## 1.0 PART 1 - GENERAL

1.1 DESCRIPTION

1.1.1 SCOPE OF WORK:

1.1.1.1 The work to be performed under these specifications includes furnishing all labor, materials, tools, and equipment necessary to design, fabricate, construct, inspect and test a single pedestal spheroidal welded steel elevated water storage tank, including the design and construction of the foundation and accessories as shown on the drawings and specified herein.

1.1.1.2 The work shall also include all labor, new materials, and equipment necessary to clean, paint and disinfect the water storage tank as specified herein.

1.1.2 RELATED WORK:

The work shall also include all labor, materials, and equipment necessary to construct the site improvements and site piping as shown on the drawings.

1.1.3 DESCRIPTION:

1.1.3.1 The tank and support structure shall be of the single pedestal spheroidal style similar to the Waterspheroid® as designed and constructed by CB&I. The tank and support structure shall be of all welded steel design.

1.1.3.2 The tank shall consist of a dome roof, toroidal upper shell, conical lower shell, and conical bottom plate. The support structure shall be a butt-welded single pedestal consisting of a cylindrical shaft and a conical base “bell.”

1.1.3.3 Transition sections between the tank and shaft, and between the shaft and “bell” shall be smooth, doubly curved, continuous “knuckle” sections. Discontinuous transitions and intersections through compression rings are not acceptable for these transition sections.

1.1.3.4 To ensure an aesthetically pleasing tank the design of the cone and ball plate(s) shall minimize the number and total length of visible weld seams (shop and field). A scaled plate layout sketch must be provided with the bid, or be cause for rejection. In addition, both knuckles on the lower and upper shaft junctions shall be double curvature pressed formed with a maximum of eight vertical weld joints for tanks with capacities up to and including 1,250,000 gallons, and a maximum of twelve vertical joints for greater capacities.

1.2 PRE-QUALIFICATION OF CONTRACTOR

1.2.1 Bids will only be accepted from experienced Contractors having a minimum of ten years’ experience in the design and construction, using in-house capabilities, of single-pedestal spheroidal elevated tanks of equal or greater capacity. Each bidder shall provide a list of a minimum of ten such tanks that have been in satisfactory operation for at least five years. The list shall include project locations, completion dates, contact names, and telephone numbers.

1.2.2 The spheroidal single pedestal style tank and foundation design, welded steel tank fabrication and construction shall be performed by the Contractor’s own direct hire employees and shall not be subcontracted. The tank’s foundation may be supervised and installed by the Contractor or a qualified local foundation subcontractor.

1.2.3 The Contractor’s EMR Rating shall be less than or equal to 0.80. Each bidder shall submit their current EMR letter with the bid, as only Contractors with an EMR less than or equal to 0.80 will be considered. Failure to provide this information, and/or ratings above 0.80 (indicating below average safety standards) shall be cause for rejection of the bid.

1.3 STANDARDS, CODES AND GUIDES

The following standards and specifications are referenced. The latest edition shall be used if the edition is not specified.

| | |
|---|---|
| AWWA D100 | Standard for Welded Carbon Steel Tanks for Water Storage |
| AWWA D102 | Standard for Painting Steel Water Storage Tanks |
| AWWA C652 | Standard for Disinfection of Water Storage Facilities |
| ACI 301 | Specifications for Structural Concrete for Buildings |
| ACI 318 | Building Code Requirements for Structural Concrete |
| NSF 61 | Drinking Water System Components |
| OSHA | Occupational Safety and Health Standards |
| SSPC-PA1 | Paint Application Specification |

1.4 OWNER OR ENGINEER SUPPLIED INFORMATION

The Owner or Engineer shall provide the following information with the bid documents:

1.4.1 Geotechnical investigation report that is specific to the site and prepared by a qualified Geotechnical Engineer. The geotechnical investigation report shall include a determination of the Site Class to be used for the structure's seismic design. The determination of the Site Class shall be in accordance with AWWA D100.

