

GUJARAT WATER SUPPLY & SEWERAGE BOARD

GANDHINAGAR

(A WHOLLY OWNED GOVERNMENT OF GUJARAT UNDERTAKING)



Name of Work: Estimate for Construction of Under Ground Sump of 1.20 lakh liters at

Thapala Village Under Rejuvenation Programme

Estimated Cost: Rs. 5,30,420.00

TECHNICAL SPECIFICATION

Executive Engineer

Gujarat Water Supply & Sewerage Board

Public Health works division Junagadh

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Item wise Specification

Item No.1.

U.G Sump at H.W Site, Circular (1.20 Lakh Litres)

RCC GSR (description of item for turnkey tender)

Preparing structural design of RCC Under Ground / Partially under ground | above high ground level Reservoir of required capacity as per relevant I.S. standards and constructing the same, including excavation in all types of soil strata (including rock) including shoring strutting if required, for loose soil / to protect from collapse, casting 100 mm thick P.C.C. levelling course in M-15, Refilling the pit with proper soil and disposing of the surplus stuff at all lead. Including cement plaster in CM 1-2 with approved water proofing compound to all over inside container (i.e. walls, base, top slab/dome bottom etc all), Including all types of labour and material charges of lowering, laying, erecting / hosting and jointing of pipe assembly to inlet, outlet overflow, washout and bye pass arrangement as per hydraulic design. Providing and fixing accessories, CI Manhole frame and cover, water level indicator, adequate cow type ventilators or lantern type ventilator with stainless steel jail ROG chambers for valves Providing and applying three coats of cement paint / snowem to the out side face of structure. It also includes satisfactory water tightness test as per relevant I.S. code and painting name of scheme and capacity on the tank 3s per direction of engineer in charge.

List of Indian Standards for Design of GSR & SUMP:-

The structural design of GSR shall be in accordance with provisions relevant I.S standards

- (1) IS. 3370 part I & II 2009 or its latest revision
- (1.1) IS. 3370 part III & IV 1965 or its latest revision
- (2) IS. 456 - 2000 or its latest revision.
- (3) IS. 1893 - 2000 -1984 or its latest revision,
- (4) IS 675, Part-1 to 3, 1987 or its latest revision.

General Specifications:-

- (1) Water depth in container shall be adopted as per data of tender. Capacity shall be calculated excluding free board of the reservoir. If water depth is not specified, the suitable water depth / acceptable to field engineer in accordance with hydraulic.
- (2) Shape of container (in plan) specified by in data shall be adopted in absence otherwise shape shall be adopted.
- (3) Size shall be fixed as per availability of space (land area) at site / acceptable engineer in charge.
- (4) Effect of overlapping of pressure bulbs on soil due near by structure and proposed sump should be considered.
- (5) Care shall be taken that no damage should occur to nearby existing structure. Compensation shall be paid for the same by agency.
- (6) The minimum concrete grade for RCC shall be M-30.
- (7) HYSD Fe 415 / 500 grade reinforcing bars conforming to I.S, 1785 / 1139 shall be considered in design. CRS / TMT bars shall be provided, In saline atmosphere corrosion resistance stainless steel / HCR rebar shall be provided. Any other steel can be used with approval of C.E./ in situation of non availability in market without extra cost,
- (8) Minimum size (or thickness) of various components shall be provided as per tender criteria | specifications in absence as per IS Std. practice of G.W.S.S.B. Minimum dimensions specified for various components in tender data / specifications shall be provided without fail.
- (9) The safe bearing capacity (SBC) shall be referred from SBC test report. In absence of report it shall be referred from data sheet. If poor soil is found / water table is met with during

excavation SBC shall be scientifically ascertained and design shall be revised, No extra shall be paid for increase in quantity.

- (10) DI pipes end special shall only be used if type is not specified in tender,
- (11) The rate shall include cost of dewatering during excavation making all arrangement when water table meets within depth.
- (12) The structure shall be designed properly to resist uplift due to ground water table specified in data or actual ground water table meets with during excavation, If GWT / Uplift is mentioned in tender and during excavation it does not meet 7.5% rate shall be reduced.
- (13) SS pipes railing shall be provided over sump periphery when sump height is ≥ 1.5 meter above ground level.
- (14a) RCC Staircase/RCC Steps should be provided from GL to sump top slab based on the height of the GSR above/below the ground.
- (14.b) RCC stair case with SS railing to be provided inside reservoir container BB Masonry stair cabin with MS safety door having locking arrangement to be provided for GSR, Sump and HGLR of capacity more than 7.5 lakhs liter with top slab. If dome is constructed as top slab then provide minimum opening of 900 mm x 2000 mm with curbing and SS railing around.
- (15) Appearance of structure should be aesthetically good looking acceptable to authority.
- (16) Any change in size, shape, depth below GL, height above GL, water depth, F.B., size of member etc can be permitted in exceptional case due to site condition or hydraulic design requirement by CE. No extra 'shall be paid for change.
- (17) Any change in data, dimensions, shape, water depth, reduction in size if permitted by competent authority and if it reduces quantity then payment shall be pro-rata.
- (18) When capacity of GSR / Sump is > 20 lakh litres two or suitable compartments acceptable to executive engineer shall be designed and provided.
- (19) Agency shall engage qualified (at least graduate) consulting engineer for designing the structure and he / she shall visit the site for guidance of work,
- (20) 75% part rate shall be payable for concrete, reinforcement and plastering items of container until satisfactory hydraulic testing for water tightness is performed as per tender condition. Till the work shall be treated as incomplete

Above conditions / general specifications Sr. No. 1 to 20 are part and parcel of tender (contract) and prevail over other provisions in tender.

DETAILED SPECIFICATION

Detailed specification given here shall be treated as extension or partial modifications to the specifications of respective items given in the volume of specification published by Gujarat Water Supply and Sewerage Board.

IS:1893 (Part-I and Part-II) :2002 , IS 875 Part-III 2002 , IS 13920 and IS 4326 shall be followed.

The contractor shall submit a note on design methodology and construction as prepared by design engineer after the award of contract. The note should indicate general description and salient features of the design covering following points.

- i) Capacity
- ii) Shape & type.
- iii) Staging height of tank indicating various levels.
- iv) S.B.C. adopted in the design i.e. S.B.C. of strata based on actual test report and type of foundation proposed with proper justification.

- v) Site plan showing location.
- vi) Line diagram showing dimensional and sectional elevation with important levels.
- vii) Plan showing piping arrangement.
- viii) Design parameters proposed to be adopted for detailed design

2.0 GENERAL REQUIREMENTS:

Foundation for ESR General Technical Specification

The free board shall be 300 mm below soffit of roof beam or lowest point of dome and shall be included in the depth of water for design purpose

Maximum actual water depth excluding free board shall not exceed 6.0 m. Minimum dimension of member - General Technical Specification

The design shall be for Seismic Zone as per latest I.S 1893 and the staging shall be designed for ductile detailing as per I. S. 13920.

The width of braces shall be of the following

- a) The width of braces shall be minimum 250 mm.
- b) There shall be minimum distance of 75 mm between two adjoining reinforcement bars provided in the braces as well as beams. In case of horizontal braces these shall be chamfered by 40 x 40 mm.

Width to depth ratio in case of braces shall preferably be more than 0.3.

Increase in permissible stress in braces for earth quake / wind force design will not be allowed

Vertical center to center distance between braces shall not exceed 6.0 m. At the joint of braces & columns, the links to the column bars shall be tied properly & this shall be thoroughly checked before concreting.

For design having more than six columns provision of internal bracing is obligatory. External bracing is also obligatory.

Irrespective of the type of foundation proposed in the design one set of bracing be provided at the ground level.

Wherever annular raft is provided, the inside & outside width of raft shall be such that the center of gravity of upward reaction shall coincides with column/ raft beam center.

Uplift pressure on the foundation of structure should be considered as per available water table at site in rainy season.

