

**SECTION 13150
WATER FEATURE**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall perform all work necessary to complete the Contract in a satisfactory manner. Unless otherwise stated, the Contractor shall furnish all materials, equipment, tools, labor and incidentals necessary to complete the Work. The Work includes, but is not limited to the following:
1. Fine Grading and other grading modification required in the installation of the Water Feature Systems
 2. Water Feature stream edge walls and other shoreline treatments
 3. Water Feature hardened bottom and slope protection, including structural shell and aesthetic rock, cobble and boulder treatments
 4. Water Feature Seepage Control Lining - Membrane System
 5. Recirculation Pumping Systems
 6. Equipment Vaults remote from main residential structure, etc.
 7. Water Supply Level Sensors, electrically actuated fill line valve, electrically actuated Lake Level Control Valves
 8. Lake Mechanical and Hydraulic systems
 9. Motor Control Center Electrical Panels including electrical connections to the equipment
 10. Water Quality Treatment, including all water chemistry analyzers, controllers and chemical delivery system
 11. Water fall retaining walls
 12. Rocks and boulders, waterfalls, weirs, streams, etc.
 13. Miscellaneous items required for a complete operational Water Feature system.
 14. Water Feature fill up
 15. Maintenance of the Water Feature Systems during Operational Testing Phase
 16. Operational Testing and Commissioning of the Water Feature System
- B. RELATED WORK BY OTHERS
1. Landscaping
 2. Electrical power to Equipment Room
 3. Water Supply to Equipment Room
 4. Storm Drains and Sanitary Sewer lines to equipment spaces
 5. Other Civil, Mechanical and Electrical work on the project.
- C. REFERENCE SPECIFICATIONS & STANDARDS:
1. Uniform Building Code, Current Edition
 2. Manual of Steel Construction, AISC, 8th Edition

3. National Electrical Code, current edition
4. Manual of Standard Practice, Concrete Reinforcing Institute
5. American Concrete Institute ACI 301, 302 and 318
6. Applicable Federal, State and local Safety Codes, Ordinances and Orders
7. ASTM A 312 - Specification for Seamless and Welded Austenitic Stainless Steel Pipe
8. ASTM B 88 - Specification for Seamless Copper Water Tube

1.2 GENERAL REQUIREMENTS

- A. The Plans, Specifications and other contract documents shall govern the Work. The Plans and Specifications and other contract documents are intended to be complementary to describe and provide for a complete project.
- B. In submitting a proposal for this project, the bidder is required to visit the project and examine the site of the work to fully understand the scope of work, the materials, labor and workmanship required and the conditions under which they will be provided.
All special conditions set forth in the bidding documents shall be a part of these Specifications.
- C. Before entering into a contract for execution of the work, the Contractor shall verify all quantities, dimensions and shall, upon discovering any error or omission or discrepancies between the Plans, Specifications and actual conditions, immediately call it to the attention of the Owner and Water Feature Engineer. No work shall be done where there is a discrepancy until approval has been given by the Owner and the Water Feature Engineer.
- D. The Owner shall, at the request of the Contractor, provide plans or field staking locating existing lines and underground utilities. Before excavating, the Contractor shall verify the location of cables, conduits, pipes, sewers and other underground utilities and shall take proper precautions to avoid damage to such utilities. In the event of a conflict or discrepancies, the Contractor shall promptly notify the Owner and request for necessary relocation. Failure to follow this procedure places upon the Contractor the responsibility of making any and all repairs for damages of any kind at his expense.
- E. The Contractor shall provide necessary safeguards and exercise caution against damage to existing site improvements. The Contractor shall be responsible for any damage resulting from his operations and shall repair or replace such damage at his own expense.
- F. The Contractor shall furnish and install a complete Water Feature systems as described in the scope of work. All work shall be in strict accordance with Plans, Specifications and existing codes and regulations.

G. Soils reports, Architectural, Civil, Mechanical and Electrical Plans, and other documents have been prepared for this project. By reference, these project documents are made a part of these specifications. Copies of the plans and reports are available for inspection at the Owner's office.