1.4.2 Summary of FAA requirements such as height restrictions, obstruction marking or obstruction lighting. The elevated water storage tank may affect navigable airspace. The Owner or Engineer shall file Form 7460-1 with the FAA (http://forms.faa.gov/) to determine requirements.

1.5 SUBMITTALS

1.5.1 Each Bidder shall submit with its proposal a sketch of the spheroidal tank showing major dimensions and plate thicknesses. A sketch of the foundation showing preliminary dimensions and approximate quantities of concrete and reinforcing steel shall also be provided with the bid. Failure to provide either of these sketches shall be cause for rejection of the bid.

1.5.2 Prior to construction, the Contractor shall furnish construction drawings of the tank, support structure and foundation sealed by a Professional Engineer licensed in the State of _____. Construction drawings for the foundation shall show applicable design and construction standards, materials of construction, design loads and allowable soil bearing or pile capacity.

1.5.3 A summary of the design for the foundation, support structure and tank shall be provided before construction. The design summary shall show applicable design and construction standards, materials of construction, design loads and results showing conformance with the specifications. The design shall be sealed by a Professional Engineer licensed in the State of _____.

1.5.4 Welder’s certifications shall be submitted in accordance with AWWA D100.

1.5.5 Provide an operating and maintenance manual containing operating instructions, maintenance instructions, as-built construction drawings, cleaning and painting instructions, a gage table and catalog cuts of equipment supplied.

## 2.0 PART 2 - PRODUCTS

### 2.1 GENERAL

Furnish an elevated water storage tank as shown on the drawings and as specified in this section. The design, materials, fabrication, construction, testing and inspection of the tank, support structure and foundation shall comply with AWWA D100, except as modified herein. Tank capacity, head range, height to TCL and top of foundation elevation shall be as shown on the drawings. Tank net capacity shall be _____ gallons.

### 2.2 DESIGN CRITERIA

#### 2.2.1 GENERAL

2.2.1.1 Dead load shall be the estimated weight of all permanent construction and fittings. The unit weight of steel shall be considered as 490 pounds per cubic foot and the unit weight of concrete shall be taken as 144 pounds per cubic foot.

2.2.1.2 Water load shall be the weight of the water when the tank is filled to the overflow. The unit weight of water shall be 62.4 pounds per cubic foot.

2.2.1.3 The roof snow load shall be in accordance with AWWA D100 and based on a uniform roof load of ____ pounds per square foot.

2.2.1.4 Wind loads shall be based on AWWA D100 for an ultimate wind speed, $V_{ult}$, of _____ mph and Exposure Category C in accordance with ASCE 7 for Category IV (essential facility) structures.

2.2.1.5 Horizontal and vertical seismic loads shall be based on AWWA D100 for Category IV (essential facility) structures, using tank center coordinates of _____ latitude and _____ longitude. The Site Class shall be as specified in the geotechnical report.

2.2.1.6 The structural effects of the applied loads shall be considered with the loads defined according to ASCE 7 Load combinations used for allowable stress design and strength design shall conform to AWWA D100.

2.2.1.7 The design for all sections of the steel tank shall be per the classes of materials and unit tension/compression stresses specified in AWWA D100. A design per Section 14 of AWWA D100 shall not be permitted.

2.2.1.8 Shells designed by Method 2 of Sec. 3.4.3.2 of AWWA D100 shall be measured in accordance with Sec. 11.4.3.2.2 of AWWA D100. Documentation of the measurements and a certificate of compliance shall be provided.

2.2.1.9 All openings in the support structure shall be properly reinforced. Loads imposed by openings in the base of the support structure shall be accommodated in the foundation design.

2.2.1.10 The overturning moment used in designing the support structure and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e., P-Delta effect).

2.2.1.11 Unless otherwise noted, at junctions in plates where meridional forces are discontinuous such as cone to cylinder junctions, a tension or compression ring may be required to resist the radial forces generated. In these regions, the allowable stresses shall not exceed those specified in AWWA D100.

