Appendix D

Material and Performance Specifications

DEWEY LOEFFEL LANDFILL SUPERFUND SITE
NASSAU, NEW YORK
MATERIAL AND PERFORMANCE SPECIFICATIONS INDEX

Specification Number	Specification Title
DIVISION 2 - SITE CONSTRUCTION	
02200	Trenching, Backfilling, and Compacting
DIVISION 3 – CONCRETE	
03001	Concrete
DIVISION 13 - SPECIAL CONSTRUCTION	
13000	Pre-Engineered Metal Building
DIVISION 22 – PLUMBING	
22000	Process Piping
DIVISION 26 – ELECTRICAL	
26000	Electrical General
DIVISION 40 – PROCESS INTEGRATION	
40000	Instrumentation and Controls
DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT	
43100	Storage Tanks
43200	Pumps – General Requirements
43300	Pressure Filter System
DIVISION 44 – POLLUTION AND WASTE CONTROL EQUIPMENT	
44100	Air Stripper System
44200	Liquid-Phase Granular Activated Carbon System
44300	Vapor-Phase Treatment System
DIVISION 46 – WATER AND WASTEWATER EQUIPMENT	
46000	Bioreactor System

SECTION 02200 – TRENCHING, BACKFILLING, AND COMPACTING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. CONTRACTOR shall provide all labor, materials, equipment, and incidentals required to perform all excavating, filling, and grading, and disposing of earth materials as shown, specified, and required for construction of Underground Facilities and related construction required to complete the Work.

B. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Perform excavation work in compliance with requirements of authorities having jurisdiction and Laws and Regulations, including:
a. OSHA, 29 CFR Part 1926, Section .650 (Subpart P – Excavations).

2. Obtain required permits and approvals for excavation and fill work, including work permits from right-of-way owners and permits from environmental authorities having jurisdiction over discharge of water from excavations.

1.3 SUBMITTALS

A. Delivery Tickets:

1. Copy of delivery ticket for each load of aggregate and borrow material delivered to the Site. Each delivery ticket shall indicate project and contract by name and number, date, material type, department of transportation item number when applicable, and quantity delivered.

1.4 SITE CONDITIONS

A. Existing Structures:

1. The Contract Documents show or indicate certain structures and Underground Facilities adjacent to the Work. Such information was obtained from existing records and is not guaranteed to be correct or complete. CONTRACTOR shall explore ahead of the excavation to determine the exact location of all existing structures and Underground Facilities. Existing structures and Underground Facilities shall be supported

and protected from damage by CONTRACTOR. Immediately repair and restore existing structures and Underground Facilities damaged by CONTRACTOR without additional cost to OWNER.

2. Movement or operation of construction equipment over Underground Facilities shall be at CONTRACTOR's sole risk and only after CONTRACTOR has prepared and submitted to ENGINEER and utility owners (as applicable), and received acceptance therefrom, a plan describing CONTRACTOR's analysis of the loads to be imparted and CONTRACTOR's proposed measures to protect structures and Underground Facilities during the Project.

3. Coordinate with utility owners for shut off of services in active piping and conduits. Completely remove buried piping and conduits indicated for removal and not otherwise indicated as being abandoned or to remain in place.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General Fill:

1. Material shall be free of: rock and gravel larger than three inches in any dimension, debris, waste, frozen materials, organic material, and other deleterious matter.

2. Fill shall have a liquid limit not greater than 45, and plasticity index not greater than 25.

3. Previously-excavated materials complying with the Contract Documents requirements for general fill may be used for general fill.

4. When on-Site materials are found unsuitable for use as general fill, provide select fill or approved off-Site general fill materials. Prior to using off-Site material as general fill, furnish submittal for and obtain ENGINEER's approval of the material proposed for use.

B. Pipe Bedding Material:

1. A naturally or artificially graded mixture of natural crushed gravel, crushed stone, and natural or crushed sand meeting ASTM D 2940 that 100 percent passes a 1.5 inch sieve

END OF SECTION 02200

SECTION 03001 - CONCRETE

PART 1 – GENERAL

1.1 WORK INCLUDED

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.2 RELATED DOCUMENTS

A. Structures to be created using cast-in-place concrete are further specified and detailed in the Drawings.

1.3 DEFINITIONS

A. Cementitious Materials: Portland Cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 50, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.

2. Form materials and form-release agents.

3. Steel reinforcement and reinforcement accessories.

4. Admixtures.

5. Waterstops.

6. Curing materials.

7. Floor and slab treatments.

8. Bonding agents.

9. Adhesives.

10. Vapor retarders.

11. Epoxy joint filler.

12. Joint-filler strips.

13. Repair materials.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.7 REFERENCES AND REGULATORY REQUIREMENTS (ALL LATEST EDITIONS)

A. American Concrete Institute (ACI)

B. Concrete Reinforcing Steel Institute (CRSI)

C. American Society of Testing Materials (ASTM)

D. Corps of Engineers Conrete Research Division (CR CRD)

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.

2. Furnish ties with integral water-barrier plates for concrete required to be water tight.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60 deformed.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150 , Type I.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded.

C. Lightweight Aggregate: ASTM C 330.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints.

1. Profile: As indicated.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PVC Waterstops:
a. Greenstreak, Synko-Flex.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Hydrotite; Greenstreak, Synko-Flex.

2.7 VAPOR RETARDERS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Clean.

D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

F. Products: Subject to compliance with requirements, provide one of the following:

1. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:
a. Spray-Cure & Seal Plus; ChemMasters.
b. Lumiseal Plus; L&M Construction Chemicals, Inc.
c. CS-309/30; W. R. Meadows, Inc.
d. Cure & Seal 31 percent UV; Symons Corporation.
e. Masterkure-N-Seal HS; ChemRex/MBT.

2. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
b. Polyseal WB; ChemMasters.
c. Lumiseal WB Plus; L&M Construction Chemicals, Inc.

d. Vocomp-30; W. R. Meadows, Inc.
e. Masterkure-N-Seal W; ChemRex/MBT/.

2.9 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

C. Reglets: Fabricate reglets of not less than 0.0217 inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland Cement according to ACI 301 requirements.

D. Maximum Water-Cementitious Materials Ratio: 0.55 for concrete required for foundations.

E. Maximum Water-Cementitious Materials Ratio: 0.45 for slabs on grade.

F. Air Content Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1 percent, unless otherwise indicated:

1. Air Content: 5.5 percent for 1-1/2-inch- nominal maximum aggregate size.

2. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.

G. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

I. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

END OF SECTION 03001

SECTION 13000 – PRE-ENGINEERED METAL BUILDING

PART 1 – GENERAL

1.1 DESIGN REQUIREMENTS

A. Applicable building code: new york state building code 2010.

B. Design wall and roof panel system to withstand specified loads with deflection of 1/240th of span, maximum.

C. Anchor rods: furnish design criteria for anchor bolts furnished by others, to resist the loads induced by the design loads on the structure.

1.2 SUBMITTALS

A. Design data: provide detailed design criteria and calcULations.

B. Certification: manufacturer certification that the building conforms to the contract documents and manufacturer's standard design procedures.

C. Shop drawings: show building layout, primary and secondary framing member sizes and locations, cross-sections, and product and connection details.

D. Product data: information on manufactured products to be incorporated into the project.

E. Color charts: for selection of colors.

F. Anchor rod installation drawings: layouts with bolt diameters.

G. Reactions: submit reactions for design of foundation.

H. Specimen warranty.

1.3 QUALITY ASSURANCE

A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a professional engineer experienced in design of this work and licensed in the state of new york.

B. Design data and shop drawings submitted for review shall bear the seal of a professional engineer licensed in the State of New York.

C. Qualifications:

1. Manufacturer: company specializing in manufacturing products specified in this section with minimum 5 years documented experience.

2. Erector: company specializing in performing work of this section with minimum 5 years documented experience and approved by manufacturer.

1.4 WARRANTY

A. Provide manufacturer's standard warranty for:

1. Panel finish: 20 years.

2. Weather-tightness: 20 years

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metallic building company.