H. Contractor's Qualifications

The Contractor and his field supervisor assigned to this project shall have the minimum qualifications of having successfully completed five Water Feature projects of equal or greater scope than this project. The Contractor shall submit a reference list of Landscape Architects/Engineers, Owners, etc., with a brief description of the work involved.

I. Terminology

As used throughout in the Specifications, the following terms shall mean -

"Water Feature" or "Water Feature Systems" : the Water Feature for which the Work has to be done.

"Owner" : the Owner of the project or the duly authorized representative of the Owner.

"Contractor" : the Water Feature Contractor

"Water Feature Engineer" : STO Design Group, Inc. or the duly authorized representative of STO Design Group, Inc.

"Engineer" : the Civil Engineer for the project

"Soils Engineer": the Soils Engineer for the project

"Landscape Architect" : the Landscape Architect for the project

"Architect" : the Architect for the project

PART 2 - PRODUCTS

A. PRODUCTS SPECIFIED BY BRAND NAME OR SUPPLIER

1. Products specified by BRAND NAME or SUPPLIER as indicated on the Plans shall be provided and installed by the Water Feature Contractor.
2. List of Accepted Brand/Manufacturer for Valves, Fittings, etc. as shown in Schedule A of these Specifications.

B. PRODUCTS NOT SPECIFIED BY BRAND NAME OR SUPPLIER

1. Pipes and Fittings
 - a. PVC pipes and fittings shall be Schedule 40 and 80, Type 1, Normal Impact, conforming to ASTM D 1785-73 and D 2241-73, D 2466-69 and D 3036-72. PVC solvent cement shall conform to ASTM 2564-73 and rubber gasketed bell and spigot joints shall conform to ASTM D 3139.
All exposed PVC piping in equipment room and vaults shall be Schedule 80.
 - b. All steel pipe, other than stainless types, shall be Schedule 40, galvanized. Provide corrosion resistant wrapping for underground piping installation.
 - c. Cast iron fittings shall be Class 125. Stainless Steel valves shall be Type 316, ASTM A 351 CF8M and ASTM A276.
 - d. Copper Pipes shall conform with ASTM B 88 and shall be Type K, soft temper for buried tubing and hard drawn for above ground application. Fittings shall be soldered or sweated on and shall be of wrought copper conforming to ANSI B16.22. Soldered joints shall contain 95% tin and 5% antimony. No solders or fluxes containing more than 0.2% of lead shall be used.
 - e. Stainless Steel Pipes - Type 304, Schedule 10 conforming to ASTM A312 with stainless steel threaded fittings, or with stainless steel welded fittings.
2. PVC pipe installation shall conform to the requirements of Technical Report PPI-TTR13 (8/73), Plastics Pipe Institute; all solvent cement jointing conforming to ASTM D-2855.
3. Valves - All valves shall have a minimum of 125 psi rating.
4. Concrete, Concrete Steel reinforcement and Formwork shall conform to the following requirements:
 - a. Portland Cement shall conform to ASTM C 150, Type V
 - b. Reinforcing Steel shall conform to ASTM A 615, Grade 60
 - c. Aggregates shall conform to ASTM C 33
 - d. Tie wire shall be soft annealed steel, 18 gage min.
 - e. Formwork shall be Construction Grade Douglas Fir lumber for Studs and Whalers. Plywood for forms shall be of the grade "Exterior B-B" (concrete form), conforming to the latest Product Standard for Soft Plywood, Construction and Industrial, of the National Bureau of Standards. Form plywood shall bear Grade marks and be 5 ply type, minimum 5/8" thick for studs or joists spaced not more than 12" center to center, otherwise 3/4" thick.
 - f. Air Place Concrete shall be used for Water Feature Construction. The Water Feature Contractor shall provide Owner with Concrete Supplier's statements of materials, admixtures, mix proportions, anticipated 28 day compressive strength and Test Reports.
 - g. Concrete for purposes not otherwise specified shall be 2500 psi minimum 28 day compressive strength. A trial design mix shall be

