 2,000 Lits       | One day of the total Domestic water requirement for the project                               |
| 2       | Underground Fire Reservoir attached with Domestic UGR | 75,000 Lits.     | To be provided as per NBC part IV 2016  |
| 3       | Total capacity of Rain Water Harvesting Tank required | 2,700 Lits.      | To be provided as per MoEF guidelines as per site requirement.                                |
| 4       | Total Nos. of Rain Water Recharge Pits                | 1 Nos            | No. of Rain Water Recharge pit shall be as per RWH and Conservation manuals. CPWD & NBC norms |

#### Over Head Reservoir Capacity:-

| Sl. No. | Description       | OHR Domestic | OHR Flushing | OHR Fire                 | Remarks   |
|---------|-------------------|--------------|--------------|--------------------------|---|
| 1       | For All Buildings | 2,000 Lits   | 1000 Lits.   | As per NBC part IV, 2016 | Half days (1/2) Storage of the total water (Domestic + Flushing) requirement of the project |

#### 2.4. Water Distribution

The domestic overhead water tanks as well as the flushing water over head water tanks at the terrace of the building shall receive water through **Fixed Speed Centrifugal pumps** to be installed in the Fire & Domestic Pump Room room respectively. Water distribution shall be designed to ensure availability of minimal residual pressure of at all user outlets. Pipe sizing shall be based on fixture unit calculation as per ASPE standard. However, the maximum velocity in the water supply piping shall not exceed 2 m/second.

Color coding for domestic water, fire wet riser supply piping shall be ensured for clear identification of the piping.

#### 2.5. APPURTENANT

Following appurtenant shall be included in the design of water supply system for efficient functioning:

▪ **Domestic Air Vents**

Automatic air vents shall be provided on cold water risers to eliminate possibility of air locking and to ensure efficient water flow / pressure availability at the user outlets.

▪ **Backflow Prevention**

Double check type back flow prevention valve shall be provided on all connections to non-potable water systems for ensuring high hygiene standards.

▪ **Flow Restrictors**

Appropriate flow restrictors shall be provided for economizing on water consumption. The flow restrictors shall be typically sized for following flow / discharge. The **flow rate** should be confirmed by the **PCB Consultant**.

|               |   |                |
|---------------|---|----------------|
| Wash Basin    | : | 4.75 – 3.8 LPM |
| Water Closets | : | 3 – 6 LPM      |
| Shower        | : | 6-8 LPM        |
| Kitchen Sink  | : | 4-6 LPM        |
| Faucet        | : | 3-4 LPM        |

▪ **Gate Valve**

Full bore gun-metal gate valve or CP concealed stop cock shall be provided for isolation of water supply in the designated areas. Further Superior quality chrome-plated angle valve shall be provided for cold / hot water isolation to wash basin faucets and for WC cistern water supply.

▪ **Pressure Gauge**

Pressure Gauge shall be provided on each type of water supply piping for efficient balancing and monitoring of the system if required.

The water distribution for the Complex shall be under gravity through overhead tanks and designed on principle of zoning to ensure availability of adequate residual head at user outlet.

2.6. **RO water system:**

RO water will be required for drinking purpose. A centralized RO system is proposed. Minimum Capacity of RO System will be 2000 Ltrs/Hr & stored in a food Grade HDPE Tank. RO water will be supplied through a set of pressure pump to the required place & in required pressure, mainly Kitchen area. All R.O. system shall have activated carbon filter, UV treatment unit along with TDS controller, filtration unit, minerals controller as per latest technology.

## 2.7. Pumping & Distribution System:

### i. Domestic Water:

Domestic water from domestic water tank shall be transmitted via domestic pumping system (HPN) to the overhead fire water tank from this water will be over flow to the domestic water over head tank of the building and from this water shall be supplied by gravity to all user points. The system shall be designed to take care of peak demand of water and a residual pressure at the ground floor users' point shall be minimum 1.25 kg/cm<sup>2</sup>. Water supply system will be completely automatic through level controller and proper level should be setup in all the tanks to monitor the level of water.

The sizing of the entire distribution network is based on the simultaneous use of fixture unit's demand.

A shut off valve is provided within the battery limit of each sub branch, which serves for the purpose of maintenance of any utility.

Individual toilets will be provided with main control valve for isolation and maintenance of the same.

Air release valve, non- returning valve and water hammer arrester shall be provided as per requirement of the design.

## 3. SOIL/WASTE DISPOSAL

### 3.1. CONCEPT OF THE SYSTEM

The system shall be designed keeping in view the following:

- Natural grading of the site.

- Layout of different facilities in the building
- Levels of road and other services in the Vicinity.
- Sub-soil water table.
- Soil conditions

### 3.2. Approach to Planning

The drainage system shall be a double stack system as per **National Building Code**, in which the soil & waste pipes shall be separated with vents. The disposal from water closets & waste pipe shall be connected to the vertical soil & waste stack respectively. All traps of water closets and the urinals shall be completely vented in the system. Local manholes shall be finally connected to main existing Local Authority drain line.

Vent system shall be designed to facilitate escape of gases and odor from all parts of sanitary & waste system to the atmosphere at a point above the building and to allow admittance of air to all part of the system, so that siphonage, aspiration or back pressure conditions do not cause loss of seal at traps.

The location of stacks shall be coordinated with other services and in consultation with the Architect.

Provision for cleaning eyes shall be made at strategic locations to facilitate system maintenance.