B. Or as approved.

2.2 METAL MATERIALS

A. Structural steel plate, bar, sheet, and strip for use in bolted and welded constructions: ASTM A572, a570, a529, or a36, with minimum yield strength of 50,000 psi.

B. Structural steel material for use in roll formed or press broken secondary structural members: ASTM A570, or a607 with minimum yield strength of 55,000 psi.

C. Galvanized steel sheet for roll-formed or press broken roof and wall coverings, trim and flashing: ASTM A653, with minimum yield strength of 50,000 psi.

D. Hot-rolled steel shapes: w, m and s shapes, angles, rods, channels and other shapes; ASTM A992 or ASTM A36 as applicable; with minimum yield strengths required for the design.

E. Structural bolts and nuts used with primary framing: high strength, ASTM A325.

F. Bolts and nuts used with secondary framing members: ASTM A307.

2.3 FRAMING COMPONENTS

A. Primary framing: rigid frame solid web framing consisting of tapered or uniform depth rafters rigidly connected to tapered or uniform depth columns. Provide a clear span that supports the loads at bay spacings indicated.

B. Endwall framing: portal frame framing.

C. Purlins: z-shaped; depth as required; with minimum yield strength of 55,000 psi; simple span or continuous span as required for design.

D. Girts: z- or c-shaped; depth as required, with minimum yield strength of 55,000 psi; simple span or continuous span as required for design.

E. Wind bracing: portal, torsional, diagonal bracing or diaphragm in accordance with manufacturer's standard design practices; utilizing rods, angles, and other members, with minimum yield strengths as required for design.

F. Primary frame flange bracing: attached from purlins or girts to the primary framing, minimum yield strength as required for design.

G. Base angles: 2 inch by 3 inch by 0.059 inch steel angles, with minimum yield strength of 55,000 psi.

H. Door headers and jambs: z- or c-shaped; depth as required; with minimum yield strength of 55,000 psi.

I. Sag angles and bridging: steel angles with minimum yield strength of 36,000 psi.

J. Fabrication: fabricate according to manufacturer's standard practice.

1. Fabricate structural members made of welded plate sections by jointing the flanges and webs by continuous automatic submerged arc welding process.

2. All welding operators and processes shall be qualified in accordance with the american welding society structural welding code, AWS D1.1.

3. Field connections. Prepare members for bolted field connections by making punched, drilled, or reamed holes in the shop.

K. Shop coating: finish all structural steel members using one coat of manufacturer's standard shop coat, after cleaning of oil, dirt, loose scale and foreign matter.

2.4 ROOF AND WALL PANEL COMPONENTS

A. Roof panels: 36 inch wide net coverage with 1-1/4 inch high major ribs at 12 inches on center with minor ribs spaced between the major ribs.

1. Material: galvanized steel with g90 coating.

2. Thickness: 26 gage.

3. Side laps: at least one full major rib, with a supporting member bearing edge on the lower panel and an anti-capillary groove on the upper panel.

4. Length: continuous from eave to ridge.

5. Endlaps where required: 6 inches wide, located at a support member.

6. Finish: kynar 500 pre-painted finish on exterior surface, wash coat on interior surface. Color selected by owner from manufacturer's full line.

7. The roof shall be tested and certified to meet underwriters laboratories, inc., uplift rating: UL 90.

B. Wall panels: 36 inch wide net coverage with 1-1/4 inch high major ribs at 12 inches on center with minor ribs spaced between the major ribs.

1. Material: galvanized steel with g90 coating.

2. Thickness: 26 gage.

3. Side laps: two fully overlapping major ribs secured together with 1/4 inch diameter color-matched carbon steel fasteners.

4. Length: continuous from sill to eave.

5. Endlaps where required: 4 inches wide, located at a support member.

6. Crimp panels at the base and notch to make roof panel configuration at the eave.

7. Cut panels square at each end; provide base trim at sill.

8. Finish: kynar 500 pre-painted finish on exterior surface, wash coat on interior surface. Color selected by owner from manufacturer's full line.

C. Panel fasteners:

1. For roof panels: stainless steel-capped carbon steel fasteners with integral sealing washer.

2. For wall panels: coated carbon steel.

3. Color of exposed fastener heads to match the wall panel finish.

4. Concealed fasteners: self-drilling type, of size as required.

5. Provide fasteners in quantities and location as required by the manufacturer.

D. Flashing and trim: match material and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weather-tightness and a finished appearance.

E. Plastic parts: glass fiber-reinforced resin or thermo-formed abs.

1. Abs: minimum 1/8 inch thick.

2. Color: manufacturer's standard color.

F. Sealants, mastics and closures: manufacturer's standard type.

1. Provide at roof panel endlaps, sidelaps, rake, eave, transitions and accessories as required to provide a weather-resistant roof system; use tape mastic or gunnable sealant at sidelaps and endlaps.

2. Provide at wall panel rakes, eaves, transitions and accessories.

3. Closures: formed to match panel profiles; closed cell elastic material, manufacturer's standard color.

4. Tape mastic: pre-formed butyl rubber-based, non-hardening, non-corrosive to metal; white or light gray.

5. Gunnable sealant: non-skinning synthetic elastomer based material; gray or bronze.

G. Blanket insulation: glass fiber with factory-laminated facing material:

1. Glass fiber: odorless, neutral-colored, long filament, flexible resilient, produced in compliance with the naima 202 specifications.

2. Thermal resistance: to meet r=19 at 75 degrees f mean temperature.

3. Flame spread index: 25 or less, when tested in accordance with UL 723.

4. Smoke developed index: 50 or less, when tested in accordance with UL 723.

5. UL classified.

6. Facing: white vinyl scrim polyester; 0.0025 inch thick pvc film, glass fiber scrim reinforcing, 0.0005 inch thick polyester film; permeance 0.02 perms. Composite fiberglass and facing to meet flame spread of 25 or less, smoke developed of 50 or less, when tested in accordance with UL 723.

7. Provide facing 3 inches wider on both edges than blanket.

8. Width: as required for installation.

9. Use blanket insulation at roof and walls.

2.5 WALL ACCESSORIES

A. Service doors.

B. Sectional overhead doors.

C. Provide framed openings for louvers.

2.6 ROOF ACCESSORIES

A. Eave gutters: roll-formed 26 gage steel sheet, with gutter straps, fasteners and joint sealant; same color as wall panels.

1. Downspouts: 4 by 5 inches in 10 foot lengths with downspout elbows and downspout straps; same color as wall panels.

B. Snowguards:

1. Manufacturers: snojax, inc., or as approved.

2. Fabricated from clear polycarbonate.

3. Provide adhesive for securing snowguards to roof panels.

4. Consult manufacturer for spacing recommendations.

C. Provide framed openings for fans.

2.7 DOORS

A. Overhead doors to be coiling type, steel construction, insULated. Curtain slats min 20 ga exterior and 24 ga back cover. Locking mechanism required. Provide counterbalancing mechanism with helical torsional springs. Place hood exterior of building.

B. Interior mandoor - 20 ga., honey comb core, with 16 ga. Frame and locks.

C. Exterior mandoor - 18 ga., insULated core, standard keying, ball bearing hinges, and 16 ga. Frame.

END OF SECTION 13000

SECTION 22000 – PROCESS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work covered by this Section consists of furnishing and installing all piping and miscellaneous appurtenances as indicated on the Contract Drawings and specified herein for the multi-phase extraction and treatment system.

B. General

1. Install the piping and appurtenances to suit.

2. Provide all piping with all necessary insulation, supports, and flex joints as specified herein.

3. Provide protection on all exposed flange faces and machine surfaces to prevent in-transit damage.

4. Provide covers on all valve connections to keep dirt out.

1.2 REFERENCE STANDARDS

A. ASTM A53 for galvanized steel pipe.

B. ASTM F1281 or ASTM 1282 for polyethylene tubing.

C. ASTM D1784 and D1785 for schedule 80 PVC plastic pipe.

D. ASTM D2466 for Schedule 80 PVC Fittings.

E. ASTM-D-2855 for heavy body cement for PVC Fittings.

F. BOCA Basic/national Plumbing Code

G. Plastic Pipe Institute

H. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standard Practice SP-58 (Hangers and Supports).