Columns inside container for supporting roof beam/ slab may be provided as per design requirement. However the size shall not be less than 300 mm dia. No square or rectangular columns shall be allowed.

Water density shall be taken as 9.81kN/m³

For all duck foot bends for inlet, outlet and overflow arrangements, individual columns with footing resting at foundation level of ESR shall be provided

Age factor for increase in strength shall not be considered for design.

The foundation shall be checked for negative pressure on soil due to combined direct & bending stresses. Negative pressure shall not be allowed on the foundation soil.

CRS Fe 415/500 shall be used for Water Retaining Structures and TMT Fe415/500 shall be used for Non Water Retaining Structures (Make: SAIL, TATA TISCON, RINL (VIZAG) shall be used

Minimum steel: Design requirements as set out in relevant codes in respect of steel shall be fully satisfied. However following minimum steel should be provided.

Minimum cover to reinforcement shall be as per I. S. 456 - 2000 and I. S. 3370 (Latest version

Design shall be based on accepted bases and well known methods of design as well as the provision of I.S Codes (Latest edition). However methods based on experimental investigation on models as mentioned in Clause 18.2 3 in I. S. 456 - 2000 shall not be allowed. Similarly the methods / practice of design having no documented evidence

shall not be entertained. Only well defined & well known methods of design shall be followed.

Construction requirement:

The Min. concrete grade for RCC shall be M25 for Non Water Retaining Structures and M30 for Water Retaining Structures. Proportion of concrete ingredients shall be as per Mix design using weigh batching.

Maximum clear spacing between horizontal bracings shall be 3 m (storey height)

The BB Masonry cabin with MS door shall be constructed when spiral staircase is outside the staging.

M.S. ladder shall be provided and fixed for access to Sump Inside and Outside from G.L. For ESR having more than 5 m height RCC spiral staircase or suitable RC staircase shall be constructed.

For ESR-having staging height more than 15 m the spiral staircase shall be provided inside the staging with effective tie beams in more than one direction.

Water level indicator shall be provided and fixed float type /electronic (as specified) DI pipes & specials shall only be used,

Effective curing shall be carried out as per specifications

1. R.C.C. staircase of 1.0 m clear width with R.C.C. parapet in M 25 concrete shall be provided from G.L. to bottom slab walkway. Necessary tie beams connecting external columns of ESR & staircase at every brace level shall be provided. M. S. ladder shall be provided from bottom slab walkway to roof slab level for access.
2. R.C.C. cantilever catwalk (Gallery) of 1.0 m clear width with three rows of 25 mm Φ G. I. pipe railing shall be provided at bottom floor level. The railing shall be in 400 mm side wall edge of gallery, R.C.C posts of 150 mm diameter constructed at 2.0 m center to center along the side wall at outer edge of gallery and 1.0 m high. At top slab also similar G. I. pipe railing on 100 mm diameter R.C.C. post & at 2 m spacing shall be provided.

3. Adequate number of C. I. Ventilators of 150 mm dia in addition to central ventilating shaft shall be provided on top slab of ESR as directed by Engineer.
4. Minimum One No. of C.I. Medium class Manhole frame & covers (wt. 53 Kg.) with locking arrangement shall be provided and fixed in the roof slab of ESR as directed by Engineer.
5. One Aluminum ladders 450 mm width for access into the tank through manhole left in the roof slab shall be provided & fixed. Ladders shall be provided as per specifications as directed by Engineer
6. Electronic water level indicator assembly of approved type and make shall be provided & installed as directed by Engineer.
7. Lightening arrester as per I. S. specifications & confirming to I. E. rules shall be provided & fixed.
8. Vertical & Horizontal piping of C. I. double flanged pipes & C. I. Double Flanged Specials of required sizes for inlet, outlet, overflow, bye pass & washout arrangement together with suitable C.I. double flanged sluice valves shall be provided as per approved drawings. For washout one tee shall be fixed on the outlet pipe with one sluice valve of suitable diameter. Sluice valves confirming to IS 14846 - 2000 of Kirloskar, IVC, IVC make only shall be provided.
9. Required number of B. B. masonry / R.C.C chambers of suitable size, with C. I. manhole frame & cover shall be provided and constructed at suitable locations for sluice valves and drainage line as directed by Engineer
10. Inside and Outside surface of tank, exposed faces of columns, braces, beams, bottom portion of gallery & bottom slab and all exposed surfaces of slab be provided with smooth finish and then three coats (one primary coat of white cement and two coats of snowcem) of approved shade of snowcem paint as per colour scheme approved by the Engineer shall be rendered.
11. Internal surface of container including top slab bottom shall be provided with two coats of epoxy paint (food grade) as directed by Engineer
12. Letter indicating capacity of tank, name of scheme, year of construction shall be embossed or engraved on vertical wall of container & shall be painted with suitable shade of oil paint in two coats as directed by Engineer.
13. On completion of work hydraulic test or water tightness test shall be done as per standard specification till satisfaction of the Engineer. Water required for testing & construction shall be made available by the contractor at his cost. If during testing any damage or leakage or sweating occurs to the structure it will be the responsibility of the contractor to rectify the same.
14. Drainage arrangement consisting of RCC NP 3 pipes to carry away the wash water and overflowed water shall be provided up to nearby Nalla or surface drain. The length of drainage pipe shall be up to 100.0 meters only.
15. Plinth protection in PCC M 15 shall be provided all around the structure as directed by Engineer.

16. Providing and constructing office at each service reservoir having minimum 13.5 m² carpet area in R.C.C. framed structure with B.B. masonry walls complete as directed by Employer
17. M.S. ladder shall be provided and fixed for access to Sump Inside and Outside from G.L.

**CRITERIA FOR PREPARATION OF DESIGNS OF RCC SUMP/ ESR BY PRIVATE AGENCY
(ONLY FOR SELF DESIGN BY CONTRACTOR)**

SBC test shall be carried out by Agency on its own cost.

GENERAL:

- 1.1 Capacity of the container of the tank shall be the volume of the water it can store between the designed full supply level (F.S.L) and lowest supply level (L.S.L) i.e. the level of the lip of the outlet pipe. Due allowance shall be made for 20 mm. thick plastering the tank from inside, while calculating the capacity of the tank.
- 1.2 Freeboard is the vertical distance between F.S.L. and Soffit of covering slab or dome or beam supporting the cover. In any case the free board shall not be less than 300 mm from bottom of beam.
- 1.3 Height of the staging or height of the tower shall be the vertical difference between L.S.L. of the tank and the average ground level at the site of tank.
- 1.4 Dead storage shall be the storage capacity of water below L.S.L. depth of dead storage shall be the vertical distance between the top outlet level and wash out level. The washout pipe level shall be at the lowest portion of the container.
 - 1.4.1 Minimum depth of water for dead storage shall be 100 mm even for flat bottom slab and not more than 300 mm for inlet i.e. bottom dome slab type tank.
- 1.5 Water depth in the tank shall be the vertical distance between L.S.L. and F.S.L. of tank.
- 1.6 The allowable bearing pressure or the safe bearing pressure on the strata as specified in the table of IS 1004-1978 or its latest revision, whichever is less shall be considered and design of foundation shall be based on this unit pressure unless specified.
 - 1.6.1 Notwithstanding anything mentioned above regarding S.B.C. whenever the Engineer- in-charge of design directs that bearing capacity shall be determined by carrying out actual soil exploration and tests due to conditions as mentioned in para 2.0 of IS 1992-1969. The same shall be carried out by a Government laboratory or any other approved laboratory and allowable bearing capacity so arrived shall be taken as the basis of design. The factor of safety adopted in case of actual test shall be as per clause 6.1 (A) of IS 6403-1971.
 - 1.6.2 IS:1893 (Part-I and Part-II) :2002 , IS 875 Part-III 2002 , IS 13920 and IS 4326 shall be followed.
 - 1.6.3 As per IS:11682 - 1985 page 25 Typical reinforcement details of shaft "The" Ties or "Links" jointing to vertical bars of shaft is highly needed.