2.2.1.12 No corrosion allowance is required unless specified in Sec. 7.8 herein.

#### 2.2.2 FOUNDATION

2.2.2.1 The design of the foundation shall conform to ACI 318 except as modified herein.

2.2.2.2 The foundation design shall be by the Contractor and shall conform to the recommendations given in the geotechnical report. The foundation depth shall be as required for the extreme frost penetration shown in AWWA D100.

2.2.2.3 Earth cover shall be a minimum of _____ feet over top of pipe in accordance with AWWA D100. Any pipe passing through the foundation which does not meet this minimum cover requirement shall be properly insulated until such minimum cover is achieved.

2.2.2.4 Unless modified by the Geotechnical Engineer, shallow foundations shall be sized to provide a safety factor of 3.0 against the ultimate soil bearing capacity in accordance with AWWA D100. For deep foundations, the safety factor shall be as required by AWWA D100 Table 20. When direct vertical loads are combined with wind or seismic, the safety factor for shallow foundations may be reduced to 2.25, and the safety factor for deep foundations shall follow AWWA D100 Table 20.

2.2.2.5 The foundation shall be sized such that there is a minimum safety factor of 1.5 against overturning for wind or seismic events using service load combinations.

2.2.2.6 Foundation piling shall conform to the design and detailing requirements of International Building Code (IBC) Section 1810, including the supplemental design and detailing requirements based on the assigned Seismic Design Category (SDC).

## 2.3 APPURTENANCES

### 2.3.1 ACCESS DOOR

One 36-inch by 80-inch plate access door with flush threshold shall be provided and located in the base of the support structure complete with a handle, drip cover, and dead bolt lock. The door shall be fabricated from steel plate with adequate stiffening and specifically designed for use with the tank. A step-over threshold is not acceptable.

### 2.3.2 PIPING & PRESSURE RELIEF

2.3.2.1 A _____-inch diameter inlet/outlet pipe shall be provided from the bottom of the tank to a flanged connection at the base of the support structure. The inlet/outlet pipe shall be steel with welded connections and have a thickness not less than 1/4 inch. The inlet/outlet pipe shall have an expansion joint above the base bend. Provide taps as shown on the drawings.

2.3.2.2 The inlet/outlet pipe shall extend at least six inches above the bottom of the tank floor or be equipped with a removable silt stop.

2.3.2.3 A _____-inch diameter overflow pipe equipped with an anti-vortex entrance detail shall be provided. The overflow shall be designed to accommodate the maximum inlet rate specified in Sec. 2.3.2.4. The overflow pipe shall be steel with welded connections. The overflow shall extend down the inside of the access tube and support structure and discharge at a point approximately two feet above finish grade onto a splash block. The end of the overflow shall be covered with No. 4 galvanized steel wire mesh screen.

2.3.2.4 At least one aluminum pressure-vacuum vent near the roof's center shall be provided. The vent(s) shall be sized to handle pressure differential caused by water entering or leaving the tank at a maximum rate. The maximum inlet rate is _____ gpm, and the maximum withdrawal rate is _____ gpm. The open area of the overflow shall not be considered as a venting area. The vent(s) shall have insect screens and be designed to relieve pressure or vacuum if the screen frosts over or is clogged and shall be easily dismantled for cleaning. The vent(s) shall be self-correcting. The pressure-vacuum vent may be mounted on the exhaust hatch.

### 2.3.3 ACCESS, LADDERS & PLATFORMS

2.3.3.1 Provide a ladder system which extends from grade to the upper shaft platform. This ladder shall be equipped with ladder safety cable.

2.3.3.2 Provide a ladder on the interior of the access tube from the upper shaft platform to the tank roof. This ladder shall be equipped with ladder safety cable.