### 3.3. DESIGN CRITERIA

The system shall be designed as per design criteria stipulated in the “Manual for Sewerage & Treatment” published by the **Central Public Health and Environment Engineering Organization, Ministry of Urban Development, Govt. of India, IS-SP/35(S&T)-1987** and National and International practices on the subject. These criteria are as follows:

|    |                       |   |                                 |
|----|-----------------------|---|---------------------------------|
| a. | Flow of sewage        | : | 85% of water supply (peak flow) |
| b. | Peak flow             | : | 3 times average flow            |
| c. | Min. diameter of pipe | : | 150/200 mm dia                  |
| d. | Min. velocity in pipe | : | 0.6 m / second                  |
| e. | Max. velocity in pipe | : | 2 m / second                    |

|    |   |                     |
|----|---|---------------------|
| f. | Flow conditions in pipes:                         |                     |
|    | Pipes upto 400 mm dia                             | : 0.50 full running |
|    | Pipes above 400 mm dia                            | : 0.67 full running |
| g. | Min. depth of pipe below ground level:            |                     |
|    | For branches                                      | : 0.45 m            |
|    | For other   | : 2.10 m            |
| h. | Formula for calculation and design of sewer lines | : Manning's Formula |

**Wherever required, all balconies, terraces, planters and other formal landscape areas will be drained by vertical down takes or other type of drainage system. ( Polyurea water proofing along with drain cell and geofabric must be used for proper drainage)**

### 3.4. STORM WATER DISPOSAL SYSTEM

- Maximum intensity of rainfall is assumed as 100 mm/hr.
- Co-efficient of Run-off is taken as per NBC-2016.
- Road camber is taken as 1:100 for concrete roads starting from center.
- Surface slope as minimum 1:500.

#### 3.4.1. Disposal System

- Rain water pipes / spouts will be provided in terrace for taking out rainwater.
- Slope of natural ground and infiltration capacity of open ground within the plot will not be sufficient to absorb / dispose off surface water. Percolation wells will be provided for rainwater harvesting and to raise subsoil water level. Excess rain water will be disposed to the available storm water drain.
- The rainwater will be disposed off into percolation / rain water harvesting pits. The overflow from the percolation / rainwater harvesting pits will be connected to the nearby storm water drain available from local public body.
- A grating at the main entrance will be provided to prevent entry of outside rainwater to the premises.

- e. All road crossings for services shall be provided with RCC pipe and manholes for the ease of maintenance and to avoid any digging of roads.
- f. Ground shall have minimum 1:500 surface slopes towards storm water collection system.
- g. The storm water collected from the terraces of the buildings can be used to recharge the ground water by providing a network of rainwater recharge pits at suitable intervals.
- h. Modular Rainwater Harvesting System should be used as per NBC and Rainwater Harvesting & Conservation Manuals.

### 3.4.2. RAIN WATER DISPOSAL

In general the rain water from terraces and other open areas shall be collected through rain water down-take pipes and storage directly to Rain Water Harvesting Tank and the over flow shall be allowed to connect the Rain Water Recharge pit or to Local Authority Storm Water Drain.

Calculations for rainwater harvesting pits are given below in:

#### Available Run-off from Site

| S. No.               | Catchment   | Area (sq m) | Run-off Coefficient | Average Annual Rainfall (m) | Available Annual Run-off (cum) |
|----------------------|-------------|-------------|---------------------|-----------------------------|--------------------------------|
| 1.                   | Roof top    | 1391        | 0.9                 | 1.14                        | 1428                           |
| 2.                   | Green       | 472         | 0.1                 | 1.14                        | 54                             |
| 3.                   | Paved Areas | 1480        | 0.7                 | 1.14                        | 1182                           |
| <b>Total Run-off</b> |             |             |                     |                             | <b>2664</b>                    |

#### Calculation for RWH Pits

| S. No.                | Catchment   | Area (sq m) | Run-off Coefficient | Peak Hourly Rainfall (m) | Available Annual Run-off (cum) |
|-----------------------|-------------|-------------|---------------------|--------------------------|--------------------------------|
| 1.                    | Roof top    | 1391        | 0.9                 | 0.01                     | 13                             |
| 2.                    | Green       | 472         | 0.1                 | 0.01                     | 0.47                           |
| 3.                    | Paved Areas | 1480        | 0.7                 | 0.01                     | 10.40                          |
| <b>Total Run-off</b>  |             |             |                     |                          | <b>84</b>                      |
| <b>Retention Time</b> |             |             |                     |                          | <b>15 min</b>                  |

|                                    |           |
|------------------------------------|-----------|
| <b>Available Run-off in 15 min</b> | <b>21</b> |
| <b>Volume of RWH System</b>        | <b>3</b>  |
| <b>Nos. of Pits Provided</b>       | <b>1</b>  |

### 3.4.3. STORM WATER DISPOSAL

The entire storm water from the campus would be disposed by suitable drainage system to the rainwater harvesting system and excess is disposed off to the existing storm water drain outside the campus.

The RCC drains channel shall be provided at the road ends to collect the Rain Water in Harvesting Sump and overflow shall be connected to external storm water drain & recharge soak pits at suitable intervals as per landscaping layout.

### 3.5. SANITARY FIXTURES & FITTINGS (All fixtures should be approved by GRIHA)

All sanitary wares shall be white superior quality vitreous china. Water closets (European pattern) shall be wall hung or floor mounted as per Architectural designed. Water closet shall be provided with concealed dual flush type cistern.

All wash basins throughout the building shall be of white vitreous china under or over counter, oval wash basin / flat back wash basins with or without pedestal, and hot and cold water single lever mixer fitting, waste coupling with CP bottle trap fixed to the outlet. Inlet connections shall be connected by CP angle stop cocks below the counter.

Shower in the toilets shall have a cold & hot water arrangement with single lever diverter or wall mixer and CP spout with hand shower provision shall be provided. The shower arm and rose / rain shower shall be of throw away type and the spray from the rose shall be adjustable.

All sinks in kitchens shall be of stainless steel with or without single / double drain board and cold / hot water mixer fittings. CP waste coupling and bottle trap shall be provided in the pantries.

Suitable superior quality accessories such as CP toilet paper holder, CP towel rails, CP soap dish shall be provided at suitable locations toilets.