2.0 GENERAL REQUIREMENTS:

- 2.1 Cement concrete shall be in accordance with IS 456-2000 fine and coarse aggregates shall be conforming to IS 383-1963 or its latest revision. The selection of the type of fine and coarse aggregate to be actually used shall be as directed by the Engineer-in- charge.
- 2.2 For parts of the tank in contact with stored water and closing vapour above FSL shall be in concrete grade M250 or in richer grade.

2.3 *Inlet, Outlet, Overflow and Washout pipe:*

Materials:

Cast iron flanged pipe of appropriate class shall only be used.

2.3.1 *Inlet Pipe:*

The size of inlet pipe shall be same that of rising main to ESR.

2.3.2 *Outlet Pipe:*

The outlet pipe shall be of one diameter higher as that of inlet pipe.

2.3.3 *Overflow pipe:*

The size of overflow pipe shall be one diameter higher than that of inlet pipe.

2.3.4 *Washout Pipes:*

Outlet cum washout arrangement shall be provided with sluice valves at GL. Detailed drawing showing all the pipes, duck foot bends, chamber, sluice valves and other necessary connection shall be furnished in the plan. Plain concrete block in M-150 for duck foot bands shall be of minimum depth of 600 mm. The width of the block shall have an offset minimum of 150 mm.

2.4 *Water Level Indicator:*

A water level indicator shall be provided confirming to I.S. for the tank reading depth of water in meters with least count of 10 cm. The system shall consist of uncorrodable material and shall be simple and easy to maintain. The water level indicator shall be provided and fixed as approved and directed by the Engineer-in-charge.

2.4.1 Access to roof for an entry to the inside of the tanks shall be provided. At roof level of the tank the access to roof manhole from the ladder or stair shall be properly provided with parapet or railing. At ground level or at walkway level the access forgoing up shall be provided with a door and locking arrangement. Railing at roof level and at gallery level shall be provided.

2.4.2 At least two manhole with frame and cover of CI medium type shall be provided with ladder for entering into the container for maintenance purpose. The size of manhole frame shall be 0.9 x 0.6 meter 75 kg.

2.5 *Lightening Arrestor:*

Lightening arrestors shall be provided on the roof of the tank as per IS 2309-1969. Position and height of lighting arrestors shall be such that the whole structure shall be enclosed within dome having its apex at top and of the arrestors and generated by a line inclines at 60° to the vertical. The arrestors shall be suitably earthed. Copper strip shall be covered with GI pipe 25-mm dia up to 4-meter height from GL.

The roof of the tank shall be ventilated by providing cowls or ventilators with mosquito proof net for ventilators. They shall be fixed with proper framing. Ventilation area shall not be less than of (A) 0.04% of the free water surface when cowl type ventilators are provided. (B) Cross sectional area of the inlet pipe. (C) Cross sectional area of the outlet pipe.

2.5.1 All tanks shall be checked for seismic forces confirming to IS 1893-1975 or its latest revision and wind forces also.

2.5.2 Water tank in vicinity of mines, galleries and blasting sites or in areas which may be subjected to blasting sites or in areas which may be subjected to blast or shock, shall be designed for the dynamic forces developed due to blast equipment.

- 2.5.3 Members of towers, which are primarily subjected to dynamic stresses, shall be checked for ductility of the members at the joint.
- 2.5.4 Staircase and all columns shall be tied together just above foundation level by structural members such as a braced or a tie ring beam.
- 2.6 Following shall be the minimum thickness of various members of the tank container.

Roof slab	100 mm
Bottom slab	200 mm
Roof Dome	100 mm
Container Dome	150 mm
Vertical wall including shaft wall	150 mm
Inclined wall or shall requiring shuttering of one side	170 mm
(i) Slope with horizontal more than 30°	150 mm
(ii) -Do less than 30°	150 mm

- 2.7 Error up to 2 % in weights, forces, moments etc. in the design calculations may be neglected.

3.0 LOADS:

- 3.1 For all RCC and PCC component unit weight shall be taken as 25000 N/m³, 24000n/m³ respectively, allowance of platter up to 20 mm. Inside surface of container shall be taken in to consideration of in normal circumstances.
- 3.2 Water load shall be taken as 10000n/m³.
- 3.3 Live load and snow load shall be taken as per IS: 875-1964 or its latest revision.
- 3.3.1 No live load may be assumed while designing the staging (or tower) and foundation for seismic loads.
- 3.3.2 Live load on gallery all-round the elevated tank shall be considered as 1500 n/m².
- 3.4 Wind load as per Fig. i.e. basis maximum wind pressure or Indian including winds of short duration as per IS 875 Part-III 2002 shall be considered.
- 3.5 Seismic forces on the tower shall be as IS:1893 (Part-I and Part-II) :2002 or its latest revision. Wind and seismic forces shall not be assumed to act simultaneously.
- Increases in permissible stresses Where stresses due to wind or earth quack temperature & shrinkage effects are combined with those due to dead, live and impact loads the stresses specified in table 13, 16 & 17 of 456-1978 may be increased up to a limit of 33.50%.

4.0 DESIGN:

4.1 General:

- 4.1.1 Shape of the structure shall be as directed by Engineer-in-charge and shall be selected depending upon site condition from the standard shape.
- 4.1.2 General description and salient feature as mentioned below of the design shall be not allowed by the Engineer-in-charge and shall be mentioned in the design before detail design calculations starts.
- 4.2 Sketch showing dimensional section, elevation with plan shall be given.

4.2.1 The safety against overturning of structure shall be computed quite accurately.

4.2.2 Design shall be based on the worst possible combination of various loads, moments, shears and resultant stress in the tank for the following two cases.

(i) Tank Full 'A'

(ii) Tank Empty

Tank full means depth of water inside the container up to full height of the container without consideration of free board.

Or safe bearing capacity of soil based on actual soil investigation report of the laboratory.

Position of sub soil water level.

Chemical analysis if sub soil water and soil where possibility of brackish/saline water is ascertained.

Location of site on index plan with respect to latitude and longitude.

4.2.3 Design shall be based on accepted basis and methods of design as well as the provision of IS 3370-1965, IS 456-1978, IS 1343-1960, IS 2210-1962, IS 2204-1962 etc.

and their latest revision. However methods based on experimental investigation as mentioned in Para 18.2 % "C" in IS 456-1978 shall not be entertained.

4.3 The parts of the structure neither in contact with the liquid on any face more enclosing the space above the liquid as in the case of stages of a tower shall be designed on working stress method on accordance with the requirement of IS 456- 1978. Staging may be designed on limit method as per IS 456-1978.

4.4 Design of members other than these excluded by above (i.e. roof, walls, floor etc. of the container) shall be based on consolidation of adequate resistance of cracking as well as adequate strength calculation of stresses shall be Para s per 3.2.2 of IS 3370 (part-II) 1965 or its latest revision.

4.4.1 PERMISSIBLE STRESS IN CONCRETE FOR RESISTANCE TO CRACKING:

For calculations relating to the resistance of members to cracking the permissible stresses in tension (direct and due to bending) and shear shall confirm the values specified in Table-I of IS 3370 (part-II 1965)

The permissible tensile stresses due to bending apply to the fact of the member in contact with the liquid. In members less than 225 mm thick and in contact with the liquid on one side, these permissible stress in bending apply to the face remote from liquid.

4.5 FOR STRENGTH CALCULATION:

4.5.1 In strength calculation, the permissible concrete stresses shall be in accordance with para-44 of IS 456-1978. Where the calculated shear stress in concrete alone exceeds the permissible value reinforcement acting in conjunction with diagonal compression in the concrete shall be provided to take the whole of the shear.