2.3.3.3 Provide a ladder from the upper shaft platform to the tank bottom manhole.

2.3.3.4 The ladder safety cable shall be an OSHA approved, galvanized system as manufactured by DBI-Sala, or equal. The Owner shall be supplied with two (2) harnesses, 2 lanyards and two (2) sleeves.

2.3.3.5 A steel condensate ceiling with drain shall be supplied, located at the junction of the pedestal shaft and base bell. The condensate ceiling shall be equipped with a drainpipe connected to the overflow pipe.

2.3.3.6 An upper shaft platform shall be supplied, located at the top of the support structure.

2.3.3.7 Provide an access tube located on the vertical centerline of the tank. The access tube shall have a minimum diameter of 48 inches and shall provide access from the upper shaft platform to the tank roof.

2.3.4 MANHOLES, HATCHES & VENTS

2.3.4.1 One 24-inch diameter painter's access manhole shall be provided giving access to the exterior painter's rails located at the top of the support structure.

2.3.4.2 Two 32-inch diameter hinged rainproof hatches shall be supplied. One shall be at the top of the access tube with spring assist, chain, hook, and inside handle. The other shall be adjacent to the access tube for entry into the tank and shall have a handle and hasp. The hatch openings shall have a curb four inches high and the cover shall have a downward overlap of two inches.

2.3.4.3 One 24-inch diameter flanged exhaust hatch shall be supplied, located adjacent to the access tube, and so constructed that an exhaust fan may be connected for ventilation during painting.

2.3.4.4 One 24-inch diameter tank bottom manhole shall be provided in the tank bottom with access by ladder from the upper platform.

2.3.4.5 Two 30-inch diameter manholes shall be supplied. One shall be in the condensate ceiling with the other in the upper platform.

2.3.5 PAINTER'S RAILS

Provide painter's rails as shown on the drawings and specified herein:

2.3.5.1 Interior Painter's Rails: On tanks with a capacity of one million gallons or greater, a rail shall be attached to the underside of the roof at the roof-to-shell junction.

2.3.5.2 Exterior Painter's Rails: A minimum of two rails shall be located near the top of the support structure and be accessible from the upper shaft platform via the painter's access manhole.

2.3.6 ELECTRICAL

Interior waterproof light sockets with rigid conduit, wiring and switch shall be provided inside the support structure and access tube. The total number and location of lights shall be as shown on the drawings. All wiring shall be in conduit. The conduit and wiring shall terminate with a junction box in the base of the support structure. Duplex outlets shall be installed as shown on the drawings. Electric service shall be provided and connected by others.

2.3.7 GALVANIC CORROSION PROTECTION

Dissimilar metals (e.g., stainless steel, copper, and brass) more noble than carbon steel and installed inside the tank below the TCL shall be electrically isolated from carbon steel tank components to which they attach. Painting of the dissimilar metals does not eliminate the requirement for isolation.

## 3.0 PART 3 – EXECUTION

3.1 INSPECTION

Inspection and testing shall be in accordance with AWWA D100. Shop subassembly welds that require radiographic inspection shall be inspected in the shop or field. If radiographic inspection is performed in the shop, radiographs shall be provided to the Engineer prior to their delivery to the jobsite.

3.2 CONCRETE FOUNDATION

3.2.1 If, during excavation, conditions are encountered which differ from those given in the geotechnical report, appropriate adjustments to construction schedule and price will be negotiated.

3.2.2 An inlet/outlet pipe extending a minimum of 3 feet outside the foundation wall shall be included as part of the foundation.

3.2.3 Provide a 6-inch-thick concrete slab at grade in the base of the support structure. The slab shall be placed over compacted structural backfill and shall be reinforced with welded wire reinforcement. Provide 1/2-inch expansion material at the slab to foundation intersection and at floor penetrations. Provide saw-cut control joints at 18 feet maximum spacing. The slab shall be sloped towards the floor drain. The slab shall be constructed in accordance with the latest edition of ACI 301.