#### 3.5.1. CP & SANITARY FIXTURES (Samples to be approved post sampling by the E/I or higher authority from BCD)

##### 3.5.1.1. SCOPE OF WORK



- a. Work under this section shall consist of furnishing all material and labour as necessary and required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the schedule of quantities.
- b. Sanitary fixtures (samples to be approved from Engineer in charge) shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the project.
- c. Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.

#### 3.5.1.2. GENERAL REQUIREMENTS

- a. All fixtures and fittings shall be provided with all such accessories as required to complete the item in working condition whether specifically mentioned or not in the schedule of quantities, specifications, drawings.
- b. All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural/interior designer's requirements.
- c. Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required or as per directions of Architect/Engineer-in charge.
- d. All fittings and fixtures shall be fixed in a neat workmanship manner true to levels and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at contractor's cost.
- e. When directed, contractor shall install fixtures and accessories in a mock-up room for the approval of the Architect/Engineer-in charge. Sample room fixtures may be reused on the works if undamaged, but no additional payment for fixing or dismantling shall be admissible.

#### 3.5.1.3. MATERIALS:

| S. NO. | Description                           | Material                                    |
|--------|---------------------------------------|---|
| 1      | Pumping                               | Submersible pump as required                |
| 2      | Rain water harvesting                 | Modular System                              |
| 3      | Storm water drainage                  | RCC-Hume Pipe as per IS 458: 2003           |
| 4      | External Sewage                       | RCC-Hume Pipe as per IS 458: 2003           |
| 5      | External water supply                 | HDPE pipe as per IS 4984:2016               |
| 6      | Internal Soil,Waste Vent & Rain water | SWR-PVC as per IS:13592- 1992 or latest.    |
| 7      | Internal water supply                 | CPVC as per IS 15778                        |
| 8      | Hot water                             | Centralized Geysers                         |
| 9      | Hot water pipes                       | Pipe insulation with 9/13 mm Nitrile rubber |

#### **a. INDIAN W.C.**

a. Indian W.C. pan shall be White Vitreous china Orissa pattern W.C. pan of size 580x440 mm with integral type foot rests. Each W.C. shall be provided with a 100mm dia cast iron or porcelain P or S trap with or without vent horn.

b. W.C. shall be flushed by means of a 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever) conforming to IS : 7231. complete with accessories.

c. The W.C. shall be fixed in level in a neat workmanlike manner. The W.C. and trap shall be set in cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20mm nominal size). Joints between W.C. and flush pipe shall be made with a putty or white lead and linseed oil and caulked well or with an approved rubber joint.

#### **b. EUROPEAN W.C.**

a. European W.C. shall be white vitreous china wall hung water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C. concealed flushing cistern, including flush pipe, with manually controlled device (flush plate), conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls.

b. Each W.C. seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C.

**a. SENSOR URINALS**

Urinals shall be 580x380x350 mm with white PVC automatic flushing cistern, with fittings, standard size C.P. brass flush pipe, spreaders with unions and clamps (all in C.P. brass) with waste fitting as per IS : 2556, C.I. trap with outlet grating and other couplings in C.P. brass, including painting of fittings

**b. LAVATORY BASIN**

- a. Wash basin with C.I. brackets, 15 mm dia CP Brass single hole basin mixer of approved quality and make, including painting of fittings and brackets, cutting and making good the walls wherever required.
- b. Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 cms above the floor or as directed by Architect/Engineer in charge.

**c. MIRRORS**

- a. Bevelled edge mirror of superior glass (of approved quality shall be electro coated copper 6mm thick of guaranteed reputed make. The size shall be 600x450 mm or as per the interior design. The image shall be clear and without waviness at all angles of vision.
- b. Mirrors shall be provided with backing of 12mm thick marine plywood sheet fixed with C.P. brass semi- round headed screws and cup washers or C.P. brass clamps as per the interior design.

**d. ACCESSORIES**

- i. All chromium plated and porcelain accessories as shown on the drawings or directed by Architect/Engineer in charge.
- ii. All C.P. accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by Architect/Engineer in charge.

- iii. Porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand ) and fixed in relation to the tiling work.

**e. TOILET CUBICLE PARTITION**

**DIVIDERS** - 12mm thick compact laminate options available for divider panels, providing a robust structure fixed with premium quality Wall Fixing Profiles.

**MID & END PANELS** – Mid and End Panels provide stability to the whole structure made from 12mm thick compact laminate, hence providing a thick, durable structure.

**DOORS** - 600mm wide doors are made from 12mm thick compact laminate.

**The partition to be approved from BCD /primary Architect.**

**f. URINAL PARTITIONS**

Urinal partitions shall be of high pressure laminates (HPL) of very good quality (Greenlam or equivalent) or of Granite double moulded as per specifications approval from the E/I before installation. fixed at proper heights with C.P. brass bolts, anchor fasteners and M.S. clips as recommended by the manufacturer and directed Architect/Engineer in charge.

## 1.1. Brief outline specification for major equipment

### 1.1.1. HUBLESS PIPES & FITTINGS

Hubbless centrifugally cast (spun) iron pipes epoxy coated inside & outside IS:15905 for Soil, Waste water and Vent pipes with complete fittings as per the design and plumbing layout finalized by the BCD/ Architect.

### 1.1.2. TRAPS:

#### NAHANI TRAP OR FLOOR TRAPS

Nahani traps or floor traps shall be SWR deep seal with an effective seal of 50 mm.

The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) mixed with water proof compound and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30 x 30 cms of the required depth. The trap shall be installed at lowest point ensure no pending occurs at perimeters of the drain.

#### FLOOR TRAP INLET

Bath room traps and connections shall ensure free and silent flow of discharging water.