I. MSS Standard Practice SP-69 (Selection of Hangers and Supports).

J. Nayyar Mohinder L., P.E.: Piping Handbook, Sixth Edition, (New York: McGraw-Hill; 1992).

K. ANSI/AWS D1.1-Structural Welding Code

1.3 REGULATORY REQUIREMENTS

A. CONTRACTOR shall conform to all federal, state and local guidelines, laws, codes, rules, regulations or ordinances that are applicable to conduct the scope of Work described in this specification.

B. CONTRACTOR shall have all state, local or federal licenses, certifications or registrations necessary to legally conduct the Work described in this specification.

C. Electrical installations shall conform to the requirements of ANSI/NFPA 70. All electrical products furnished and installed for completion of the Work shall be listed by Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Qualifications of manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to ENGINEER.

B. Qualifications of installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this section.

C. Basis of acceptance: The manufacturer's recommended installation procedures, when approved by ENGINEER, will become the basis for inspecting and accepting or rejecting actual installation procedures used for this work.

1.5 SUBMITTALS

A. Submit warranties as applicable.

1.6 DELIVERY, STORAGE, AND PRODUCT HANDLING

A. Shipping:

1. Ship piping and appurtenances complete except where disassembly is required by transportation regulations or for protection of components.

2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which is intended.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of ENGINEER and at no additional cost to ENGINEER.

PART 2 PRODUCTS

2.1 GENERAL

A. Proprietary products: References to specified proprietary products are used to establish minimum standards of utility and quality. Unless otherwise approved by ENGINEER, provide only the specific products. Design is based on the materials specified.

2.2 THREADED GALVANIZED STEEL PIPE

A. Provide Schedule 40 galvanized steel piping meeting ASTM A53 as required.

B. Fittings: Schedule 40 galvanized steel fittings to match pipe wall thickness.

C. Connections: At pipe joints and fittings, connections shall be either flanged or NPT

D. Flanged Connections: Flanges shall be 150# flanges.

E. Flange Gaskets: Join galvanized carbon steel flanges with full face gaskets, 1/8 inch thick. Provide machine made or die stamped gaskets with inside and outside edges concentric. Oversize bolt holes to prevent crimping of gasket when installed. Gasket material shall be Teflon.

2.3 PLASTIC TUBING

A. POLYETHYLENE TUBING

1. Polyethylene Tubing: ASTM F1281 or ASTM 1282.

2.4 PVC PIPE AND FITTINGS

A. Provide Type 1, Grade 1, Schedule 80 PVC pipe and fittings conforming to ASTM D1784 and D1785 as required.

B. Solvent Welded Connections: Connections at pipe joints and fittings are to be solvent welded except where connecting to unions, valves, and equipment with threaded or flanged connections.

C. Flanged Connections: Connections at valves and appurtenances with a pipe I.D. of 3 inches or larger are to be flange to flange. Flanges are to be socket-welded 150# flanges.

D. Gaskets: Join PVC flanges with full-face gaskets, 1/8 inch thick. Provide machine made or die stamped gaskets with inside and outside edges concentric. Oversize bolt holes to prevent crimping of gasket when installed. Gasket material shall be Teflon.

E. PVC Fittings: Schedule 80 PVC pressure fittings shall conform to ASTM D2466.

F. Cement shall be ASTM-D-2855 heavy weight, heavy body cement.

2.5 FLEXIBLE CONNECTORS

A. Provide flexible connectors for piping connections as indicated on the Contract Drawings and to all plastic tanks in the treatment building.

B. Connections: Flanges are to be socket-welded 150# flanges.

C. Gaskets: Join flanges with full-face gaskets, 1/8 inch thick. Provide machine made or die stamped gaskets with inside and outside edges concentric. Oversize bolt holes to prevent crimping of gasket when installed. Gasket material shall be Teflon.

2.6 PIPING INSULATION

A. Provide Armaflex or equal closed cell foam pipe insulation where required on Contract Drawings. All pipe insulation shall be continuous through wall and ceiling openings and sleeves. Thickness of insulation shall be one inch.

B. Insulation shall be covered with a UV-protective coating or jacket.

C. Provide insulation or safety shielding on process piping that may experience elevated temperature (including but not limited to air stripper exhaust piping).

2.7 PIPE HANGERS AND SUPPORTS

A. Install pipe supports at a spacing of no more than seven feet on-center.

B. Install in accordance with ASTM B31.9, ASTM F708, and MSS SP89.

C. Install female welded studs in manner recommended by stud manufacturer for attaching hanger rods to steel members.

D. Install hangers to provide minimum ½-inch space between finished covering and adjacent Work.

E. Install “Hilti-Drop in Type” concrete rod hanger fasteners in concrete in manufacturer’s approved fashion where necessary for attaching hanger rods to concrete. Do not install insert in concrete veneer used for fireproofing structural steel members.

F. Support pipe within two feet of end of all pipe runs.

G. Support riser piping independently of connected horizontal piping.

H. Unless noted on the Contract Drawings, install trapeze and shelves by accepted method described in AISC Steel Construction Manual where necessary. The use of trapeze type pipe hangers is preferred in areas where multiple pipes can be supported, to reduce the number of hangers. Trapeze hangers constructed of tubing or pipe is preferred. Where pipe or tubing is used, ends shall be capped and sealed. Angle iron, if used, shall only be used as vertical members.

I. Wall, floor, or ceiling sleeves shall not be used to support pipe.

J. Provide additional supports for concentrated loads such as flanges, valves, or specialties, and at changes in direction.

K. Support all valves, fittings, and tubing such that all swing joints make and break freely and such that undo stress is not placed on tubing by valves or other in-line components.

2.8 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this section, shall be new, first quality of their respective kind, and as selected by CONTRACTOR subject to the approval of ENGINEER.

END OF SECTION 22000

SECTION 26000 – ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Primary and secondary power wiring and distribution system.

B. Electrical control systems and interlock wiring.

1.2 RELATED WORK

A. SCADA Control and Monitoring System.

1.3 QUALITY ASSURANCE

A. Comply with applicable local, state and federal codes.

B. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades.

C. Employ only qualified journeymen for this work. Employ a competent qualified electrician to supervise the work.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data literature as requested by the Engineer.

1.5 DELIVERY AND STORAGE

A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage.

C. All damaged painted surfaces of equipment to be touched up to match original paint.

1.6 RECORD DRAWINGS

A. A set of record drawings will be maintained on the jobsite by the Contractor.

PART 2 PRODUCTS – NOT APPLICABLE

END OF SECTION 26000

SECTION 40000 – INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provision, installation, testing and start-up of level, flow, pressure, temperature, DO, pH measuring devices and transmitters, and any accessories required for a complete operable installation.

1.2 RELATED WORK AND REQUIREMENTS

A. Section 43100: Storage Tanks

1.3 QUALITY ASSURANCE

The instrument supplier(s) must be qualified in accordance with the qualifications set forth below:

A. The supplier shall be regularly engaged in instrumentation work of the type called for under these Specifications and must have the requisite experience, capital facilities and plant required to complete the work successfully. The supplier shall have successfully completed the installation of instruments for plant monitoring and control of like magnitude, comparable complexity, and similar function.

B. The qualification system shall have been in satisfactory operation for a sufficient period of time not less than one year, to establish the reliability of the equipment proposed to be furnished.

1.4 SUBMITTALS

A. Furnish shop drawings and other pertinent data to the Engineer prior to installation.

B. One (1) copy of the operation and maintenance manuals shall be furnished to the Engineer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle items of equipment in a manner that will prevent any damage.