3.2.4 All concrete work shall comply with ACI 301.

3.3 WELDING

3.3.1 All welding shall comply with AWWA D100.

3.3.2 All welding procedures, welders and welding operators shall be qualified in accordance with ASME Section IX for the processes and positions utilized.

3.3.3 To minimize corrosion and rust staining on the underside of the roof, the underside roof plate laps, and rafter-to-roof plate seams shall be seal welded. The minimum thickness for seal welded roof plates without structural framing shall be 1/4 inch.

3.3.4 The edges or surfaces of the pieces to be joined by welding shall be prepared by flame cutting, plasma arc cutting, arc gouging, machining, shearing, grinding, or chipping and shall be cleaned of detrimental oil, grease, scale, and rust. The edges of the pieces may have a protective coating applied to them which need not be removed before they are welded unless specifically prohibited by the welding procedures.

3.3.5 Field and shop welding may be done by the shielded metal arc welding process, the gas metal arc welding process, the flux core arc welding process, and the submerged arc welding process.

3.3.6 Plates and component members of the tank shall be assembled and welded following erection methods which result in a minimum of distortion from weld shrinkage. Surfaces to be welded shall be free from loose scale, slag, heavy rust, grease, paint, and other foreign material.

3.3.7 Full penetration butt-welded joints shall be inspected using the radiographic examination method. The number and location of the radiographs and the acceptance criteria shall be as required by AWWA D100. Inspection by sectional segments is not allowed.

3.3.8 When the cone plate thickness has been determined using a nonlinear buckling analysis, the contractor shall measure the actual imperfections of the cone plates after welding. The measurements shall be taken in the meridional direction. Measurements shall be taken at each meridional weld seam and midway between each meridional weld seam. Where the actual imperfections exceed the tolerances assumed in the analysis, further evaluation will be required and corrective action such as reworking the shell or adding stiffeners may be required.

3.3.9 To assist in the maximization of the paint's lifecycle, all welds on the tank exterior shall be ground smooth and blended to a NACE-D profile. All welds on the tank interior shall be ground smooth and blended to a NACE-D profile. Welds on the interior dry support column can remain in an as-welded condition but must have a profile adequate for the specified paint system. Engineer/Owner reserves the right to provide third-party inspection to ensure compliance to this requirement.

## 4.0 PART 4 – COATINGS & FINISHES

4.1 GENERAL

4.1.1 All tank painting and paint testing shall be in accordance with AWWA D102, the Steel Structures Painting Council Specification SSPC-PA1, approved paint manufacturer specifications and as specified herein.

4.1.2 Each system shall be from a single manufacturer.

4.1.3 Pre-construction full-thickness shop primers shall be utilized in the fabrication process to preserve the blast profile and cleanliness. In the field, weld seams and abraded areas will be cleaned on a spot basis. The remaining sound primer will be cleaned to remove dirt and other contaminants. After cleaning, the specified coating system will be applied in its entirety in the field at the thickness (mils) specified.

4.1.4 No paint shall be applied when the temperature of the surface to be painted is below the minimum temperature specified by the paint manufacturer, or less than 5 degrees above the dew point temperature. Paint shall not be applied to wet or damp surfaces or when the relative humidity exceeds 85% unless allowed by manufacturer's data sheets. Follow the paint manufacturer's recommendations for the specific paint system used.

4.1.5 After erection and before painting, remove slag, weld metal splatter and sharp edges by chipping or grinding. All surfaces welded, abraded, or otherwise damaged shall be cleaned and primed in the field according to the paint system requirements.

4.1.6 All areas blasted in the field shall be coated before any rusting occurs.

4.2 EXTERIOR COATING SYSTEM (AWWA D102 OCS-6)

4.2.1 Shop Surface Preparation: Spot clean as required to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a commercial finish in accordance with the recommended methods outlined in the Steel Structures Painting Council Specification SSPC SP-6/NACE No. 3.

4.2.2 Shop Primer: Immediately after abrasive blasting and before any rusting occurs apply one coat of zinc rich aliphatic urethane to a dry film thickness (DFT) range of 2.5 to 3.5 mils.