4.5.2 Permissible compressive stress (Directly only) in shells (i.e. Top Dome, Conical Wall and shall be reduced by 43% for 10 cm thick walls. For thickness more than 30 cm, the compressive stress shall be reduced by 50% and for inter media thickness 10 cm. to 30 cm. linear interpolation shall be done.

4.6 PERMISSIBLE STRESSES IN STEEL:

- 4.6.1 For resistance to cracking the steel and the concrete are assumed to act together. For checking the tensile stresses in un cracked concrete for avoidance of cracks, the tensile stress in the steel shall be the product of the modular ratio and the corresponding allowable tensile stress in concrete as per IS 3370(part-II) 1965 or its latest revision. Modular ratio "M" for different concrete mix shall be taken as under:

Grade of Concret e	Modula r Ratio "M"
M-150	19
M-200	13
M-250	11
M-300	10

- 4.6.2 For strength calculation (concrete assumed to be cracked), the permissible stresses in reinforcement shall be as per Table -2 of IS 3370(part-II) 1965 or its latest revision. For steel, the stresses shall be as per IS 1966 or its latest revision.

- 4.7 The analysis of staging of the tank shall be done by using any established method such as portal method etc. The staging shall be analyzed from combination of dead, dead live loads and wind seismic loads. The effect of continuity of beams of the junction shall be properly accounted and column reaction worked out, for different condition of loading, axial force, shear force, bending moments.

- 4.7.1 Modules of elasticity of concrete MEC shall be taken as $5700/FC$ where equal to characteristic cube strength of concrete in N/m^2 as per IS 456-1976.

- 4.7.2 Columns shall be checked for tensile stress for both the conditions as mentioned in para 4.3.2 in combination with axial tension and bending due to wind or seismic loads, and shall be checked for bond for maximum tensile stress arrived.

- 4.7.3 Columns may be assumed to be fixed at the top of footing.

- 4.7.4 Water Tower in seismic zone (V) of IS 1393-1975 twin diagonal (crossed) backing of steel in vertical plane in addition to the horizontal bracing may be provided.

4.8 COLUMNS:

- 4.8.1 Reinforcement shall be provided on both faces of the load-bearing shaft. Minimum vertical reinforcement in the shaft shall be of 0.4% of the gross concrete area required, Minimum horizontal reinforcement shall be 0.3% of the gross concrete area. Required in ease, for tower in high stigmatic zone (IV & V) minimum horizontal reinforced shall be 0.4% of the gross concrete area; for before bars of medium tensile or height tensile steel the above steel requirements may be reduced by 20 %.

- 4.8.2 Shaft shall be checked for combined axial load and bending the to wind or seismic loads and shall satisfy the provision of IS 456-1978 in tank full and tank empty condition.

- 4.8.3 Horizontal construction joints in shaft shall be as minimum as possible. On account of minor in accordance in construction shaft the allowable direct compressive stress shall be reduced by multiplying with 0.8% factor. On account of buckling reduction factor, if any, shall be multiplied to the value 0.85. For the calculation of direct compressive stress the contribution of steel shall be neglected.

- 4.8.4 Age factor for increasing strength shall not be considered.

- 4.8.5 Shaft shall be checked for tensile stress for worst condition in combination with axial tension on bending due to wind or seismic load.

5.0 FOUNDATION:

- 5.1 The permissible increase in bearing pressure for different types of foundation shall be as per table -I of IS 1893-1965 or its latest revision. When seismic forces are considered and for wind forces it shall be as per IS 1904-1966 or its latest revision.
- 5.2 For the purpose of the design of foundation the loading data shall be given the magnitude of vertical load, lateral load and moments at top of footing (Foundation) level. The data shall be made available, for both the cases as per Para 4.3.2.
- 5.2.1 The foundation area, door, individual column footings, combined footings, angular rafts and solid rafts shall be worked out on the basis of lower most value of the safe bearing capacity or allowable bearing pressure values as derived from IS 1904-1978, IS 9403-1971, IS 8009-1976 or their latest revision.
- 5.2.2 In case of purely cohesive and CI pipe of soil particulars attention should be given to IS 1903-1978 clause 6 & 7. Settlement shall be calculated as per IS 8009 (part I) 1976 for foundation.
- 5.2.3 In case of purely cohesion less soil, foundation shall be design for safe bearing capacity and shall be checked for permissible total as well as differential settlement values as given in relevant IS.
- 5.2.4 If the foundation consists of individual columns footing, minimum clear distance between center of column shall be equal to twice the width of footing and clear distance between the edge of footing shall be not less than width of footings.
- 5.2.5 In case of soil beneath the footings are not of the same characteristics the footing shall be designed for the soil having lowest SNC or ANP as the case may be. In such conditions the permissible limits of total as well as differential settlement shall be limited to 75% of the permissible limit given in ISS.
- 5.2.6 For special type of foundations like well foundation under beam pipe foundation etc., decision of Superintending Engineer, Public health Design Circle shall be final and binding to the designer.
- 5.2.7 Classification of soil and all characteristics of soil relevance to BSBC and APB shall be as per the soil in irrigation reports of Government stipulation. Government approved investigators.
- 5.3 For the design of foundation angular or solid raft type, the "PLACE THEORY" shall be adopted.
- 5.4 In normal circumstances minimum 100-mm thick plain cement concrete with 100 mm projection around in Grade M 100 with coarse aggregate as metal shall be provided as leveling course. Where injurious soil progressive water is expected the leveling course shall be grade not weaker than M 15 and if necessary Sulphate resisting or the special cement shall be used. The ground level within the foundation area of the structure shall be consolidated properly with a suitable slope to drain out rainwater outside the foundation.

6.0 DETAILING:

6.1 MINIMUM REINFORCEMENT FOR WATER RETAINING MEMBER:

- 6.1.1 The minimum reinforcement in walls, floors, roofs, in each of two directions at right angle shall have an area of 0.3% of the concrete selection in that direction for sections up to 100.00 mm thick. For section for thickness greater than 100 mm and less than 450 mm thick, minimum reinforcement each of two directions shall be nearly deducted from at 0.3% for 100 mm thick sections or greater two layers of

reinforcing steel shall be place one near each face of the section to make up to minimum reinforcement specified in this clause.

- 6.1.2 The minimum reinforcement specified in this 6.1 above may be decrease by 20 % in case of high yield strength bars confirming to IS 1786-1976 or IS 139-1966.
- 6.1.3 Minimum clear cover to reinforcement under normal conditions shall be as per Para 25.4 of IS 456-1978.
- 6.1.4 For liquid faces of parts of members either in contact with the liquid or enclosing the space above the liquid shall be as per para 7.2 IS 3370 (part-I 1965).
- 6.1.5 In case of Raft Foundation, the cover to reinforcement shall be as per 4.6.2 of IS 295 (part-I) 1973.
- 6.1.6 In case of "shaft" the cover to reinforcement shall be as under;
Vertical 25 mm
Horizontal 15 mm
- 6.2 For members of structure in contact with water, effective cover shall not be more than 60 mm. Even bars subjected to bending stress, or bars subjected to tension due pure tension in the member the effective cover shall not more than 75 mm.
- 6.4.1 Spacing of reinforcement shall be as per para 25.3 IS 456-1978.
- 6.4.2 Spacing of lateral ties for column shall satisfying provision of Para 25.3.2 'C' of IS 456- 1978.
- 6.4.3 The additional suggested criteria for reinforcing steel which accounts for existing moments, tension etc. i.e. other than temperature or binding steel shall comprise of minimum 8 mm for deformed or 10 mm mild steel bars.
- 6.4.4 The spacing between two Para in main reinforcement shall distribution steel, stirrups, links etc. shall not exceed 30 cm.
- 6.4 For members of the container, the maximum diameter of reinforcement in tension shall not exceed as given below depending upon the geometrical percentage of reinforcement. (Ratio of tensile steel to gross is concrete.)