B. Follow manufacturer's instructions for short term and long term storage.

1.6 COORDINATION

A. Co-ordinate this work with the work of other trades to avoid interferences and to provide for timely installation.

PART 2 - PRODUCTS

2.1 CLOSED PIPE MAGNETIC FLOW METERS

A. Provide flow measurement systems (designated as FIT on drawings) as follows:

1. FIT-100: Measurement of flow downstream of pump P-100
2. FIT-200: Measurement of flow downstream of pump P-200A/B
3. FIT-410: Measurement of flow downstream of pump P-410A/B
4. FIT-510: Measurement of flow downstream of pump P-500A/B
5. FIT-800: Measurement of flow downstream of pump P-800
6. FIT-900: Measurement of flow downstream of pump P-820A/B

B. Transmitter and Measuring Device

1. Shall be Badger Magentoflow, or equal.
2. Furnish flow transmitter for continuous measurement of flow. The unit shall include a front panel-mounted flow rate indicating meter and provide a 4-20 mA analog output signal proportional to the flow. The unit shall be installed between two pipe flanges having the same diameter as the flow meter connections.
3. The flow tube and electrodes shall be made of stainless steel and be capable of operation over a temperature element at the sensor that automatically compensates for errors due to large temperature changes. The external surface of the sensor shall be protected by corrosion resistant paint.
4. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.2 LEVEL MEASUREMENT

A. Provide liquid level measurement systems (designated as LT on drawings) as follows:

1. LT-100: Measurement of liquid level in tank T-100

2. LT-200: Measurement of liquid level in tank T-200

3. LT-410: Measurement of liquid level in tank T-410

4. LT-800: Measurement of liquid level in tank T-800

B. Transmitter and Measuring Device

1. Transmitter shall be Wika Model LS-10, or equal.

2. Furnish level transmitter for continuous measurement of liquid level. The unit shall provide a 4-20 mA analog output signal proportional to the level.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.3 LIQUID PRESSURE MEASUREMENT

A. Provide pressure measurement systems (designated as PIT on drawings) as follows:

1. PIT-410: Measurement of pressure upstream of PF-410A/B

2. PIT-420: Measurement of pressure downstream of PF-410A/B

3. PIT-520: Measurement of pressure upstream of GAC-601/602

B. Transmitter and Measuring Device

1. Transmitter shall be Foxboro model IGP10, or equal.

2. Furnish pressure transmitter for continuous measurement of fluid pressure. The unit shall include a front panel-mounted pressure indicating meter and provide a 4-20 mA analog output signal proportional to the pressure.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.4 AIR PRESSURE MEASUREMENT

A. Provide pressure measurement systems (designated as PIT on drawings) as follows:

1. PIT-300C: Measurement of pressure upstream of B-300

2. PIT-510: Measurement of pressure downstream of B-500

B. Transmitter and Measuring Device

1. Transmitter shall be Foxboro model IGP20, or equal.

2. Furnish pressure transmitter for continuous measurement of air pressure. The unit shall include a front panel-mounted pressure indicating meter and provide a 4-20 mA analog output signal proportional to the pressure.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.5 FLOAT LEVEL SWITCHES

A. Provide level switches (designated as LSxx on drawings) as follows:

1. LSHH-100: High-High in T-100

2. LSLL-100: Low-Low level in T-100

3. LSHH-200: High-High level in T-200

4. LSLL-200: Low-Low level in T-200

5. LSH-300: High level in T-300

6. LSH-400: High level in T-400

7. LSHH-410: High-High level in T-410

8. LSLL-410: Low-Low Level in T-410

9. LSHH-800: High-High level in T-800

10. LSLL-800: Low-Low Level in T-800

11. LSH-900: High level building sump

B. Level switches shall be GEMS Model LS750, or equal.

2.6 PH MEASUREMENT

A. Provide a pH measurement system (designated as AE on drawings) as follows:

1. AE-300: Measurement of pH in T-300

2. AE-900: Measurement of pH downstream of T-800

B. Transmitter and Measuring Device

1. Shall be Foxboro model 870ITPH, or equal.

2. Furnish transmitter for continuous measurement of pH. The unit shall provide a 4-20 mA analog output signal proportional to the measured pH.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.7 AIR FLOW MEASUREMENT

A. Provide flow measurement systems (designated as FIT on drawings) as follows:

1. FIT-500: Measurement of air flow through AS-500

B. Transmitter and Measuring Device

1. Transmitter shall be Sierra model 620S, or equal.

2. Furnish transmitter for continuous measurement of air flow. The unit shall include a front panel-mounted indicating meter and provide a 4-20 mA analog output signal proportional to the flow.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.8 TEMPERATURE MEASUREMENT

A. Provide temperature measurement systems (designated as TT on drawings) as follows:

1. TT-300: Measurement of temperature in T-300

2. TT-500: Measurement of air temperature through AS-500

B. Transmitter and Measuring Device

1. Transmitter shall be Foxboro model RTT15, or equal.

2. Furnish transmitter for continuous measurement of temperature. The unit shall include a front panel-mounted indicating meter and provide a 4-20 mA analog output signal proportional to the temperature.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.9 DISSOLVED OXYGEN MEASUREMENT

A. Provide dissolved oxygen measurement systems (designated as AE on drawings) as follows:

1. AE-310: Measurement of dissolved oxygen concentration in T-300

B. Transmitter and Measuring Device

1. Transmitter shall be Hach model 5790000, or equal.

2. Furnish transmitter for continuous measurement of dissolved oxygen. The unit shall include a front panel-mounted indicating meter and provide a 4-20 mA analog output signal proportional to the dissolved oxygen concentration.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

2.10 PADDLE-TYPE FLOW METERS

A. Provide flow measurement systems (designated as FIT on drawings) as follows:

1. FIT-001: Measurement of flow from leachate underground storage tank

2. FIT-101: Measurement of flow from EW-1

3. FIT-102: Measurement of flow from EW-2

4. FIT-103: Measurement of flow from EW-3

5. FIT-104: Measurement of flow from EW-4

6. FIT-105: Measurement of flow from EW-5

7. FIT-106: Measurement of flow from EW-6

8. FIT-107: Measurement of flow from EW-7

9. FIT-108: Measurement of flow from EW-8

B. Transmitter and Measuring Device

1. Shall be Badger Recordall model 55, or equal.

2. Furnish flow transmitter for continuous measurement of flow. The unit shall include a flow rate indicating meter and provide a 4-20 mA analog output signal proportional to the flow.

3. The transmitter enclosure with indicating meter and all electronic controls shall be NEMA 4 rated.

END OF SECTION 40000

SECTION 43100 - STORAGE TANKS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provision of four liquid storage tanks with all appurtenances and accessories required for a complete installation.

B. Tanks to be supplied:
   1. Four water storage tanks (T-100, T-200, T-410, and T-800), flat bottom, closed top.

1.2 SUBMITTALS

A. Furnish shop drawings and other pertinent data to the Engineer and obtain his approval before delivery.

1.3 REFERENCES

A. ASTM (American Society for Testing and Materials) Standards:

D618 Conditioning Plastics and Electrical Insulating Materials for Testing

D638 Tensile Properties of Plastics

D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D883 Definitions of Terms Relating to Plastics

D1505 Density of Plastics by the Density-Gradient Technique

D1525 Test Method for Vicat Softening Temperature of Plastics

D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics

D1998 Standard Specification for Polyethylene Upright Storage Tanks

D2765 Degree of Crosslinking in Crosslinked Ethylene Plastics as Determined by Solvent Extraction

D2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

D3892 Practice for Packaging/Packing of Plastics

F412 Definitions of Terms Relating to Plastic Piping Systems

B. ARM (Association of Rotational Molders) Standards:
Low Temperature Impact Resistance (Falling Dart Test Procedure)

C. ANSI Standards:
B-16.5 Pipe Flanges and Flanged Fittings

D. OSHA Standards:
29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids

E. UBC CODE:
Uniform Building Code 1997 Edition

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle equipment in accordance with the manufacturer's instructions in a manner so as to prevent any damage.