4.2.3 Field Surface Preparation for Blast Cleaning: After erection and prior to field touch-up priming, all surfaces shall be cleaned to remove all surface contamination including oil, grease, dust, dirt, and foreign matter. Chip or grind as required to remove all slag, weld metal splatter and sharp edges.

4.2.4 Field Blast Cleaning: All rusted, abraded, and bare metal / unpainted areas shall be blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3. All shop primed areas shall be brush blasted to SSPC SP-7/NACE No. 4.

4.2.5 Field Touch-Up: Spot prime with zinc rich aliphatic urethane to a DFT range of 2.5 to 3.5 mils.

4.2.6 Field Intermediate Coat: Apply one coat of Hi-build epoxy, to a DFT range of 2.0 to 3.0 mils. The color shall be tinted to contrast the prime coat.

4.2.7 Field Finish Coat: Apply one coat of gloss finish polyurethane, to a DFT range of 2.0 to 3.0 mils. The finish color shall be selected by the Owner.

4.2.8 The total DFT range of the three coat Exterior Paint System shall be 6.5 to 9.5 mils.

4.3 INTERIOR WET COATING SYSTEM (AWWA D102 ICS-5)

4.3.1 Shop Surface Preparation: Spot clean as necessary to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a near-white finish in accordance with SSPC SP-10/NACE No. 2.

4.3.2 Shop Primer: Immediately after abrasive blasting and before any rusting occurs, apply one coat of zinc rich aliphatic urethane, to a DFT range of 2.5 to 3.5 mils.

4.3.3 Field Surface Preparation for Blast Cleaning: After erection and prior to field touch-up priming, all surfaces shall be spot cleaned as required to remove all surface contamination including oil, grease, dust, dirt and foreign matter. Chip or grind as required to remove all slag, weld metal splatter and sharp edges.

4.3.4 Field Blast Cleaning: All rusted, abraded, and bare metal / unpainted areas shall be blast cleaned to a near white finish in accordance with SSPC SP-10/NACE No. 2. All shop primed areas shall be brush blasted to SSPC SP-7/NACE No. 4.

4.3.5 Field Touch-Up: spot prime with zinc rich aliphatic urethane, to a DFT range of 2.5 to 3.5 mils.

4.3.6 Irregular surfaces, including weld seams, bolt heads and nuts, corners, and edges, shall be stripe coated by brush or roller after the field spot prime coat has been applied and prior to application of the first full field coat.

4.3.7 Field Intermediate Coat: Apply one coat of Immersion approved epoxy, to a DFT range of 4.0 to 6.0 mils. The color shall be tinted to contrast the prime coat.

4.3.8 Field Finish Coat: Apply one coat of Immersion approved epoxy, to a DFT range of 4.0 to 6.0 mils.

4.3.9 The total DFT range of the Interior Paint System shall be 10.5 to 15.5 mils.

4.3.10 Interior immersion surfaces will be holiday tested per NACE SP0188.

4.4 INTERIOR DRY COATING SYSTEM (Per Manufacturer's Recommendation)

4.4.1 Shop Surface Preparation: Spot clean as necessary to remove all oil and grease from the surface prior to blast cleaning. All surfaces shall be abrasive blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3.

4.4.2 Shop Primer: Immediately after abrasive blasting and before any rusting occurs, apply one coat of zinc rich aliphatic urethane, to a DFT range of 2.5 to 3.5 mils.

4.4.3 Field Surface Preparation for Blast Cleaning: After erection and prior to field touch-up priming, all surfaces shall be spot cleaned as required to remove all surface contamination including oil, grease, dust, dirt, and foreign matter. Chip or grind as required to remove all slag, weld metal splatter and sharp edges.