### 1.1.3. C.P./STAINLESS STEEL GRATINGS

Floor and Urinal traps shall be provided with 100-150mm square or round C.P./Stainless steel grating as approved by Client's Representative with rim, of approved design and shape. Minimum thickness shall be 4-5mm or as specified in the Bill of Quantities.

### 1.1.4. CLEANOUT PLUGS

Contractor shall provide cast brass cleanout plugs in all horizontal run more than 15 meter length required one cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket and lead caulked joint.

### 1.1.5. PIPE SLEEVES

Pipe sleeves 50mm larger diameter than pipes shall be provided wherever pipes pass through walls and slabs and annular space filled with fire proof materials like putty, fire seal etc. All

pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matters. Vertical sleeve shall finish 50mm above finish floor level.

#### **1.1.6. ENCASING IN CEMENT CONCRETE:**

Encasing of pipes is required to provide stability to the line and prevent its damage during construction.

#### **1.1.7. SOIL AND WASTE PIPES UNDER FLOOR**

Pipes laid in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement: 2 coarse sand : 4 graded stone aggregate 12mm size) 75mm in bed and all round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height at intervals of 1.8m. All drainage pipes except when fixed above ground or in exposed locations shall be encased in cement concrete as specified above for soil and waste pipes. The bed and encasing thickness shall however be 150mm in bed and all round.

#### **1.1.8. CUTTING AND MAKING GOOD:**

Contractor shall provide all holes cut outs and chases in structural members necessary and required for the pipe work as building work proceeds. Wherever cut outs, holes are left in the original construction, they shall be made good with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 20mm nominal size) or cement mortar 1:2 ( 1 cement : 2 coarse sand) and the surface restored as in original condition.

#### **1.1.9. SLEEVES/CUTOUTS:**

Contractor shall utilize all cutout and sleeves provided during construction to prevent breaking. The annular space between the pipe and the sleeve shall be filled up with approved type of fire hydrant sealant. When sleeves are misplaced or inaccurately located (if any) contractor shall make the holes in the wall or structural members at his own cost.

#### **Testing:**

Entire drainage system shall be tested for water tightness and smoke tightness during and after completion of the installation. No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber bellow plugs, manometers,

smoke testing machines, pipe and fitting work test benches and any other equipment necessary and required to conduct the tests.

#### **1.1.10. THE SMOKE TEST SHALL BE CARRIED OUT AS UNDER:**

Smoke shall be pumped into the pipe at the lowest end from a smoke machine, which consist of bellow and a burner. The materials usually burnt is greasy cotton based which gives but a clear pungent smoke which is easily detectable by sight as well as by smell if there is leaking at any point of the drain.

All materials obtained and used on site must have manufacturers hydraulic test certificate for each batch of materials used on the site.

#### **1.1.11. JOINTING:**

The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions / recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:- Clean the outside of the pipes spigot end and the inside of the ceiling groove of the fitting.

Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm to make the pipe fully fitted to the fitting. The horizontal pipes on the wall shall be fixed with M.S. fabricated clamps with necessary provisions to take care the expansion and contraction in PVC pipes. The spacing of the clamps shall be at the intervals of 1.5 mtr to 2 meter depends on the requirement of the supporting arrangements. Solvent joints shall be used as per manufacturer recommendations.

Rubber Seal Rings for Joints & Access Doors: Manufactured in accordance with IS: 5382 for 75 mm / 90 mm / 110 mm sizes. These are made out of natural rubber with a shore 'A' hardness pf 40 × 5. Provide superior resistance to biological attack. Special design of cross section ensures perfect sealing. Lubricant: Available in 100 gms, 250 gms & 500 gms packing. Specially formulated for compatibility with rubber seal as well as PVC which does not support the growth of bacteria or fungi.

#### **1.1.12. PIPE, HANGERS, SUPPORT, CLAMP, BRACKETS ETC.:**

##### **1.1.12.1. SUPPORTS:**

UPVC pipes require supports at close intervals. Recommended support spacing for unplasticised PVC pipes is 1200 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

#### **1.1.12.2. TESTING:**

Before the system is put into use, it should be tested for leakages by air test, hydraulic test or smoke test. All lengths of PVC SWR water pipes shall be fully tested for water tightness by means of water test maintained for not less than 30 minutes. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water head. The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

#### **1.1.12.3. LAYING AND JOINTING:**

The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and 'O' rubber ring for vertical line. The type of joint shall be used as per site conditions/direction of the Client's Representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with G.I. adopter for insertion in the R.C.C. slab for a water proof joint complete.



#### **1.1.12.4. REPAIRS:**

While temporary or emergency repairs may be made to the damaged pipes, permanent repairs should be made by replacement of the damaged section. If any split or chip out occurs in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated sufficiently to soften it so that it may be slipped over the damaged hard pipe.

#### **1.1.12.5. MEASUREMENTS:**

These pipes shall be measured along the centre line of the pipe including all specials in Rmt. The quoted rate for respective items shall include the following:-

- a) Cost of respective pipes and specials and jointing materials.
- b) Laying, fixing and jointing with necessary clamps, brackets, screws, etc., and curing.
- c) Making good all damages to the parts of the building to suit the surroundings.
- d) Testing and making good the defects, if any

#### **1.1.13. CPVC PIPES**

The pipes shall be CPVC (Chlorinated Poly Vinyl Chloride) material for hot & cold water supply piping system with pipes as per CTs SDR -11 at a working pressure of 320 PSI at 23 deg C and 80 PSI at 82 deg.C, using solvent welded CPVC fittings i.e. Tees, Elbows, Couplings, Unions, Reducers, Brushing etc. including transition fittings (connection between CPVC & Metal pipes / GI) i.e. Brass adapters (both Male & Female threaded and all conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493, with clamps / structural metal supports as required /directed at site including cutting chases & fitting the same with cement concrete / cement mortar as required, including painting of the exposed pipes with one coat of desired shade of enamel paint. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of client.