1.5 COORDINATION

A. Coordinate this work with the work of other trades to provide for timely installation.

1.6 WARRANTY

A. The manufacturer shall certify that the equipment shall meet or exceed the specified performance requirements and be free from defects in material or workmanship for a period of 12 months in service.

PART 2 - PRODUCTS

2.1 HDPE TANKS

A. Tank T-100

Manufacturer:	Snyder Industries or Equivalent
Model:	1800000N or equivalent
Capacity:	550 Gallons

B. Tank T-200

Manufacturer:	Snyder Industries or Equivalent
Model:	1780200N or equivalent
Capacity:	2,000 Gallons

C. Tank T-410

Manufacturer:	Snyder Industries or Equivalent
Model:	8060000N or equivalent
Capacity:	550 Gallons

D. Tank T-800

Manufacturer:	Snyder Industries or Equivalent
Model:	1831000N
Capacity:	1,000 Gallons

2.2 TANK ACCESSORIES

A. Tank Fittings

1. Fittings - Threaded Bulkhead

a. Threaded bulkhead fittings are available for below liquid installation depending on the tank diameter and the placement of the fitting in the tank. Fittings must be placed away from tank knuckle radius' and flange lines. Consult SII for placement questions. The maximum allowable size for bulkhead fittings placed on a curved sidewall section of tanks 48 in. to 142 in. in diameter is 2 inch size. Tank wall thickness must be considered for bulkhead fitting placement. The maximum wall thickness for each fitting size is shown below.

Fitting Size	Maximum Wall Thickness
1/2 in.	0.750 in.
3/4 in.	0.875 in.
1 in.	0.875 in.
1 1/4 in.	0.875 in.
1 1/2 in.	0.875 in.
2 in.	1 in.
3 in.	1.125 in. (Flat Surface Only)

b. The bulkhead fittings shall be constructed of PVC, PP, or other specified material. Gaskets shall be a minimum of 1/4" thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton□, or other specified material.

2. All tank fitting attachments shall be equipped with flexible couplers or other movement provisions provided by the tank customer. The tank will deflect based upon tank loading, chemical temperature, and storage time duration. Tank piping flexible couplers shall be designed to allow 4% design movement. Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement.

B. Tank Attachments

1. Tank Attachments - U-Vents

a. Each tank must be properly vented for the type of material and flow rates expected. Vents must comply with OSHA 1910.106 (F) (iii) (2) (IV) (9) normal venting for atmospheric tanks or other accepted standard, or shall be as large as the filling or withdrawal connection, whichever is larger but in no case less than 1 in. nominal inside diameter. U-vents are offered in sizes from 1 in. to 6 in. with or without screening. Consult SII for necessary venting and placement information.

b. All u-vents shall be constructed of PVC or other specified materials.

2. Tank Attachments – Flange Adapters

a. Flange adapters may be purchased as optional equipment to adapt threaded or socket fitting outlets to 150 lb. flange connections for connection to piping system components. Flange adapters are available in PVC, CPVC or other specified materials. Flange adapter construction shall utilize schedule 80 components in sizes ranging from ¾" to 8" depending on material required.

END OF SECTION 43100

SECTION 43200 – PUMPS – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work covered by this Section consists of furnishing all materials, labor, tools, equipment and installation of pumps inside the treatment system.

1.2 REGULATORY REQUIREMENTS

A. Contractor shall conform to all federal, state and local guidelines, laws, codes, rules, regulations or ordinances that are applicable to conduct the scope of Work described in this specification.

B. Contractor shall have all state, local or federal licenses, certifications or registrations necessary to legally conduct the Work described in this specification.

C. Electrical installations shall conform to the requirements of ANSI/NFPA 70. All electrical products furnished and installed for completion of the Work shall be listed by Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

A. Qualifications of manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to Owner and Engineer.

B. Qualifications of fabricators: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. Basis of acceptance: The manufacturer's recommended installation procedures, when approved by the Owner and/or Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

1.4 SUBMITTALS

A. The following shall be submitted:

1. Provide manufacturer's catalogue information, pump curve, materials, dimensions, end connections, and pertinent data and ratings for all equipment.

2. Descriptive literature from the manufacturer's detailing all valves-including installation, operation and maintenance, instructions, spare parts lists, and exploded assembly views.

B. Submit equipment warranties as applicable.

1.5 DELIVERY, STORAGE, AND PRODUCT HANDLING

A. Shipping:

1. Ship equipment complete except where disassembly is required by transportation regulations or for protection of components.

2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which is intended.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of Owner and Engineer and at no additional cost to Owner or Engineer.

PART 2 PRODUCTS

2.1 GENERAL

A. All equipment shall be fully compatible with a Class I, Division II environment. All instrumentation, switches, etc., shall be compatible with an intrinsically safe circuit.

B. Provisions shall be made for convenient electrical and control wiring connections from the pumps to the treatment system electrical panel to facilitate ease of diagnostics, troubleshooting, and repair as necessary.

2.2 DESIGN CRITERIA

A. All pumps shall be designed to meet the flow requirements as shown on the Contract Drawings.

B. VFD controlled pump motors shall be 3 phase, 240 VAC, totally enclosed fan-cooled.

C. All other pump motors shall be 1 phase, 240 VAC, totally enclosed fan-cooled.

D. Process sludge pump (P-400) shall be progressive cavity or other Engineer approved positive displacement or low shear pump.

END OF SECTION 43200

SECTION 43300 – PRESSURE FILTER SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work covered by this Section consists of furnishing all materials, labor, tools, equipment and installation of one bag filter assembly (with appurtenant valves and fittings).

1.2 REFERENCES

A. Code of Federal Regulations

B. International Building Code

C. International Fire Code

D. International Mechanical Code

E. Occupational Safety and Health Administration

F. National Electric Code (NEC) / National Fire Protection Agency (NFPA)

G. NEMA

1.3 REGULATORY REQUIREMENTS

A. CONTRACTOR shall conform to all federal, state and local guidelines, laws, codes, rules, regulations or ordinances that are applicable to conduct the scope of Work described in this specification.

B. CONTRACTOR shall have all state, local or federal licenses, certifications or registrations necessary to legally conduct the Work described in this specification.

C. Electrical installations shall conform to the requirements of ANSI/NFPA 70. All electrical products furnished and installed for completion of the Work shall be listed by Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Qualifications of manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to ENGINEER.

B. Qualifications of fabricators: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. Basis of acceptance: The manufacturer's recommended installation procedures, when approved by the ENGINEER, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

1.5 SUBMITTALS

A. The following shall be submitted:

1. Provide CONTRACTOR's design drawings including bag filter mechanicals. All shop drawings shall be submitted to the ENGINEER prior to construction.

2. Provide manufacturer's catalogue information, pressure drop curve, materials, dimensions, end connections, and pertinent data and ratings for all equipment.

B. Submit equipment warranties as applicable.

1.6 DELIVERY, STORAGE, AND PRODUCT HANDLING

A. Shipping:

1. Ship equipment complete except where disassembly is required by transportation regulations or for protection of components.

2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which is intended.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of ENGINEER and at no additional cost to ENGINEER and OWNER.

PART 2 PRODUCTS

2.1 GENERAL

A. The vessels shall be of 304 stainless steel construction.

B. Vessels shall be equipped with 2” flanged inlet/outlet connections.

2.2 DESIGN CRITERIA

A. Bag Filter Assemblies:

PF-400

1. Filter: 50 micron
2. No. required: 1
3. Capacity: 5 gpm

PF-410A/B

1. Filter: 10 micron
2. No. required: 2
3. Capacity: 25 gpm

B. Valves:

1. Ball valves shall be installed on the bottom of each vessel to act as a drain.

END OF SECTION 43300

SECTION 44100 - AIR STRIPPER SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide a low profile air stripper (AS-500) for removal of volatile organic compounds from groundwater.

1.2 WARRANTY

A. The manufacturer shall certify that the equipment shall meet or exceed the specified performance requirements and be free from defects in material or workmanship for a period of 12 months in service.