Up to 1.0%	16 mm dia.
Up to 1.5%	22 mm dia.
Up to 2.0%	25 mm dia.

Note:

- 1.0 In case of dispute regarding interpretation any above clause, the decision of the Superintending Engineer, Public Health Circle, Concerned will be binding to the Designer.

In case of any clauses not included in the above criteria the decision of the Superintending Engineer, Public Health Design Circle will be final and binding to the Designer.

INSTRUCTION FOR PREPARATION OF DESIGN OF RCC ESR/SUMPS

- 1.0 The design of RCC ESR/ Sump supplied by the contractor in his own design shall be in accordance with the design criteria prepared by the Public Health Design Circle, Gandhinagar (copy of design criteria is attached). The design and drawing supplied by contractor should be accepted after the approval by the competent authority from the Department.

2.0 The contractor should mention the name, qualification, experience etc. of the design engineer who will be the necessary design scrutiny work etc. The design Engineer should attend the office of the Department if required at any stage prior to the acceptance of design or drawing construction with reference books etc. It will be the duty of designer to submit the design drawings and compliance of remarks by the Department.

3.0 PAYMENT AS PER PAYMENT SCHEDULE

4.0 COMMON CONDITIONS:

- 4.1 All petty items occurring if the work shall be carried out in workman like manner as per specification published by G.W.S. & S. Board and as per general specification current in the Division and as per instruction of the Engineer-in-charge from time to time.
- 4.2 Extra charge of claims in respect of extra work shall not be allowed unless such works are ordered in written by the Engineer-in-charge and are claimed for in specified manner before the work is taken in Hand.
- 4.3 The contractor shall engage on in experience and qualified supervisor as his authorized agent for the work. He shall be responsible to take from time to time such orders as may be given by the Engineer-in-charge to carry them.
- 4.4 As order book shall be maintained on the work site and the contractor shall sign the orders given by the Engineer-in-charge and he shall carry out them promptly. The order books shall be surrendered to the Department on completion of Work.
- 4.5 The contractor shall have to clear the site of work before it commences and after the work is completed for which separate claim shall not be entertained.
- 4.6 In addition in the required stores the contractor shall provide at his own cost the suitable temporary office shed with a covered area of about 20 sqmt. with necessary furniture for the use of Government staff while in works. The shed and furniture on completion of the work shall be removed by the contractor at his own cost.
- 4.7 The contractor shall provide at his own cost all labour charges setting out the as may be required for lining and setting out the as may be required for lining and setting up the works satisfactory and adequate facilities site scaffolding etc. for facility of checking his work or taking measurements etc.
- 4.8 Department shall give reasonable facilities to the contractor to enable him to obtain controlled materials at controlled rates as may be fixed from time to time. The contractor shall however not be entitled to time. The contractor shall however not be entitled to claim any compensation extra time limit to account of non-supply at controlled rates. The materials obtained shall be only used for the work in question. Any materials remaining surplus shall be neither disposed nor removed by the contractor without obtaining written permission of Department to that effect. Government shall have the right to take delivery of the surplus materials at the original purchase price of the receipt contractor shall be sue of such materials to the satisfaction of Engineer-in-charge and submit in monthly statement thereof.

- 4.9.1 The contractor at his own cost expense shall provide necessary housing accommodation and the sanitary Arrangement for his staff and labour and shall pay direct of the authorities concerned all rates. Taxes royalties and other charges.
- 4.9.2 The contractor shall also comply with the requirement of the Health Department as regards anti-malarial measures etc.
- 4.10 Water require for the execution of work and for the water tightness test of the reservoir shall be supplied by the contractor at his own cost in manner satisfactory to the Engineer-in-charge of work.
- 4.11 The contractor shall not be entitled to claim compensation from the Government. For works suffered on account of delay where such delay is caused either by
- (i) Difficulties relating to the supply of Railway Wagons,
 - (ii) Force major,
 - (ii) Acts of the God,
 - (iii) Any other reasonable caused beyond the control of the Department. In case of delay Govt. shall however grant such extension of time limit for the completion as may appear reasonable to the Engineer-in-charge and his decision shall be final.
- 4.12 The contractor shall be responsible to pay complete compensation to his staff and to his labours according to the labour compensation rules, on account of accidents and less of life or less of the life due to accident.
- 4.13 The Contractor has to Provide IPS flooring inside the vertical shaft area and Plinth protection of 1 mt. Surrounding to ESR.

5.0 DECLARATION:

The contractor shall have made declaration as under: -

"I have made myself thoroughly conversant conditions as regards the availabilities or otherwise of all construction materials skilled and unskilled labour on which. I have quoted my rates for this work. The specifications, drawing and design of this work have been careful studies and are understood by me before the submission of this tender. "

1.0 EXCAVATION FOR FOUNDATION

When the rates are to be quoted for a work based on " contractors own design" the word excavation for foundation shall mean excavation for foundation in all types strata such as soil soft murrum as well as hard rocks up to the designed depth at which foundation is to rest. No extra payment will be given for any change in strata at the same place. The rate shall also include dewatering and shoring strengthen if and where found necessary.

- 1.1 Excavation shall be carried out as per approved drawing. The excavation made deeper or wider than that required as per drawing shall not paid, but such deeper excavation if carried out shall have to be filled up using C.C. 1:3:6 by the contractor without extra cost. If the type of strata require wider excavation at top (GL) or deeper Then contractor shall excavate the trench accordingly but no extra payment for such wider or deeper excavation shall be made.
- 1.2 The rate shall include providing cured warnings lights during night time providing barricading consisting of metal ropes and bamboo for which no extra payment will be made.

- 1.3 The contractor shall make his own arrangements to obtain prior permission directly from relevant authorities for staking of excavated stuff near work side. If he fails to obtain such permission, then he will have to make his own arrangement without claiming extra cost to transport and stack the excavated stuff at a suitable place approved by the Engineer-in-charge of work.
- 1.4 The excavated stuff shall be stacked at least 3.0 meter away from the edge of excavated trench, if enough space is not available at work site then the excavated stuff shall be stacked at suitable place situated away from site. Similarly, the surplus stuff shall have to be disposed off at a suitable place for which contractor shall have to obtain permission directly from relevant authorities. No extra payment for transportation of excavated stuff or surplus stuff shall be made.
- 1.5 No excavated stuff shall be disposed off or used for any purpose other than refilling without prior permission of Engineer-in-charge of work.
- 1.6 Details shown in the data sheet regarding water table are approximate. The contractor should make his own arrangements for taking trial pits at his own cost more quoting his rates for as certain type of strata water table, quantity of seepage water etc.
- 1.7 Work at night time shall be carried out only with written permission of Engineer-in charge.
- 1.8 Bottom of the excavated foundation trench shall be sprinkles with water (If water table is not above foundation level) and well rammed to obtain a reasonably firm and level bedding.
- 1.9 The rates shall include continuous dewatering of seepage water or rainwater from, trenches to keep the trench dry particularly during casting of base concrete, Concrete for footing and columns of shaft etc.
- 1.10 Whenever collapsible types of strata are encountered pucca shoring and strutting shall be invariably claim shall be entertained.

2.0 C.C. M 100 BASE CONCRETE FOR LEVELLING COURSE:

- 2.1 For all practical purpose and in absence of proportioning of concrete on base of preliminarily tests, C.C. 1:3:6 may be provided as a levelling course i.e. one part of cement three parts of sand and six parts of black trap kapachi. Specification for various ingredients of concrete such as sand, cement, kapachi, water shall be as these given in specification for C.C. M 100.
- 2.2 While laying base concrete for levelling course the concrete shall not be dumped from above but shall be carried out to the bottom and gently placed from a height not exceeding 1.5 meter. If concrete is transported by chutes, then the same shall be remixed at bottom of chutes to overcome any segregation that might have occurred.