#### **1.1.14. PP (Polypropylene) PIPES**

The pipes shall be **PP (Poly Propylene)** material for sewerage & drainage piping system. The pipe shall be round and shall be supplied in straight lengths with socketed ends (Push-fit with rubber seal). The internal & external surfaces of pipes shall be smooth, clean, and free

from grooving and others defects. The pipes shall be designed by external diameter and shall be conform to **EN 1451-1**

The pipe shall be **low noise level** (Less than **20db**). The smoke development category **Q1 (Low Smoke Development)** and the HTPP system meets the requirements of **EN 4102-2** with fire classification **B2**.

#### 1.1.15. UPVC PIPES AND FITTINGS

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, free from grooving and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS:13592. The pipes shall be of Class-B; 6 Kg/sqm pressure rating.

##### a. Fittings

Fittings shall be of the same make as that of pipes, injection molded and shall conform to Indian Standard.

##### b. Laying and Jointing

The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and 'O' rubber lubricant ring for vertical line. The type of joint shall be used as per site conditions / direction of the Owner's site representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with GI adopter for insertion in the RCC slab for a water proof joint complete as directed by Owner's site representative.

##### c. Supports

UPVC pipes require supports at close intervals. Recommended support spacing for unplasticized PVC pipes is 1400 mm for pipes 75 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

#### 1.1.16. VALVES

##### a. Isolation Valve

All valves (gate, globe, check, safety) shall be of gun metal suitable for the particular service as specified. All valves shall be of the particular duty and design as specified. Valves shall either be of screwed type or flanged type, as specified, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to ASTM specifications.

Sluice valves, where specified shall be flanged sluice valves of cast iron body. The spindle, valve seat and wedge nuts shall be gunmetal. They shall generally have non-rising spindle and shall be of the particular duty and design as specified. The valves shall be supplied with suitable flanges, non-corrosive bolts and gaskets.

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect with supply pipe.

| S.No | Type of Valve   | Size            | Construction | Ends    |
|------|-----------------|-----------------|--------------|---------|
| a.   | Isolating Valve | 15 mm to 50 mm  | Gun Metal    | Screwed |
|      |                 | 65 mm and above | Gun Metal    | Flanged |

|    |                                |                               |                        |                    |
|----|--------------------------------|-------------------------------|------------------------|--------------------|
| b. | Sluice Valve & Butterfly Valve | 65 mm and above               | Cast Iron              | Flanged            |
| c. | G.M. non return valve          | 15 mm to 50 mm<br>65 mm above | Gun Metal<br>Gun Metal | Screwed<br>Flanged |
| d. | Flap Type – Non Return valve   | 65 mm and above               | Cast Iron              | Flanged            |

All valves shall be suitable for the working pressure involved.

#### **b. Pressure Gauge**

The pressure gauge shall be constructed of die cast aluminium and stove enamelled. It shall be weather proof with an IP 55 enclosure. It shall be a stainless steel Bourdon tube type pressure gauge with a scale range from 0 to 16 Kg / cm square. Each pressure gauge shall have a siphon tube connection. The shut off arrangement shall be by Ball Valve.

#### **1.1.17. WATER FITTINGS**

Unless otherwise specified all Gunmetal fittings such as gate, globe, check & safety valves shall be fitted in pipe line in workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to desired pressure rating. The defective fittings and joints shall be replaced or redone.

#### **1.1.18. STORAGE TANKS UNDERGROUND & OVERHEAD TANK. (ACCESSORIES & CONNECTIONS)**

Storage tanks for water supply shall be in reinforced cement concrete built by the building contractor. Each tank shall be provided with a Heavy-Duty Cast-Iron manhole frame and cover. Proper waterproofing should be done in and outside to make it leak proof.

##### **Outlets and overflow –**

All nozzles for puddle flanges in RCC tank for inlet, outlet, overflow and scour etc. shall be provided by civil contractor., further connections and accessories shall be provided under this contract.

##### **Testing**

All pipes, fittings and valves, after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 7 kg / sq.cm whichever is higher. Pressure shall be maintained for a period of at least thirty minutes without any drop. A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Primary Consultant.

In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes' or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor during the defects liability period without any cost.

After commissioning of the water supply system, Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves, which do not effectively operate, shall be replaced by new ones at no extra cost and the same shall be tested as above.

#### **1.1.19. DRAINAGE (Sewers & Storm Water Drains)**

##### **Scope of work**

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all the drainage system as required by the drawings and specified hereinafter or given in the Schedule of Quantities.

Drainage system shall include: -

- a. Sewer lines including excavations, pipelines, manholes, drop connections and connections to the existing sewer.
- b. Storm water drainage, excavation, pipelines, manholes, catch basins, drain channels and connections to the existing storm water drain.

##### **General requirements**

- a. All materials shall be new of the best quality conforming to specifications and subject to the approval of the Architect/Engineer in charge
- b. Drainage lines and open drains shall be laid to the required gradients and profiles.
- c. All drainage work shall be done in accordance with the local municipal bye-laws.

- d. Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority.
- e. Location of all manholes, etc. shall be got confirmed by the Contractor from the Architect / Landscape Architect. As far as possible, no drains or sewers shall be laid in the middle of road unless otherwise specifically shown on the drawings or directed by the Architect/Engineer in charge

### **Alignment and grade**

#### **Excavation**

The sewer pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the Architect/Engineer in charge. No deviations from the lines, depths of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the Architect/Engineer in charge.

#### **Excavation in tunnels**

The excavation for sewer works shall be open cutting only, unless the permission of the Engineer in charge is obtained for laying pipes in tunnel where sewers have to be constructed along narrow passages or difficult ground.