- submitted for the Water Feature's Engineer's approval.
5. Joint Sealant shall be either:
 - a. Fiber Expansion Joint Type -
Conforming to ASTM D 1751 or closed cell Neoprene
Sponge Rubber conforming to ASTM D 1752.
 - b. Elastomeric Joint Sealant -
Elastomeric Joint Sealant shall be chemical cure, non-sag,
permanently flexible polyurethane sealant conforming to U.S.
Federal Specification TT-S-00227E, Types I and II, Class A,
ASTM C-920-79, Type M, Class 25, Grade P and NS.
 6. Geomembrane - The geomembrane shall be first quality domestic goods specifically manufactured and suitable for Waterscape lining application. The geomembrane shall be manufactured by calendaring or extruding process and shall be uniform in thickness, size and surface texture. The membrane liner shall be a flexible, durable, watertight product free of pinholes, blisters or contaminants. The geomembrane shall be compounded from first quality virgin materials with no regrind or reprocessed materials added.
 7. Rocks and Boulders - Natural rocks and boulders shall be from a source approved by the Landscape Architect or Owner. Artificial rock shall be samples submitted and approved by Landscape Architect or Owner. All of the exposed finish surfaces of Water Feature system ponds, stream sidewalls and streambeds, waterfalls, etc, shall be natural rock, boulder or cobble per the plans and Landscape Architect's direction. None of the concrete shell installed for protection of the Hypalon liner shall be visible.

PART 3 - EXECUTION

A. SUBMITTALS

1. **SEQUENCING AND SCHEDULING:** Prior to start of Work, prepare a detailed schedule of the work for coordination with the other trades. Schedule for start of critical items of water feature installation and the final completion of the Work within the requirements of the total Project Schedule.
2. **SHOP DRAWINGS:** Shop drawings as required by the Plans and Specifications or as requested by the Water Feature Engineer shall be prepared with current engineering practice and at the Contractor's expense. Drawings shall be of such size and scale to clearly show all necessary details.
Submittal of the shop drawings and subsequent review by the Water Features Engineer shall not relieve the Contractor from the responsibility for errors and omissions in the drawings or from deviations from the Contract Documents.
3. **REQUEST FOR INFORMATION (RFI)**

Water Feature systems installation shall conform in entirety to plans and specifications. Contractor shall submit written RFI for any clarification of plans deemed necessary. Any deviations from plans and specifications requires written

concurrence from the Water Feature Engineer, and all formal RFI responses shall be written.

4. **REQUEST FOR SUBSTITUTION OF PRODUCTS:** Request for substitutions of products shall be submitted for the Water Features Engineer's approvals. The request shall state reasons for substitution and shall be accompanied by full data, documentation and other materials required for a full evaluation by the Water Feature Engineer. Substitution products shall not be installed until approved in writing by the Water Feature Engineer.

Five copies shall be transmitted to the Water Feature Engineer for review at least 15 days before substituted products will be required for the work. Materials shall not be furnished, fabricated or installed nor any work done for which substituted materials are required, before Water Feature Engineer's review.

5. **OTHER ITEMS OF SUBMITTALS:** The Contractor shall provide the Owner with As Built Drawings, Manufacturer's Catalogs, Maintenance Manual and other submittals as called for in this Specification and in Plans.

B. EQUIPMENT

1. Pumps, jets, heat exchangers, compressors, filters, water chemistry treatment equipment, automatic water chemistry analyzers, chemical feeders, equipment controllers and all other equipment shall be installed as shown on plans and in accordance with manufacturer's directives and installation procedure information.
2. All equipment installation shall comply with applicable codes.
3. All pumps, heaters, filters, water chemistry analyzers and other principal items of equipment shall be clearly labelled, tagged or otherwise identified by labels, preprinted on pressure sensitive adhesive backed vinyl cloth or plastic tape, or by permanently attached tags secured using stainless steel bolts or screws

C. PIPING

NOTE: All exposed PVC piping in equipment rooms and vaults shall be Schedule 80.