4.4.4 Field Blast Cleaning: All rusted, abraded, and bare metal / unpainted areas shall be blast cleaned to a commercial finish in accordance with SSPC SP-6/NACE No. 3. All shop primed areas shall be brush blasted to SSPC SP-7/NACE No. 4.

4.4.5 Field Touch-Up: spot prime with zinc rich aliphatic urethane, to a DFT range of 2.5 to 3.5 mils.

4.4.6 Field Finish Coat: Apply one coat of Hi-build epoxy, to a DFT range of 4.0 to 6.0 mils.

4.4.7 The total DFT range of the Interior Paint System shall be 6.5 to 9.5 mils.

4.5 LETTERING AND LOGO

Lettering and Logo design, size and location shall be as indicated on the drawings. Lettering/Logo shall be applied using one coat of high gloss polyurethane. Lettering / Logo color shall be selected by the Owner.

## 5.0 PART 5 - TESTING AND STERILIZATION

5.1 Sufficient cure, per the manufacturer's recommendations, of the final coat on the interior wet surface shall be allowed before the elevated tank is sterilized and filled with water.

5.2 The tank shall be sterilized per the requirements of AWWA C652. Chlorination Method No. 2 or 3.

5.3 The Owner, free of charge to the Contractor, shall furnish and dispose of sufficient water for testing and sterilization. The water shall be at proper pressure to fill the tank to the maximum working level. Any leaks in the tank disclosed by this test shall be repaired by gouging out defective areas and re-welding. No repair work shall be done on any joint unless the water in the tank is at least 2 feet below the joint being repaired. Any paint damaged by repairs shall be properly restored.

5.4 Upon completion of the sterilization procedure, the Owner or his representative shall arrange and bear the cost of any bacteriological testing of water samples from the tank that may be required. The tank shall not be placed in service until safe test results are obtained.

## 6.0 PART 6 - GUARANTEE

6.1 The Contractor shall guarantee its work for a period of one year from the date of substantial completion. Substantial completion is defined as the date when the tank is placed, or available to be placed, into service. The Contractor will repair any defects of which they are notified during that period which may appear because of faulty design, workmanship or materials furnished under the specifications. Defects caused by damaging service conditions such as electrolytic, chemical, abrasive, or other damaging service conditions are not covered by this guarantee.

6.2 All guarantees and extended warranties offered by the manufacturer or installer of paint, equipment or accessories not manufactured by the Contractor shall be obtained by the Owner directly from the manufacturer or installer. The Owner shall provide the Contractor a copy of all such guarantees and warranties.

## 7.0 PART 7 - PURCHASER OPTIONS / ALTERNATIVES

***The following items are to replace or append paragraphs within the specification by the Engineer / Owner prior to issuing specification for bidding:***

7.1 ACCESS DOOR

Provide a 36-inch by 80-inch commercial (vs plate) steel door. The door shall be 1 3/4" thick with 4 3/4-inch 16-gauge jambs, door holder and automatic door bottom. Door to be Deansteel or approved equal. The door shall be minimum 16-gauge and insulated with pre-formed polystyrene insulation. Doors shall be thoroughly cleaned, phosphated and finished with one coat of baked-on rust inhibiting prime paint in accordance with ASTM B117 and ASTM D1735. Provide three (3) full-mortise, 5 knuckle hinges,4 1/2 inches by 4 1/2 inches minimum. Hinges shall be steel, phosphated and primed coated for finish painting. Provide a complete and functional door lockset and tumbler-type lock, keyed to the Owner's existing system. Door painting shall conform to the tank exterior paint system.

7.2 BELL INSULATION & COMPLETE TANK DRAINAGE

7.2.1 Provide ___-inch thick foamed in place, medium density, closed cell polyurethane foam insulation on the entire interior surface of the bell up to and including the bottom of the condensate ceiling, to create an insulated space inside the bell. The condensate ceiling shall be near the bottom of the shaft above the lower knuckle.