#### **Opening out trenches**

In excavating the trenches, etc. the solid road metaling, pavement, kerbing, etc. and turf is to be placed on one side and preserved for reinstatement when the trenches or other excavation shall be filled up. Before any road metal is replaced, it shall be carefully sifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Architect/Engineer in charge.

The Contractor shall grub up and clear the surface over the trenches and other excavations of all trees, stumps, roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the Architect/Engineer in charge.

#### **Obstruction of roads**

The Contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall then be left for public and private transit, he

shall remove the materials excavated and bring them back again when the trench is required to be refilled. The Contractor shall obtain the consent of the Architect/Engineer in charge

### **Removal of filth**

All night soil, filth or any other offensive matter met with during the execution of the works, immediately after it is taken out of any trench, sewer or cess pool, shall not be deposited on to the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be put into the carts and remove to a suitable place to be provided by the Contractor.

### **Excavation to be taken to proper depths**

The trenches shall be excavated to such a depth that the sewer shall rest on concrete as described in the several clauses relating thereto and so that the inverts may be at the levels given in the sections.

### **Refilling**

After the sewer or other work has been laid and proved to be water tight, the trench or other excavations shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and up to 75cms above the crown of the sewer shall consist of the finest selected materials placed carefully in 15cms layers and flooded and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in 15cms layers with materials taken from the excavation, each layer is being watered to assist in the consolidation unless the Architect/Engineer in charge

### **Contractor to restore settlement and damages**

The contractor shall, at his own costs and charges make good promptly during the whole period the works are in hand, any settlement that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations and he shall be liable for any accidents caused thereby. He shall also at his own cost and expenses and charges, repair any make of any damage done to the buildings and other property.

### **Disposal of Surplus Earth**

The Contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

Timbering of sewer and trenches.

The contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, piling and sheeting and they shall be closed, timbered in loose of sandy strata and below the surface of the sub soil water level.

All timbering, sheeting and sheet piling with their walling and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse of subsidence of the walls of the trench shall be take place.

The contractor shall be held responsible and will be accountable for the sufficiency of all timbering, bracings, sheeting and sheet piling used as also for, all damage to persons and property resulting from improper quality, strength, placing, maintaining or removing of the same.

### **Shoring of Buildings**

The Contractor shall shore up or use sheet piles for all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident. No extra payment in this required shall be made.

### **Removal of water from sewer, trench etc**

- a) The Contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.
- b) If any excavation is carried out at any point or points to a greater width than the specified cross section of the sewer with its envelope, the full width of the trench shall be filled with concrete by the Contractor at his own expenses.



### **Width of trench**

Recommended width of trenches at the bottom shall be as follows :-

|                     |        |
|---------------------|--------|
| 100 mm dia pipe     | 55 cms |
| 150 mm dia pipe     | 55 cms |
| 225-250 mm dia pipe | 60 cms |
| 300 mm dia pipe     | 75 cms |

Maximum width of the bed concrete shall also be as above. No additional payment is admissible for widths greater than specified.

Maximum width of the bed concrete shall also be as above. No additional payment is admissible for widths greater than specified.

### **Materials:**

**Foamcore pipes (Below plinth from upto external chamber of respective block/building):** Foamcore pipes as per IS 16098:1 are basically multilayer pipes having outer and inner layers of conventional PVC and middle layer of foamed PVC. Outer and inner layers are designed to take the load while the middle layer of foamed PVC gives rigidity while maintaining the shape of the pipe under load. It reduces total weight of pipe and makes it light when compared to solid wall PVC pipes. The pipe is typical of solid wall PVC under load and the type of distortion is normally expected.

**Gully traps:** Gully traps shall be of the same quality as described for Foam core. Gully traps shall be fixed in cement concrete 1:5:10 mix (1 cement: 5 coarse sand: 10 stone aggregate 40 mm nominal size) and a brick masonry chamber 30x30 cms inside plastered with cement mortar 1:5 with 15x 15 cms grating inside and 30x30 cms C.I. sealed cover and frame weighing not less than 7.3 kg to be constructed as per standard drawing. Where necessary, sealed cover shall be replaced with C.I. grating of the same size.

### **Testing**

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water.

The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

Sewer lines shall be tested for straightness by:

- a. inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.
- b. means of a mirror at one end a lamp at the other end. If the pipeline is straight the full circle of light will be seen otherwise obstruction of deviation will be apparent.

The Contractor shall give a smoke test to the drains and sewer at his own expense and charges, if directed by the Architect/Engineer in charge

A test register shall be maintained which shall be signed and dated by Contractor.

#### **Reinforced cement concrete pipes (For outer drainage from building chambers to STP & Storm water):**

All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron) shall be RCC pipes of Grade M40 specified class as per IS 458: 2003. Pipes shall be true and straight with uniform bore, throughout. Cracked, warped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, when directed a certificate to that effect from the manufacturer.

#### **Laying**

R.C.C. spun pipes shall be laid on cement concrete bed or cradles as specified and shown on the detailed drawings. The cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12 mm below the invert level of the pipe properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and bonding rods etc. Cradles or concrete bed may be omitted, if directed by the Architect/Engineer in charge.

#### **Jointing**

After setting out the pipes the socket shall be centered over the spigot and filled in with tarred gaskin, so that sufficient space is left on either side of the collar to receive the mortar. The space shall then be filled with cement mortar 1:2 (1 Cement: 2 fine sand) and caulked by means of

proper tools. All joints shall be finished at an angle of 45 degrees to the longitudinal axis of the pipe on both sides of the collar neatly.

### **Testing**

All pipes shall be tested to a hydraulic test of 1.5 m head for at least 30 minutes at the highest point in the section under test. Test shall also be carried out similar to those for stoneware pipes given above. The smoke test shall be carried out by the contractor, if directed by the Project Manager and a test register shall be maintained which shall be signed and dated by the Contractor/Architect/Engineer in charge.