1. Pipe layouts shown on the plans represents the required pipe routing, allowing for minor realignment required by field conditions. Approval of the Water Feature Engineer is required for major rerouting of piping. Pipe runs shall be installed with the least number of fittings. Unless shown on plan, there shall be no pipe installation underneath the Water Feature.
2. Piping shall be installed without air entrapping high points or reverse slopes, i.e. on discharge lines, no descending runs beyond horizontal or ascending runs; on suction lines, no descending runs beyond ascending runs.
3. Pipe trenches shall be excavated to full width and depth required for proper installation and in accordance with the requirements of pipe manufacturer and applicable codes. Trench bottom shall provide uniform bearing and support for the entire length of the pipe.
4. Provide minimum 24 inch cover for all piping installation using suitable backfill material, approved by the project Soils Engineer. Backfill material in trenches shall be compacted to 90 percent of Modified Proctor Density.
5. Thrust blocks shall be provided to prevent movement of pipe lines under pressure at bends, tees, caps and valves, etc. Concrete for thrust blocking shall have a

minimum compressive strength of 2,500 psi. Concrete shall be placed against undisturbed material and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be required for thrust blocks where trench conditions require. Thrust blocks shall be properly set and adequately cured prior to pressurizing the system.

6. Provide supports and hangers for all exposed pipings in accordance with the Uniform Plumbing Code, Section 316; Plastic Pipe Institute Technical Report PPI-TR-August 1973, "PVC Plastic Piping Design and Installation"; and applicable local codes.
 - a. All pipe systems and pipe connections to equipment shall be properly supported to prevent deflection, vibration and stresses on piping, equipment and structures. All supports shall conform to ANSI/ASME B 31.1, except as supplemented or modified by these specifications. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements. The pipe supports and pipe support system shall comply with the Uniform Building Code Seismic requirements.
 - b. Appearance: Pipe supports and hangers shall be positioned in such a way as to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other work.
 - c. Separate hangers and supports shall be provided at valves. Provide one hanger or support at each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end.
 - d. Concrete pipe supports:
Concrete pipe supports shall be installed as shown on the drawings.
 - e. Separate hangers and pipe supports shall be provided at each pipe elbow, tee or fitting. Provide separate hangers and supports on both sides of each non-rigid joint or flexible pipe coupling.
 - f. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps or other equipment to which the pipe is connected.
 - g. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports. Rubber hose and flexible tubing shall be provided with continuous angle or channel support.
 - h. Pipe clamps or other devices which rely entirely on the application of a clamping force to the supported pipe in order to maintain the clamp position or location in a prefabricated channel or track will not be acceptable for use with non-metallic pipe or tubing.
 - i. Unless otherwise noted on the drawings or permitted by the Engineer, piping shall be supported approximately 1-1/2" away from the face of walls and at least three inches below ceilings.
 - j. Support Spacing:
Pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation,

plus the dynamic loads imposed by the system during operation, and shall have a minimum Safety Factor of 5 based on material ultimate strength. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending and shear stresses in the piping, with special consideration given when components such as flanges and valves impose concentrated loads. If no spacings are given on the drawings, or specified elsewhere for a particular piping system, the support must be spaced so that the stress on steel pipes does not exceed 5,000 psi.