3.0 C.C. M 150:

- 3.0 As far as possible the preparation of various ingredients of concrete shall be determined on the bases of preliminary tests as per ISS using the actual materials to be used on site. However in absence of such preliminary tests the volumetric proportion of 1:2:4 may be adopted i.e. one part of cement, two parts of sand and four parts of kapachi, water just sufficient to attain desired workability may be added. However the aim

while proportioning should be to fix the proportion of aggregation and water cement ratio shall be always sufficiently low enough to get desired strength.

3.0 Materials:

- 3..1 Coarse aggregate shall consist of tough angular black trap kapachi. The kapachi shall be obtained from approved source only. Normally at least two stock piles of different size of 12 to 20 mm and 25 mm to 40 mm shall be maintained. It will however, be preferably to maintain third stock pile of 6 mm to 12 mm also for better control on mix of concrete
- 3..2 The maximum size of coarse aggregate to be used shall be as large as possible within the limits of requirements, based on size of member and spacing of reinforcement. But aggregate exceeding 40 mm shall not be used in concrete for ESR and Sumps.
- 3..3 Depending up on the size of member, spacing of reinforcement and degree of workability desired, the coarse aggregates from different stockpiles may be mixed in a suitable proportion to get a uniform mix that does not segregate.
- 3..4 The coarse aggregate shall not contain dust, clay or other such harmful material. If directed by the Engineer the same shall be washed with water and dried before being used.

3.3.0 Fine Aggregates:

Fine aggregates shall consist of course, angular river sand free dirt and other harmful organic materials. If directed the same shall be screened and washed before being used. Sand brought from approved source shall only be used.

Contractor shall provide a temporary store with double lock arrangement for storage of this cement on work site without extra cost. Cement shall be stored in such a way that it is not affected by moisture.

3.4.0 Cement:

3.5.0 Water:

Water to be used in concrete work shall be potable, free from injurious elements such as chloride or sulphate etc. and shall be obtained from approved source only. Contractor shall make his own arrangements to obtain and store sufficient quantity of water at all times.

3.6.0 Reinforcement Steel:

The reinforcing bars to be provided with CRS Steel & shall confirm to the Tender specifications and relevant IS specifications. In spite of producing test certificates by Contractor for the proper quality of reinforcing bars, the quality of steel could also be tested by checking coating firm at plant site for bend test before doing coating and that if the reinforcing bar fails in bend test, then it shall not be provided with FBEC and in that case, cost of conveyance of such steel to plant and removing from plant shall be of the Contractors. The rechecking quality of Steel, for bend test will be done by the coating agency in the presence of contractor provided the contractor choose to remain present.

Reinforcing bars to be used shall be fresh from rolling mills as far as possible. If the bars are very much rusted in quality before providing FBEC, such bars shall have a loss of weight at contractor's risk.

- ` To ascertain the loss in weight of reinforcing bars on account of removal of rust during coating, random weightment before and after coating shall be done and that loss in weight shall be borne by the contractor.

3.7.0 Coating Bars with CRS:

The CRS coating shall be done confirming relevant IS code.

3.8.0

The coated reinforcement bars shall be tested at plant by the contractor. Test reports shall be jointly signed by authorized representatives of Contractor and the coating agency. The tests on coated bars shall be as per I.S. for the following tests.

(a) Thickness

(b) Continuity

(c) Adhesion

The frequency of tests shall be for the thickness of coating minimum ;two bars of each size from each production shifts.

- 3.8.1 In spite of above tests and test certificates produced by the contractor and coating agency, the Department/ Owner reserves the rights to carry out independent tests at coating plant for cross checking. The contractor's agreement with coating agency shall include the provisions for Department's/ Owner's cross checking and that if the coating quality is not approved by the Department/ Owner the decision of the Department/ Owner to reject or repair the coating shall be final and binding on all parties.

- 3.8.2 Holidays in coating shall not be more than two holidays per linear foot (six holidays per meter) of coated bar.

3.9.0 HANDLING:

- 3.9.1 The coated bars shall be carefully handled in order not to drop them, not to rub them on hard surface or against another coated bar while conveying, stacking, placing or stacking of fabricated bars and that for this purpose wooden packing batons shall be used at spacing of not more than 60 cms.

The coated bars shall be tied to make bundles with PVC wire so as to avoid damages to coating.

- 3.9.2 The coated bars shall be stacked with separation gap between ground and bars with wooden batons between rows of bars or bundles of such tied bars. Such wooden or padded contact shall be at spacing of not more than 60 cms.

- 3.9.3 The cut ends of bars shall be touched up with special touch up materials of specifications as provided by coating agency. There shall be minimum time gap to repair the cut ends and damaged portions with touch up materials and that failure to

do so may cause complete rejection of the coated bars. The cut ends and damaged portions shall be touched up with repair patch-up material within four hours' time gap. All damages to coating in handling etc. shall be repaired irrespective of their size. This stipulation supersedes provision of I.S. Code.

- 3.9.3 No payment will be made for coated bars which are not used in the work and that if they were paid either on account of coating of the rejectable part of bars or doing extra fabrication etc., the amount paid will be recovered from contractor. The contractor will be paid for the same quantity of steel bars used in the work and paid under relevant item.
- 3.9.4 While bending the bars, the pins of workbenches shall be provided with PVC or Plastic sleeves. It is preferable that contractor install bar bending machines suitable for FBE coated bars and that each bending operation is done in a time of not less than 90 secs.
- 3.9.5 The coated steel shall not be directly exposed to sun rays and rains and shall be protected with opaque polythene sheets or such other approved materials. While doing concreting, the workmen or trolleys shall not directly.
- 3.9.6 Movement on coated bars shall not be allowed but can move on wooden planks placed on the bars by Contractor.
In spite of all test certificates, if the coated bars are roughly handled by contractor either during transport, fabrication, stacking, placing and concreting etc. or handled in such a manner as to damage the coating for area or portion more than reasonable, the Engineer-in-Charge or Department/Owner reserve the right to reject the CRS coated bars and that if rejected then such rejected bars shall be removed by contractor from work site within three days. The decision of Engineer-in-charge will be final as to reject the bars with damage coating or to allow repairing the coating, or to get it recoated at contractor's cost.

4.0 FORM WORK:

Form work shall consist of steel plates or smooth timber planks to be joined by nuts, bolts, nails or pegs so as to have a reasonably water tight joints. Sufficient number of vertical and horizontal supports shall be providing when completed. Formwork shall be sufficiently sturdy & strong to absorb all stresses and movements. Before concrete is placed in position the formwork and steel shall be got checked through Engineer-in-charge of work. Advance intimation shall be given to the Engineer-in charge for this purpose. The ultimate responsibility for safety and of lives of workmen and that of forms etc. from beginning of work till its completions shall always rest with the contractor proper ladders and plant forms for easy access

shall be provided by the contractor without extra cost.

The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.

Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of the Engineer In charge. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

Permanent formwork shall be checked for its durability and compatibility with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair the desired appearance or durability of the structure by causing swelling, rust staining or allowing the passage of moisture.

For liquid retaining structures, sleeves shall not be provided for through bolts nor shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

The striking time for formwork shall be determined based on the following requirements:

- (a) Development of adequate concrete strength;
- (b) Permissible deflection at time of striking form work;
- (c) Curing procedure employed - its efficiency and effectiveness;
- (d) Subsequent surface treatment to be done;
- (e) Prevention of thermal cracking at re-entrant angles;
- (f) Ambient temperatures; and
- (g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20oC) forms may be struck after expiry of the time period given in IS: 456 unless approved otherwise by the Engineer In charge. For Portland Pozzolana/slag cement the stripping time shall be suitably modified as approved by the Engineer In charge. It is the Contractor's responsibility

to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stresses arising during the construction period.