### **Cement Concrete and masonry works (For Manholes and Chambers)**

#### **Materials**

#### **Water**

Water used for all the construction purposes shall be clear and free from Oil, Acid, Alkali, Organic and other harmful matters, which shall deteriorate the strength and/or durability of the structure. In general, the water suitable for drinking purposes shall be considered good enough for construction purpose.

#### **Aggregate for Concrete**

The aggregate for concrete shall be in accordance with I.S. 383 and I.S. 515 in general, these shall be free from all impurities that may cause corrosion of the reinforcement. Before actual use these shall be washed in water. The size of the coarse aggregate shall be done as per I.S.383.

#### **Sand**

Sand for various constructional purposes shall comply in all respects with I.S 650 and I.S. 2116. It shall be clean, coarse hard and strong, sharp, durable, uncoated, free from any mixture of clay, dust, vegetable matters, mica, iron impurities soft or flaky and elongated particles, alkali, organic matters, salt, loam and other impurities.

#### **Mild Steel Reinforcement**

The corrosion reluctant mild steel for the reinforcement bars shall be in the form of round bars conforming to all requirements of I.S. 432 (Grade I).

#### **Fly Ash Bricks**

Bricks shall have uniform color, thoroughly burnt but not over burnt, shall have plan rectangular faces with parallel sides and sharp right-angled edges. They should give ringing sound when struck. Brick shall not absorb more than 20% to 22% of water, when immersed in water for 24 hours. Bricks to be used shall be approved by the Architect/Engineer in charge

### **Other Materials**

Other materials not fully specified in these specifications and which may be required in the work shall conform to the latest I.S. All such materials shall be approved by the Project Manager before use.

### **Cement concrete (plain or reinforced)**

a) Cement concrete pipes bedding, cradles, foundations and R.C.C. slabs for all works shall be mixed by a mechanical mixer where quantities of the concrete poured at one time permit. Hand mixing on properly constructed platforms may be allowed for small quantities by the rate for cement concrete shall be inclusive of all shuttering and centering at all depth and heights.

b) Concrete work shall be of such thickness and mix as given in the Schedule of Quantities.

c) All concrete work shall be cured for a period or at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during the curing period.

### **Masonry**

Masonry work for manholes, chambers, septic tanks, and such other works as required shall be constructed from 1st class fly ash bricks or 2nd class fly ash brick as specified in the Schedule of quantities in cement mortar 1:5 mix (1 cement: 5 coarse sand). All joints shall be properly raked to receive plaster.

### **Cement concrete for pipe support**

Wherever specified or shown on the drawing, all pipes shall be supported in bed all round or haunches. The thickness and mix of the concrete shall be given in the Schedule of Quantities. Unless otherwise directed by the Project Engineer, cement concrete for bed, all-round or in haunches shall be laid as follows: -

|                     | upto 1.5 m<br>depth | upto 3 m<br>depth | beyond 3 m<br>depth |
|---------------------|---------------------|-------------------|---------------------|
| Stoneware pipes     | All round           | Haunches          | All round           |
| In open ground      | (1:4:8)             | (1:4:8)           | (1:4:8)             |
| (no sub soil water) |                     |                   |                     |
| R.C.C or SW         | All round           | Haunches          | Haunches            |
| (In sub soil water) | (1:3:6)             | (13:6)            | (1:3:6)             |
| C.I Pipes           | All round           | Haunches          | Haunches            |
| (In all conditions) | (1:3:6)             | (13:6)            | (1:3:6)             |
| R.C.C Pipes         | All round           | All round         | All round           |
| Or C.I Pipes        | (1:3:6)             | (13:6)            | (1:3:6)             |
| Under or building   |                     |                   |                     |

(Ratio  
refer to

cement: coarse sand: stone aggregate 40 mm nominal size)

R.C.C pipes or C.I. pipes may be supported on brick masonry or precast R.C.C or in situ cradles. Cradles shall be shown on the drawings. Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

### Manholes

The manholes are to be constructed with brick masonry as per standard specifications of NBC 2016.

### Manholes Covers

- i i. Medium duty S.F.R.C. manhole covers/ RCC grating for manholes on service roads, gully traps and manholes / chambers not following in the road / pedestrian ways/side berms/lawn area.
- ii ii. Heavy duty S.F.R.C. manhole covers/ RCC grating for manholes /service chambers/gully traps falling on main roads & service roads.
- iii iii. Shape and dimensions of Manhole covers/ RCC grating shall conform to NBC-2016/BCD//CPWD specification. & IS 12592

### Making connections

Contractor shall connect the sewer line of the building to the main manhole by providing making holes and channels etc.

## **2. CONNECTIONS TO VARIOUS MECHANICAL EQUIPMENT SUPPLIED BY OTHER AGENCIES**

All inlets, outlets, valves, piping and other incidental work connected with installation of mechanical equipment supplied by other agencies will be carried out by the contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturers' instructions and the directions of the Owner's site representative. The equipment to be supplied by the other agencies consists mainly for Process and Kitchen. The work of connections to the various equipment shall be affected through proper unions and isolating valves. The work of effecting connections shall be executed in consultation with and according to the requirement of equipment suppliers, under the directions of the Owner's site representative. The various aspects of connection work shall be executed in a similar way to the work of respective trade mentioned elsewhere in these specifications.

### **2.1.1. CONNECTIONS TO WATER TANKS**

The contractor shall provide all inlets, outlets, washouts, vents, ball cocks, overflows control valves and all such other piping connections including level indicator to water storage tanks as called for. Full way gate valves of a approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe. Overflow and vent pipes shall terminate with mosquito proof grating.

The overflow pipe shall be so placed to allow the discharge of water being readily seen. The overflow pipe shall be of size as indicated. A stop valve shall also be provided in the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm to 100mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning.