7.2.2 A 3-inch diameter non-freeze drain valve (Babco or equal) shall penetrate the tank at the low point of the upper tank floor and connect to the overflow pipe. An NSF approved flexible pipe shall be used to connect the drain valve to the overflow pipe.

7.3 ACCESS, LADDERS & PLATFORMS

7.3.1 A ladder for access to the tank interior from the roof, shall be provided and attached to the access tube. (Note: this is not recommended in cold climates where freezing may occur). This ladder shall be equipped with ladder safety cable.

7.3.2 Provide a 42-inch-high circular roof handrail, 20 feet in diameter, to encompass all centrally located roof appurtenances. The roof handrail shall be 42 inches high and shall include a top rail, intermediate rail, and toe board. The handrail must be constructed to meet all OSHA requirements.

7.4 MANHOLES, HATCHES & VENTS

For installations where mechanical equipment such as pumps and motors or chlorination equipment will be located in the base of the support structure, reinforced openings for vents and louvers shall be per drawings.

7.5 ELECTRICAL

7.5.1 Exterior lighting shall be provided above the access door(s) for added security, and exterior lighting around the base of the support structure to illuminate the tank and/or support structure for aesthetic effect, per drawings.

7.5.2 In accordance with the Purchaser's FAA Determination Letter, a double obstruction light shall be provided on the roof of the tank near the apex. The lights shall be enclosed in aviation red obstruction light globes as approved by the FAA, complete with an automatic photo-electric cell type switch. The Contractor shall install all conduit and wiring from the light to the electrical service panel.

7.6 CONDENSATION

7.6.1 The condensate ceiling shall be equipped with a drainpipe connected to the overflow pipe. Condensate ceiling location and elevation shall be as shown on the drawings.

7.6.2 If the area beneath the steel condensate ceiling is to be furnished with a controlled environment, provide flame resistant insulation on the support structure walls below the condensate ceiling, and on the underneath side of the steel condensate ceiling.

7.7 GRAVEL FLOOR

The interior of the support structure base shall be finished with a six-inch thick crushed stone or gravel floor. All excavated areas under the crushed stone or gravel floor shall be backfilled with suitable material and compacted to 90 percent maximum dry density.

7.8 CORROSION ALLOWANCE

A corrosion allowance of 1/16 inch shall be applied to tank plates in direct contact with the stored water. The corrosion allowance shall be added to the required thickness determined by design.

7.9 ANTENNA RAIL AND CABLE DETAILS

7.9.1 Provide all labor, materials, equipment, and installation to make all necessary provisions for future antenna cable(s) routing. This work includes but is not limited to the following:

7.9.1.1 Three (3) 4.5-inch outside diameter pipe penetrations (with caps) in the support structure, located approximately two feet (2') above the tank floor.

7.9.1.2 Three (3) 4.5-inch outside diameter pipe penetrations in the condensate ceiling and platform.

7.9.1.3 Three (3) 4.5-inch outside diameter pipe penetrations (with caps) in the access tube cover.

7.9.1.4 Suitable brackets welded to the inside of the support structure and access tube to safely secure future antenna cables. Bracket spacing shall not exceed 8 feet.

7.9.2 For safety considerations during antenna installation, and for maintenance, a 42" high circular roof handrail shall be furnished with a top rail, intermediate rail, and toe board. The handrail shall be 20 feet in diameter and centered on the tank access tube roof hatch. The handrail shall also provide an attachment point for the antenna(s), based on the antenna quantity and loads provided in this specification.

7.10 TANK MIXING SYSTEM

7.10.1 Furnish and erect a passive tank mixing system.

7.10.2 The storage tank mixing system shall accomplish thorough mixing of the tank contents. The mixing system shall function without mechanical pumps, blowers, or other equipment with motor drives or other continuously moving parts. The energy needed to mix the storage tank shall be provided solely by the flow of water through the tank inlet pipe, based on the following fill rate of _____gpm. The mixing system shall distribute the fresh, newly disinfected incoming water throughout the tank, reducing microbial growth and related tastes and odors.