1.3 SUBMITTALS

A. At least one month before installation of this work, the manufacturer shall submit drawings and catalog cut sheets required for the installation and operation of the equipment. These drawings shall be accurate in every detail and shall contain all information necessary to relate the equipment to the specifications.

B. At least one month before installation of this work, a comprehensive operation and maintenance manual for the low profile air stripper and appurtenances shall be submitted to the Engineer. The manual shall include detailed procedures for installation, startup, operation, trouble shooting and maintenance. The manual shall also include safety precautions, spare parts listing, design curves, drawings, and a list of operating parameters.

PART 2 - PRODUCTS

2.1 LOW PROFILE AIR STRIPPER

A. Contractor shall provide a low-profile air stripper with the following specifications and appurtenances. The unit shall be pre-assembled and entirely self-contained on a carbon steel skid. The low profile air stripper shall be Neep Environmental Systems Shallowtray Model 2650, or equal, capable of meeting the design conditions and requirements given below.

B. Materials of Construction

1. Air Stripper - The low profile air stripper (trays, sump, demister section, etc.) shall be manufactured using 304 stainless steel.

2. Gaskets - High efficiency demister and tray gaskets shall be fabricated using a suitable material compatible with expected concentrations listed below.

C. Design

1. Volatile Organic Compound Removal

Parameter	**Inlet Concentration (ug/L)**	**Outlet Concentration (ug/L)**
Acetone	16	16
Benzene	784	<1
2-Butanone	7	7
Chlorobenzene	570	<1
Chloroethane	5	<1
Chloroform	222	<1
Chloromethane	18	<1
Total Dichlorobenzenes	15	<1
1,1-Dichloroethane	36	<1
1,2-Dichloroethane	135	<1
1,1-Dichloroethene	12	<1
cis-1,2-Dichloroethene	720	<1
trans-1,2-Dichloroethene	17	<1
Ethylbenzene	17	<1
Isopropylbenzene	4	<1
Methylene Chloride	1,080	<1
4-Methyl-2-Pentanone	3	<1
1,1,2,2-Tetrachloroethane	15	<1
Tetrachloroethene	36	<1
Toluene	624	<1
1,2,4-Trichlorobenzene	90	<1
1,1,1-Trichloroethane	27	<1
1,1,2-Trichloroethane	2	<1
Trichloroethene	5,100	<1
Trichlorofluoromethane	2	<1
Vinyl Chloride	46	<1
Total Xylenes	70	<1
Bis(2-Ethylhexyl)phthalate	2	2

Parameter	Inlet Concentration (ug/L)	Outlet Concentration (ug/L)
2-Chlorophenol	1	1
2,4-Dimethylphenol	17	17
2-Methylphenol	18	18
4-Methylphenol	62	62
Pentachlorophenol	2	2
Phenol	54	54

2. Design flow rate - 25 gpm

3. Demister - The demister shall be capable of removing 95% of droplets 5 microns or larger and 99.5% of droplets 10 microns or larger at a face velocity of 7 ft/sec.

4. Flanged Inlet and Outlet – The air stripper shall be equipped with a flanged inlet and outlet configuration to maximize the integrity of piping connections and minimize head losses due to flow restrictions.

5. Downcomer – A downcomer flow distribution system shall be employed to ensure uniform distribution of water over each aeration tray and shall run the entire length of each tray. The downcomer flow distribution system shall also be designed to minimize backpressure on influent piping systems as well as minimize head losses as the water passes through each tray.

6. Tray Fastening – The sieve trays shall be connected using latching stainless steel clips, or equivalent.

7. Collection Sump – The collection sump shall be designed to minimize pump cycling requirements while maintaining sufficient turbulence to prevent solids from settling and collecting at the bottom of the sump.

D. Appurtenances

1. Pump-Out – Pump-out controls shall be incorporated with outside level controls to ease access and minimize the level of effort required for maintenance activities. A clear PVC sight glass shall be mounted outside the low-profile air stripper collection sump to allow for visual monitoring of the sump level. Stainless steel, fouling resistant level controls shall be installed in the sight glass.

2. Pressure Gauge – A pressure gauge shall be installed on the sight glass to monitor collection sump pressures for trouble shooting system operations.

3. Low-Pressure Switch – A low pressure switch shall be mounted in the blower discharge piping to shut down influent pumping when the blower operation is discontinued.

4. Airflow – An integral flow indication meter will be provided for monitoring the airflow rate of the system.

5. Blower – The low profile air stripper shall be equipped with a direct coupled centrifugal pressure blower capable of 600 CFM at 52" WC pressure. The blower shall be integrally mounted on the stripper frame with the stripper.

6. Blower Motor – The blower motor shall be capable of operating using single phase, 230/460 volt, 60 hz electrical service.

END OF SECTION 44100

SECTION 44200 – LIQUID-PHASE GRANULAR ACTIVATED CARBON SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Manufacturer shall furnish and deliver the GAC System described herein including the following components:

1. Carbon adsorber(s) with internals;
2. Activated carbon
3. Carbon adsorber system lead/lag pipe rack, valves and instruments;
4. Vent and pressure relief piping;
5. Operation and maintenance instructions

1.2 SUBMITTALS

A. Drawings:

1. Elevation and Plan View
2. Piping and Instrumentation Diagram

B. Manufacturer Specifications/Cutsheets

1. Activated Carbon
2. Valving
3. Pressure Gages
4. Interior Lining
5. Exterior Paint

PART 2 - CARBON ADSORPTION SYSTEM

2.1 VESSELS

A. General – Fabricate and deliver two (2) liquid phase carbon adsorption vessels designed for series and parallel operation. The total design flow capacity of each adsorber vessel shall be 90 gpm maximum. The pressure drop across each

adsorber, including distributor (underdrain) and collector shall not exceed 2.6 psi upon startup.

B. The carbon adsorber vessels shall be fabricated of 516-70 carbon steel, shall have a diameter of 46” and a straight side height of 60”, with flanged and dished heads. The vessels shall be designed for a maximum pressure rating of 75 psig at 130 degrees F. The vessels will be free standing and shall be supplied with fork tubes for ease of transportation and installation.

C. An 8" X 14” diameter eliptical manway shall be provided on the top head of each vessel for maintenance and carbon loading.

D. Two (2) lifting lugs will be provided on the top head.

E. Underdrain - Each vessel shall be equipped with a internal collector system constructed of PVC piping and laterals. The entire collection system shall be located below the bottom vessel tangent line.

F. Lining – Prior to application of the lining, the interior of the vessel shall be prepared in accordance with SSPC-SP 6. All sharp edges shall be rounded and all weld splatter shall be removed. The vessel interior shall be lined with 4-6 mil dft of Interline 850 NFS, a two component, chemically resistant, high solids, high build epoxy phenolic tank lining.

G. Painting - The exterior surfaces of each vessel shall be prepared in accordance with the coating manufacturers requirements. The vessel exterior shall be primed with 3 mil dft, Interseal 670HS, A low VOC, two component high build, high solids surface tolerant epoxy maintenance coating primer. Finish coat shall be a 2 mil dft Interthane 990HS, a low VOC, two component acrylic polyurethane high performance finish high gloss, waterborne alkyd enamel.

H. Each Adsorber vessel shall be fitted with connections as follows:

3” Flanged Inlet
3” Flanged Outlet
8” X 14" Eliptical Manway in top head
2” NPT Air vent.
3/4” Vessel drain.

2.2 ADSORBER PIPING

A. General - The piping for the adsorption system will include influent water distribution to the vessels, treated water collection, and adsorber vent lines. The pipe rack shall provide operation of the two adsorbers in either series or parallel operation with a single inlet and outlet connection. The piping will also allow for isolation of any one vessel for maintenance, while the other vessel remains in service.

B. The influent and effluent piping shall allow series or parallel flow patterns. The change in flow pattern is accomplished with a manual change of valve positions.

C. Process Piping - The influent and effluent piping shall be 3” diameter. All process piping shall be constructed of schedule 80 PVC and shall be fabricated using threaded or solvent-cemented connections.