### **2.1.2. PIPES HANGERS, SUPPORTS, CLAMPS ETC.**

All vertical pipes shall be fixed by galvanized clamps and galvanized angle brackets truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Horizontal pipes running along ceiling shall be fixed on galvanized structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.

Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces.

All pipes clamps, supports and hangers shall be galvanized. Factory made prefabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanize them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanized.

Clamps shall be of approved design and fabricated from MS flats (which shall be galvanized after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details / shop drawings to be submitted by the vendors.

### 2.1.3. PUMPS

Pumps shall be vertical / horizontal, centrifugal shall have directly coupled to motor. Provision of pump with pump head & base of cast iron/ SS and other parts in SS 304 shall be made. Impeller shall be hydraulically balanced and keyed to shaft. Pump shall be mounted on a concrete foundation, projecting at least 15cm above finished floor level. The pumps base shall be set on a vibration elimination pad. The pump shall be lubricated in strict accordance with the manufacturer's instructions and shall be factory aligned prior to shipment. All motors and bases shall be painted with approved finish shop coat of paint. The pump shall be selected for the lowest operating noise level and shall be complete with flexible connections, valves, and pressure gauges. The pumps shall include cost of foundation channel complete. Pump curves for all pumps offered shall be submitted. All curve indicating excessive shut-off head will not be approved.

**Pressure Pump as per the requirement to be provided at Terrace level for water supply.**

### **3. COMMISSIONING & GUARANTEE**

#### **i. SCOPE OF WORK**

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

- a. Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.
- b. On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.
- c. All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days' notice in writing shall be given to the inspecting parties before performing any test.
- d. Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.
- e. Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rotameters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Architect/Engineer in charge.
- f. Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

#### **ii. PRE COMMISSIONING**

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipe work and the like after installation and keep them in a new



condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.

- a. All strainers shall be inspected and cleaned out or replaced.
- b. Check all clamps, supports and hangers provided for the pipes.
- c. Check all the equipment, piping and valves coming under hot water system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system as for (b) above.
- d. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

### **iii. FINAL ACCEPTANCE TESTS**

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary, replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

### **iv. REJECTION OF INSTALLATION / PLANT**

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be

carried out by the Contractor at this own expense and to the satisfaction of the Authority/Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

**v. WARRANTY AND HANDOVER**

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

**vi. HANDING OVER OF DOCUMENTS**

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

#### 4. MAKE LIST

| SI No | Item / Material   | Make                                   |
|-------|---|--|
| 1.    | Sanitary & CP Fittings  | HansGrohe/ Kohler/ Grohe               |
| 2.    | Miscellaneous Items i.e. soap dish, Hand dryer, soap dish Etc.  | HansGrohe/ Kohler/ Grohe               |
| 3.    | SS Sink   | Nirali/ Cera/ Elica                    |
| 4.    | Insulation  | Therma Flax / Careflex/Armaflex        |
| 5.    | GI Pipes as per IS:1239   | Surya Prakash/ Jindal Hisar/Tata       |
| 6.    | GI Fittings (Malleable Cast Iron) as per IS:1879                | Drp-M/Unik /Zoloto                     |
| 7.    | Centrifugally Cast Iron Hubless Pipes & Fitting as per IS 15905 | Neco/Kapilans/BIC                      |
| 8.    | Valves  | Zoloto/ Leader / Kartar                |
| 9.    | Water Meter   | Kranti / Kent/Kaycee                   |
| 10    | CPVC /uPVC/SWR/ Foam core Pipes & Fittings                      | Astral/Supreme/Prince                  |
| 11.   | DWC Pipe  | Astral/Supreme/Prince                  |
| 12.   | Oil & Grease separator  | Kessel /Supreme/Ashirvad               |
| 13.   | Hydro pneumatic domestic pump                                   | Grundfos/Wilo/Kirloskar                |
| 14.   | Filter / Softener   | Brisanzia /Ion Exchange/Pentair        |
| 15.   | Solar water heater  | V-Guard/Havells/Racold                 |
| 16.   | Storage/ Instant Geyser   | AO Smith/ Racold/ Crompton             |
| 17.   | NP2/NP3 Pipe  | Local As Per IS-458                    |
| 18.   | Cables  | Finolex/Havells/Polycab                |
| 19.   | Pressure Switch   | Indfoss / Switzer/ Danfoss             |
| 20.   | Pressure Gauges   | Brc/ H.Guru/ Gic                       |
| 21.   | Fasteners   | Hilti/ Fischer/Kaloti                  |
| 22.   | Weld Rods   | Advani / ESAB/D&H Secheron             |
| 23.   | Mechanical seal   | Dura metallic / Sealol/ Eagle Burgmann |
| 24.   | Strainer  | Kranti / Grandprix/Sant                |
| 25.   | Glazed Stone Ware Pipes & Fittings                              | RK Stone Ware Pvt Ltd/, M/S Lal Chand  |

|     |   |  |
|-----|---|--|
|     |   | & Sons, Ghaziabad,/ Supertach Ceramics Pvt Ltd, Rajkot |
| 26. | FRP Manhole cover & frame and FRP Grating | Thermodrain /Pooja/Fibrocast                           |
| 27. | SFRC Manhole COVERS ETC                   | Kk/Pragati/Super Wire                                  |
| 28. | Anti-corrosive tape for pipe protection   | Pypkote/Makpolykote/AGGBRO                             |
| 29. | Vibration Eliminator Pads & Connections   | Resistoflex, Dunlop, Kanwal                            |
| 30. | Forged Steel Fittings                     | DRP /VS / Zoloto                                       |
| 31. | Air Admittance valves                     | Studor/Mc Alpine/Supreme                               |
| 32. | Water level indicator & controller        | Ital/Technika  |
| 33. | Pipe Clamps / Hangers / Support           | Camry/Chilly   |
| 34. | Paint                                     | Nerolac, Berger  |