5.0 MIXING, TRANSPORTATION AND LAYING:

- 5.1 For important works like ESR and sumps mixing of concrete shall be invariably done in approved machine mixer only. The mix obtained from the mixer shall be a uniform mass consisting of all aggregates coated with cement paste.
- 5.2 Fresh concrete shall be transported horizontally in ghamellas or wheel barrows. Vertical transportation shall be done either by manual labour or using mechanical vertical lifts. When chutes are used for transportation, care should be exercised to avoid segregation and concrete may be remixed at bottom of chutes to get uniform mix. Before any concrete is placed in position all loose materials such as dirt, chips of stones, wood, steel etc. should be removed. Inner side of forms should be coated with thin layer of oil to get a good finished surface. Concrete should not be dumped from above in which case aggregate will segregates, but placed gently from a height not exceeding 1.5 meter. Compaction of concrete shall be done by vibrators till cream appears at top. Over vibration shall be avoided to avoid segregation.

6.0 CURING:

After concrete is set in position it shall be kept continuously wet with water for 7 days either by using gunny bags (column and walls) by ponding (slab) or as directed by spraying of water.

Unless otherwise specified the rate shall include finishing the exposed surface to get good finished surface.

The forms shall be kept in position for period given below:-

Form Removal Shall be As per relevant IS Code or Specified in Drawings.

C.C. M 300 :

Specification for C.C.M-300 shall be same as those for C.C.M 200 except that grade of concrete to be produced shall be M300. Contractor shall have to design the Mix of M300 grade concrete by govt. laboratory or any govt. approved laboratory as per instruction of Engineer in Charge. Trial of Mix design test is taken in laboratory & site for conforming the test results of Mix of concrete of grade M300 & same is to be tested in the presence of representative of the GWSSB. If arbitrary volumetric proportioning is to be followed then the proportion of cement, sand and kapachi shall be 1:1:2 respectively. Since M - 300 mix is normally used in water retaining parts of container where the aim is to get dense, strong and watertight concrete,

special care shall be exercised in controlling proportion of aggregate, water cement ratio, compaction and curing.

7.0 PROVIDING AND PLACING IN POSITION STEEL REINFORCEMENT:

- 7.1 Reinforcement bars to be used in RCC work shall have to be supplied by the contractor. The rates include providing, cutting, bending, binding, hooking and placing in position including cost of binding wire. The bars shall be fusion bonded and epoxy coated.
- 7.2 Depending upon the type of reinforcement steel proposed in design (i.e. M.S. or deformed etc.) the steel shall conform to relevant ISS codes in practice. Contractor shall produce necessary test certificate in absence of which the steel bars shall be get tested by the Department at the contractor's cost.
- 7.3 Steel bars shall be cut, bent up, hooked bound with wires and then placed in position as per approved drawing. The steel shall be got checked through Engineering- charge. Before any concrete is placed in formwork advance intimation shall be given to the Engineer-in-charge for this purpose. The steel shall be cleared of any dust or rust that might have been deposited on bars.
- 7.4 Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by the Executive Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause scaling of the concrete cover.
Binding wire shall be 16 gauge soft annealed wires. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover. Substitution of reinforcement, laps/splices not shown on drawing shall be subject to Executive Engineer's approval.

8.0 RCC STAIRCASE FROM GL. TO TOP OF CONTAINER:

RCC Staircase shall be provided for easy access necessary to the top of ESR or sump. RCC staircase shall be either spiral with triangular steps fixed around RCC column rectangular steps along the periphery of circular shaft. Rise and trade of suitable dimension shall be provided to have a comfortable access. Width of staircase shall not be less than 90 cm. Separate RCC foundation shall be provided when RCC spiral stair with triangular steps is provided when cantilever steps are provided. In case of spiral staircase with triangular steps separate RCC cabin 10 cm. thick walls shall be provided with a steel door for entry of an authorized

person to the top of ESR.

However no such separate cabin need to be provided when the staircase is located inside hollow supporting shaft, but in that case enough provision for windows shall be made in addition a wooden door. The baluster and hand railing shall be made from 40 x 40 x 6 mm angles and 3/4 dia GI pipes by welding as directed by Engineering- charge and colored with three coats of paints.

9.0 WOODEN WATER LEVEL INDICATOR:

- 9.1 A wooden water level indicator of approved size and type shall be provided and fixed by the contractor. It shall consist of wooden plank of 250 mm x 40 mm.
- 9.2 The divisions on water level indicators shall show distance of 10 cm. clearly. A copper or PVC float of 500-mm dia and 50 mm height shall be provided along with steel wires pulleys etc. The entire arrangement shall be first got approved by the Engineer-in- charge of work. Letter and marking shall be painted with approved enamel paint.

10.0 COPPER LIGHTENING CONDUCTOR:

Copper lighting conductor with size of strip 20 mm x 3 mm with clamps and screw and copper plate of 600 mm x 600 mm x 6 mm and copper rod as per specification no. 120 of PWD Hand book Vol I (ISS - 2309) shall be provided and fixed by the contractor. It shall consist of copper arrestor at top, copper conductor from top up to GL and copper earthing plate shall be 1 m. deep below GL and filled with salt and charcoal to transmit the current to earth, minimum dimension of these part shall have confirmed to relevant ISS. Heights of the arrestor shall be such as to enclose the entire structure with imaginary cone generated by a inclined at 600 degrees with vertical at top.

- 11.0 Providing and fixing CI flanged pipes and special such as duck foot bends, crippling flanges bell mouthpiece etc. for inlet outlet overflow and wash out.
- 11.1 Diameter and length of above pipes shall be as given in Appendix - A. CI flanged pipes shall be vertically cast double flanges and shall be confirm to relevant ISS.
- They shall be first get approved by the Engineer-in-charge of work.
- 11.2 Item shall include providing all specials such as crippling flanges, and duck feet bends etc. as may be required on site.
- 11.3 The Item shall also include cost of all jointing materials such as nuts, bolts, rubber packing, white zinc or pig lead or lead wool if required.

- 11.4 Pipes shall be fixed perfectly vertical and straight.
- 11.5 Before fixing in position pipes shall be coated with two coats of anticorrosive paint.
- 11.6 The pipes and specials shall be tested hydraulically. Leakage if found shall be repaired without extra cost.

12.0 PROVIDING AND FIXING CI SLUICE VALVE:

- 12.1 Diameter of CI sluice valve shall be as shown in Appendix - A. CI sluice valve shall be of class - I confirming to IS - 780-1980.
- 12.2 The rate includes providing and fixing CI sluice valves with tailpieces including jointing materials such as nuts, bolts, rubber packing zinc etc.
- 12.3 The rate includes giving hydraulic test to the satisfaction of Engineer-in-charge of work.
- 12.4 Sluice valve shall be supplied with necessary spindle or wheel for operating the same.

13.0 PROVIDING AND FIXING C I M H FRAME AND COVER:

One number of C I M H frame and cover shall be providing and fixed in top slab of container. The dimensions and weight shall be as shown in Appendix - A. The C I M H frame and cover shall be first got approved by the Engineer-in-charge. Two coats of anticorrosive paints shall be applied before fixing them in position.

14.0 C I COWL TYPE VENTILATORS:

The C I Cowl type ventilator should be of 100 mm dia shape with flanged and roughing screen shall be as per Appendix - A. The rate includes providing and fixing C I Cowl type ventilator as per Appendix - A including cost of all jointing materials such as nuts, bolts, white zinc rubber packing etc. Two coats of anticorrosive paints shall be applied to the surface before they are fixed in position. They shall be first for approved by the Engineer-in-charge.

15.0 PROVIDING AND FIXING M.S. LADDER INSIDE CONTAINER:

Contractor shall have to fabricate and fixed M.S. ladder. The ladder to be fixed shall be fabricated from M.S. flat of 10 mm x 65 mm or M.S. angle having equivalent modular of selection 20 mm dia. Bars shall be fixed at 30 mm c/c. to act as steps. The ladder shall be 45 cm. wide if length of ladder is more than 8.0 m. Three coats of approved anticorrosive paint shall be applied to the ladder. The design of M.S. ladder shall be got approved by the Engineer-in-charge before it is fabricated and fixed in position. Rate includes providing and fabricating, painting and fixing in position of M.S. ladder as above.