D. Vent/Safety Relief Piping - Vent piping will be 2" diameter constructed of schedule 80 PVC materials. Graphite rupture disks shall be installed for overpressure protection.

E. Utility Piping - Utility piping will be schedule 80 PVC.

F. Piping Frame - The piping network will be provided with a structural steel support frame for support of the piping module. The frame shall support the piping and valves with minimal spacing and shall follow good design practice.

G. All process valving shall be PVC wafer body butterfly valves, EPDM seats and seals.

H. Ball valves for vent and drain piping shall be provided.

I. Pressure gauges shall be supplied and the inlet and outlet piping of each adsorber vessel to monitor pressure drop. Dial range to be 0-100 psi, 2.5 inch diameter.

2.3 ACTIVATED CARBON

A. Media - Each adsorber vessel supplied shall provide 2000 pounds of acid washed or pH control granular activated carbon, TIGG 5DCAW or TIGG pH Control or equal.

END OF SECTION 44200

SECTION 44300 – VAPOR-PHASE TREATMENT SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Manufacturer shall furnish and deliver the Granular Activated Carbon (GAC) and Potassium Permanganate (PPZ) Systems described herein including the following components:

1. GAC Vessel(s) with internals;
2. PPZ Vessel(s) with internals;
3. Activated Carbon;
4. Potassium Permanganate;
5. Operation and Maintenance Instructions

1.2 SUBMITTALS

A. Drawings:

1. Elevation and Plan View

B. Manufacturer Specifications/Cutsheets

1. Activated Carbon
2. Potassium Permanganate
3. Interior Lining
4. Exterior Paint
5. Specialty items

PART 2 –SYSTEMS

2.1 GAC VESSELS

A. General - Furnish and deliver vapor-phase carbon vessel(s) designed to hold a standard fill of 4000 lbs of activated carbon. The total design flow capacity of each vessel shall be 600 cfm.

B. The carbon vessels shall be fabricated of SA36 carbon steel, and shall have a diameter of 85" and a straight side height of 84", with flanged and dished top head and flat bottom head. The vessels shall be designed for a maximum pressure rating of 15 psig at 180 degrees F. The vessels will be free standing and shall be supplied with fork tubes for ease of transportation and installation.

C. A 20" diameter, hinged manway shall be provided on the top head of each vessel for maintenance and carbon change-out. Inlet and outlet connections shall be plain duct end.

D. Vessels are to be provided with fork tubes for ease of handling and lifting lugs on the top head. Lifting lugs shall be designed to support the fully loaded vessel.

E. Internals - Each vessel shall be equipped with inlet plenum for air distribution. The carbon bed support structure shall be designed to hold the weight of the carbon and allow even air distribution. Materials of construction shall include carbon steel, PVC and PPL.

F. Lining – Prior to application of the lining, the interior of the vessel shall be prepared in accordance with SSPC-SP 6. All sharp edges shall be rounded and all weld spatter shall be removed. The vessel interior shall be lined with 12 – 18 mil dft of a high solids catalyzed epoxy.

G. Painting - The exterior surfaces of each vessel shall be prepared in accordance with the coating manufacturer's requirements. The vessel exterior shall be primed with 3 mil dft, low VOC waterborne acrylic primer. Finish coat shall be 2 mil dft high gloss, waterborne acrylic enamel.

H. Each vessel shall be fitted with connections as follows:

14" O.D. Inlet
14" O.D. Outlet
¾" Indicator fitting
20" Manway in top head

1” Drain with plug

2.2 GAC Media

A. Media- Each vessel supplied shall be provided with 4,000 pounds of granular activated carbon, Tigg Type 5CC or equal.

2.3 PPZ Vessels

A. General - Furnish and deliver vapor-phase PPZ vessel(s) designed to hold 3,500 lbs of PPZ. The total design flow capacity of each vessel shall be 600 cfm.

B. The PPZ vessels shall be fabricated of A36 carbon steel, and shall have a diameter of 68” and a straight side height of 60”, with flanged and dished heads. The vessels shall be designed for a maximum pressure rating of 15 psig at 115 degrees F. The vessels will be free standing and shall be supplied with fork tubes for ease of transportation and installation.

C. A 20” diameter, hinged circular manway shall be provided on the top head of each vessel for maintenance and PPZ change-out. Inlet and outlet connections shall be plain end.

D. Vessels are to be provided with fork tubes for ease of handling and lifting lugs on the top head. Lifting lugs shall be designed to lift the empty vessel.

E. Internals - Each vessel shall be equipped with inlet plenum for air distribution. The PPZ bed support structure shall be designed to hold the weight of the PPZ and allow even air distribution. Materials of construction shall include carbon steel, PVC and PPL.

F. Lining – Prior to application of the lining, the interior of the vessel shall be prepared in accordance with SSPC-SP 6. All sharp edges shall be rounded and all weld spatter shall be removed. The vessel interior shall be lined with 12 – 18 mil dft of a high solids catalyzed epoxy.

G. Painting - The exterior surfaces of each vessel shall be prepared in accordance with the coating manufacturer’s requirements. The vessel exterior shall be primed with 3 mil dft, low VOC waterborne acrylic primer. Finish coat shall be 2 mil dft high gloss, waterborne acrylic enamel.

H. Each vessel shall be fitted with connections as follows:

12” O.D. Inlet

12” O.D. Outlet

¾” Indicator fitting

20” Hinged Manway in top head

1” Drain with plug

2.4 PPZ

A. General - Each vessel supplied shall be provided with 3,500 pounds of PPZ, Tigg PPM vapor-phase PPZ or equal.

END OF SECTION 44300

SECTION 46000 – BIOREACTOR SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The EQUIPMENT SUPPLIER will design, fabricate, and erect one (1) coated carbon steel Fixed-Film Bioreactor Vessel complete with cover, nozzles, manway, all internal components and appurtenances (with the exception of the corrugated PVC growth media supports), and ladder as specified herein or as indicated on the Drawings.

B. The vessels are is to be installed outdoors on a concrete foundation. Foundation design and installation by others.

C. The vessels shall conform to the Contract Drawings.

1.2 SECTION INCLUDES

A. Fixed-Film Bioreactor Vessels (T-300)

B. Fixed-Film Bioreactor Vessel Cover (T-300)

C. Internal Structural Supports for the Growth Media Supports

D. Aeration Diffuser Headers and V-Supports

E. Ladder

1.3 QUALITY ASSURANCE

A. Qualifications of EQUIPMENT SUPPLIER. Products used in the work of this section shall be new, previously unused, fabricated by a manufacturer regularly engaged in the assembly of similar items and with a history of successful production acceptable to the ENGINEER. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.4 SUBMITIALS

A. Include general shop drawings, product data, and installation instructions.

1.5 WARRANTY

A. Provide one year warranty against any defective materials or workmanship, including paint and painting, for a period of one (1) year after start-up or 18 months after acceptance, whichever is longer. If any materials or workmanship prove to be defective during this period, they shall be replaced or repaired by the EQUIPMENT SUPPLIER.

1.6 REFERENCES

A. AISC (ASD): Manual of Steel Construction (Allowable Stress Design) and Specification for Structural Steel Buildings- Allowable Stress Design and Plastic Design.

B. ANSI/AWWA D100-96: Standard for Welded Steel Tanks for Water Storage

C. ANSI/AWWA D-102-97: Standard for Coating Steel Water-Storage Tanks

D. ANSI/AWWA D103-97: Standard for Factory-Coated Bolted Steel Tanks for Water Storage

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use all means necessary to protect the materials of this section before, during and after installation and to protect the installed work and materials of all other trades. All materials shall be adequate for shipment by truck, loading and off-loading.

B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER, at no additional cost to the ENGINEER and OWNER.

PART 2 - PRODUCTS

2.1 FIXED-FILM BIOREACTOR

A. Specifications

1. Dimensions. 10 feet diameter (nominal) x 12 feet sidewall height

2. Capacity. 7,050 gallons (nominal)

3. Cover. The vessel shall be designed to support a cover constructed of either of the following materials:

a. Aluminum in accordance with the requirements contained in Part 2.2 Subpart A below; or

b. Fiberglass reinforced plastic (FRP) in accordance with the requirements contained in Part 2.2 Subpart B below.

4. Service. Groundwater containing the following constituents at the listed concentrations:

Parameter	**Concentration (µg/L)**
VOC	
Acetone	810
Benzene	9,800
2-Butanone	330
Chlorobenzene	1,900
Chloroethane	15
Chloroform	740
Chloromethane	60
Total Dichlorobenzenes	50
1,1-Dichloroethane	120
1,2-Dichloroethane	450
1,1-Dichloroethene	40
cis-1,2-Dichloroethene	2,400
trans-1,2-Dichloroethene	55
Ethylbenzene	210
Isopropylbenzene	14
Methylene Chloride	3,600
4-Methyl-2-Pentanone	140
1,1,2,2-Tetrachloroethane	50
Tetrachloroethene	120
Toluene	7,800
1,2,4-Trichlorobenzene	300
1,1,1-Trichloroethane	90
1,1,2-Trichloroethane	5
Trichloroethene	17,000
Trichlorofluoromethane	5
Vinyl Chloride	570
Total Xylenes	870

SVOC	
Bis(2-Ethylhexyl)phthalate	8
2-Chlorophenol	5
2,4-Dimethylphenol	85
2-Methylphenol	90
4-Methylphenol	310
Pentachlorophenol	10
Phenol	270

5. Corrosion Allowance. 1/8 inch

6. Construction. Carbon steel

7. Shell: 5/16 inch minimum (includes corrosion allowance)

8. Coatings. Vessel and internals constructed of ferrous metal shall be protected with a corrosion resistant finish in accordance with the latest revision of ANSI/AWWA 0102.

a. Vessel Interior. All submerged ferrous metal surfaces shall be blasted to near white metal in accordance with SSPC-10 and then coated with a coal tar coating system compatible for water storage at 100 oF containing the compounds and their concentrations listed in Section 2.1.A.4. Coal tar coating systems shall meet the specifications of Inside Coating System No. 5 or Inside Coating System No. 6 as contained in ANSI/AWWA 0102-97.

b. Vessel Exterior. All non-submerged ferrous metal surfaces shall be sandblasted to near white metal in accordance with SSPC SP-10 and then coated with an ANSI/AWWA D-102 compliant outside coating system. Color shall be white or ENGINEER approved equivalent.

9. Anchoring. EQUIPMENT SUPPLIER to design and install as needed. The foundation design drawing is found in Drawing S-1.

10. Nozzles, Supports. EQUIPMENT SUPPLIER shall provide all nozzles, flanges, plates, supports, etc. as required by the Drawings. All consumables required for assembly (welding rod, etc.) shall be supplied by EQUIPMENT SUPPLIER.

11. Ladders, Catwalks. EQUIPMENT SUPPLIER shall design and install ladders and catwalks as shown in the Drawings. The vessels shall be designed to support the additional point loading. The specific connection detail and load shall be finalized during the shop drawing process. The EQUIPMENT SUPPLIER shall include supports, support clips, and anchor bolts for the platform as needed.

B. Welded Construction

1. Fabrication of welded vessels shall comply with all of the requirements of the latest revision of ANSI/AWWA 100 and the requirements contained herein.

C. Bolted Construction

1. Fabrication of bolted vessels shall comply with all of the requirements of the latest revision of ANSI/AWWA D103 and the requirements contained herein.
2. Provide a bolted steel floor.

2.2 COVER STRUCTURE

A. Structurally Supported Aluminum Cover.

1. General

a. The aluminum cover shall be a dome structure conforming to the dimensions of the vessel. The dome structure shall be a fully triangulated space truss complete with noncorrugated closure panels. The dome shall be clear span and designed to be self-supporting from the vessel structure.

b. The dome surface paneling shall be designed as a watertight system under all design load and temperature conditions. All raw edges of the aluminum panels shall be covered, sealed, and firmly clamped to prevent slipping or disengagement under all load conditions and temperature changes.

c. The aluminum dome cover shall be supported from the rim of the vessel with primary horizontal thrust contained by an integral cover tension ring.

d. Dissimilar metals shall be isolated to prevent galvanic corrosion.

e. Provisions shall be made in the design of the connection between the cover and vessel rim to allow for thermal expansion over a temperature range of -40 °F to 140 °F.

f. The aluminum dome cover shall be equipped with a vent sized for 36 cubic feet per minute (CFM).

g. The aluminum dome cover shall be equipped with an entry dormer.

h. The aluminum dome cover shall have a mill finish.

B. Structurally Supported FRP Dome

1. General

a. Materials

1) Resin

a) The resin shall be a commercial grade or blend of polyester specified for Grade 1 fiberglass reinforced polyester resin.

b) The resin shall not contain fillers or bulk extenders except as noted below:

i. Ultra-Violet Inhibitors. Ultraviolet inhibitors shall be added to the entire laminate construction to improve weather resistance.

ii. Fire-Retardant. Fire-retardant agents may be added for improved fire resistance.

2) Reinforcing Material. The reinforcing material shall be a commercial-grade glass fiber having a coupling agent; it shall be compatible with the resin used and suitable for the particular fabrication technique.

3) Surfacing Veil. The surfacing veil shall be a commercial-grade chemical-resistant (Grade C) glass fiber and a coupling agent.

b. Laminate Construction. The laminate shall consist of an inner surface, an interior layer, and an exterior layer. Total laminate thickness, shall in no case, be less than the design allowable for 5:1 safety factor.

1) Inner Surface. The inner surface exposed to the contents shall be a surfacing veil layer 10 to 20 mils thick.

2) Interior Layer. The interior layer shall follow the inner surface and be reinforced only with non-continuous glass strands. The combined thickness of inner surface and interior layer shall not be less than 0.10 inches.

3) Exterior Layer. The exterior layer shall consist of resin and reinforcing materials built up or layered to complete the required thickness. If separate layers such as mat, cloth, or woven roving are used, a layer of chopped-strand glass shall be placed as alternate layers.

c. Exterior Surface. Exterior surface shall be shall be ultra-violet and air-inhibition protected. Color shall be white or ENGINEER approved equivalent.

d. The FRP cover shall be a dome structure conforming to the dimensions of the vessel.

e. The FRP dome shall be designed to be self-supporting from its periphery.

f. The FRP dome shall be supported from the rim of the vessel with primary horizontal loads contained by an integral cover tension member ring.

g. A design safety factor of 5:1 for stress, shall be applied to all design load combinations.

h. Provisions shall be made in the design of the connection between the cover and vessel rim to allow for thermal expansion over a temperature range of -40 °F to 140 °F.

i. The FRP dome surface paneling shall be designed as a watertight system under all design load and temperature conditions. All raw edges and drilled holes shall be deburred and sealed.

j. The FRP dome cover shall be equipped with a vent sized for 36 CFM.

k. The FRP dome cover shall be equipped with an entry dormer.

2.3 GROWTH MEDIA SUPPORTS

A. Media supports shall be constructed of A-36 carbon steel.

B. Media supports shall be fabricated in accordance with the Drawings.

C. Media supports shall be fabricated with continuous welds to provide 100% shear or tension capacity of the supporting member. Packing supports shall be prepped and finished per Part 2.1 Subpart A.9.a above.

2.4 AERATION DIFFUSER SYSTEM

A. Aeration diffusers header pipes shall be constructed of 6-inch FRP pipe in accordance with the Drawings. Drilled orifaces shall be cleaned and deburred and a Y." rim installed on each oriface.

B. Aeration diffuser header V-supports shall be constructed of A-36 carbon steel and fabricated in accordance with the Drawings.

C. Aeration diffuser header V-supports shall be fabricated with continuous welds to provide 100% shear or tension capacity of the supporting member. V-supports shall be prepped and finished per Part 2.1 Sub A.9.a above.

END OF SECTION 46000