16.0 CONSTRUCTION OF VALVE CHAMBER:

Number and size of valve chamber shall be as per Appendix - A.

Specification of various items such as B.B. masonry cement plaster, C.M. (1:3) and C.C. (1:3:6) at bottom. RCC 1:2:4 etc. shall be as these given in column of specification published by G W S & S Board and as those prevailing in Division.

17.0 PAINTING LETTER:

Following words shall be painted on the container litres capacity. The letters shall be 45 cm high and the black ground of suitable colour shall be provided. Approved enamelled paint shall only be used for painting letters and background. Entire work shall be carried out as per instruction of Engineer-in-charge.

18.0 PROVIDING AND FIXING GI PIPE RAILING AROUND TOP SLAB:

Railing shall consist of 3 raw of 25 mm dia GI pipes fixed in M.S. angles of 60 mm x 60 mm x 6 mm 0.9 m. height fixed at 2 m c/c. The materials shall be got approved by Engineer-in-charge before fabrication. Three coats of approved anticorrosive paint shall be applied to M.S. angle before they are fixed in position.

19.0 RCC CABIN:

Constructing RCC cabin 2 m dia and 10 cm wall thickness with neat finishing etc. complete. The depth of excavation for foundation of cabin shall be 0.7 m deep and 0.65 m width. RCC (1:3:6) shall be of 15 cm thick. The cabin shall be constructed in C.C. (1:2:4) with 10-cm thick wall and 2.2 m height above GL. The wall shall be constructed with 10 mm dia vertical bar at 30 cm c/c. and 6 mm dia bars circle on temporally 30 cm c/c. A steel door made 4 mm thick and steel plaster and welded with flat and 25 mm x 25 x 5 mm M.S. angle from frame. The necessary iron fixtures and fastening shall be provided by contractor at his own cost. The contractor shall have to plaster the cabin if the cabin has not smooth finishing without any extra claim.

20.0 CEMENT PAINT:

The work shall be carried out as per instruction of the Engineer-in-charge. The snowcem paint shall be waterproof cement paint and best quality shall be got approved before use.

The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fibre brush or and suitable means and washing the surface. All loose pieces shall be scrapped out and hole shall be stopped with mortar. After cleaning the surface the watering hole surface and applied snowcem paint in three coats.

21.0 WATERPROOF CEMENT PLASTER:

The cement mortar shall consist of two parts of fine river sand free from any dust and other organic matter and one part of approved quality of cement. The mortar shall be properly mixed on watertight platform. The mortar shall be used within half an hour after mixing. The water proofing materials weighting 1.5 kg of powder in one bag of cement shall be added.

The plaster shall be applied in uniform thickness of 20 mm and shall be properly smoothened with wooden & finished with cement finishing of required. The curing shall be done at least for week by sprinkling the water over the wall. The wall shall be tested for waterproof ness. The rate includes the cost of waterproofing materials. The test for waterproof ness shall be carried out by the contractor at his own cost by filling the contractor with water and it shall be checked out that there is no percolation of water from the wall. Payment shall be made per sq. m. of plaster.

22.0 BRICK PITCHING:

The brick shall be of proper quality, standard size, uniform in colour, well-burnt and free from cracks. The work of brick pitching shall be carried out in C.M. 1:6. It shall be laid as per the drawing and directed by the Engineer-in-charge. The bricks shall properly soak before being using in work. No brickbats shall be use except the bricks. The joint shall be racked out 20mm depth. Every day at the end of the days work the cement pointing in C.M. 1:2 shall be carried out by line as directed by the Engineering- charge. The excavation required for brick pitching shall have to be carried out by the contractor as directed including necessary temping consolidation etc. complete.

After completion & testing of work the contractor shall have provide & fix the Marble 'Takti' of required size with necessary writings, as directed by the Engineer in- charge.

23.0 RCC work of shaft, container and staircase should be of well finished condition if the same is not satisfactory than contractor since have to finish the surface with 12 mm thick plaster C.M. without any extra cost.

24.0 The contractor shall have to make arrangement for testing of steel bars brought on site and concrete cubes, for different mix at different stage like foundation, shaft, column, and cube should be cast on site and send Govt. approved laboratory for compressive strength at 28 days. Results must be produced in office before taking payment of work done. Testing charge must bear by contractor.

25.0 Conditions:

The paint is supplied in two packs, fine zinc dust mixed with epoxy resin as base and liquid hardener. They are to be mixed in following ratio.

Mixed Paint Properties

i)	Viscosity	20+3% seconds by flow
		Cup No.4 @ 30 ° C
ii)	Specific Gravity	1.70+3%
iii)	Post life of mixture	6-8 hrs.
iv)	Zinc dust content on DFT basis	92+/-3%
v)	Finish	Smooth and Matt.
vi)	Drying time	
	Surface dry	5 minutes
	Hard Dry	Less than 1 hr.
vii)	Over coating after	Minimum 24 hrs.
		Maximum No limit
viii)	Flash point	Above 23 o C
ix)	D.F.T.	20-25 microns depending on blasting profile
x)	Compatibility	Compatible with all systems of paints like Bituminous, conventional, chlorubber vinyl and epoxy paints.
xi)	Toxicity	Non toxic

3) Application: By Brush/Spray (Air and Airless)

4) Thinner: Epoxy thinner shall be used if required.

5) Coverage: 10 Sq. m./litre at 25 microns.

6) High build black paint.

1)	Dry time	Surface dry not more than 4 hours Hard dry not more than 18 hours Film thickness per coat 75 micron.
2)	Consistency	Thixotropic liquid
3)	Covering Capacity	5 Sq.m./liter
4)	Color	Black/Brown/Black in alternative layer

7) Characteristics:

The coating shall be non-phenolic, non-toxic. It shall afford a highly durable protective air tight coating to prevent corrosion or rusting of iron and steel against air moisture/water and shall be of sufficient elasticity to prevent racing, blistering or peeling. It shall retain its consistency at the ordinary atmospheric temperatures when packed in suitable containers. After

application of drying, the coating shall not show any surface cracks due to drying, weathering action or expansion and contraction. Its resistance to water must be perfect. It shall also be resistant to weak acid and alkalis, natural salts and to dry heat up to 150 centigrade. It should have good brush ability.

The primer as well as paint shall have to be applied as per the manufacturer's specification. The paints shall be tested in the laboratory by the owner at the cost of the contractor if found necessary. The manufacturer shall accompany each lot of primer and paint supplied. The entire procedure of applying the coating as specified shall be rigidly inspected right from cleaning stage to application of final coat.

8) Stacking of bars:

On receipt the pipes shall be stacked on wooden/concrete sleeper to ensure that they do not come in contact with earth. The contractor shall take necessary precaution for safety of bars so that no damage occurs during stacking.

Plinth Protection

Plinth protection all around the structure shall be provided as directed by Engineer. The width of plinth protection shall be min of 1.2 m and 0.1 m thickness and shall have slope towards the edge so that the water is drained out and do not enter the foundation. The plinth protection shall be in M 15 (1:2:4) PCC. The overburden or top soil from a depth of 0.3 m shall be removed by excavation & it shall be filled with murrum & boulder in layers. This filling shall be watered and well rammed as directed by Engineer. On this PCC, M 15 grade shall be provided and finished smoothly. All the piping's like inlet, outlet, washout and over flow and respective fittings like duck foot bend, bell mouth, crippling flange will be as per approved drawings.

The material of all the piping's shall be CI as per approved drawings.

Payment As per payment schedule in price bid.

25.0 Mode of measurement and payments:

As per payment schedule.

**Signature of
Contractor**

**Dy. Executive Engineer
P.H.S. Sub-Division,
Manavadar**

**Executive Engineer
P. H. Works Division,
Junagadh**