- k. Pipe supports and hangers shall be manufactured for the size and type of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient thread to permit the maximum adjustment available in the supporting item. Continuously threaded rods are not acceptable. All hangers shall have a means of vertical adjustment. Hangers shall be designed so that they cannot become disengaged by any movement of the supported pipe. All hanger rods shall be subject to tensile loading only.
- l. Hangers subject to movements:
Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow for free expansion and contraction of the piping and shall prevent excessive stress on the equipment
- m. Manufactured Supports
Stock Parts: Where not specifically shown or detailed, designs generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized wherever possible. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose
All pipe supports shall conform to the latest requirements of the ANSI Code for Pressure Piping B 31.1 and Manufacturers Standardization Society documents MSS SP-58 and MSS SP-69. All pipe support material shall be packaged as necessary to ensure delivery in satisfactory condition
Loads on inserts, brackets, clamps and other items shall not exceed the manufacturer's recommended loads.
Manufacturers, or approved equal
 1. Basic Engineers, Pittsburgh, PA
 2. Bergen-Paterson Corp., Boston, MA
 3. Elcen Metal Products Company, Franklin Park, IL
 4. ITT-Grinnell Corp., Warren, OH
 5. NPS Industries, Inc., Secaucus, NJ
- n. Contact between dissimilar metals, including contact between stainless steel and carbon steel shall be prevented. Those portions of pipe supports which contact dissimilar metals shall be rubber or vinyl coated
- o. Anchor Bolts: Anchor bolts, anchors, nuts, washers, screws and other appurtenances for attaching pipe supports and hangers shall be stainless steel in accordance with ASTM A 276, Type 316
- p. All pipe supports, other than stainless steel or non-ferrous supports, shall

- have the welds ground smooth, be sand blasted after fabrication and hot-dip galvanized in accordance with ASTM A 123.
- q. Protective coatings shall be provided for all supports.
 - r. All piping shall be identified by entire outer surface painting with a coloured paint, a lettered label and a directional label. Each water feature's piping system shall be painted with a specific colour to clearly distinguish it from all other systems.
 - s. All valves shall be identified by a tag permanently attached by means of two stainless steel bolts or screws. The wording on the valve tags shall describe the exact function of each valve.
7. All pipe installation shall be tested for water tightness. Piping installation shall meet the requirements of a field hydrostatic pressure testing of 80 psi for 4 hours, in the presence of the Water Feature Engineer. Prior to testing, all pipe lines shall be filled with water for 24 hours with the lines vacated of air. All pressure testing shall be conducted in the presence of the Water Feature Engineer. Tests which are not monitored and reviewed by the Water Feature Engineer shall not be accepted and shall be repeated.
8. Air lines shall be vacated of water before filling Water Features.
9. Pipe Identification
- a. All pipe systems shall be identified by color coding by painting the entire outer pipe surface as specified. A distinguishing colored paint shall be painted directly on the pipe to identify and differentiate each water feature's hydraulic system.
 - b. Each pipe identification shall consist of a printed label identifying the name of the pipe and a flow arrow to indicate direction of flow in the pipe. All labels shall be preprinted on pressure sensitive adhesive backed vinyl cloth or plastic tape. Letter sizes and colors for lettering, arrows and background shall comply with ANSI A13.1
Straight runs of pipe shall be identified at intervals of 10 feet maximum or at least once in each room unless otherwise directed by the Engineer. Pipe shall also be identified at a point approximately within 2 feet of all turns, elbows and valves; on the upstream side of all distribution fittings or branches; and on both sides of each floor, wall or barrier through which the line passes.
 - c. Preprinted identification devices shall be a manufactured by W.H. Brady; Seton Nameplate Corp. or equal.
10. Welding
- a. Welding requirements: All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D 1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections. All metal edges shall be accurately cut for a good fit whether they are sheared, machined or cut by a thermal process. Pipe which is thermally cut shall be machined or ground to remove scale and contaminants.

- b. Welder Qualifications: All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D 1.1 by an independent local approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.
- c. Stainless Steel Welding: For stainless steel piping, care shall be taken to prevent contamination of the weld by foreign matter, particularly mild steel, carbon, sulphur, zinc or galvanized steel. The weld bead shall be kept as small as practical but shall ensure full penetration. The weld shall not be excessively heated by multiple passes or by weld pooling. Skip and step back methods may be used for difficult welds. Welds and the weld area shall be thoroughly cleaned to improve corrosion resistance. Slag deposits, weld spatter, heat discoloration and scales shall be wire brushed and ground to match the original texture of the pipe. Wire brushes shall be stainless steel and shall not have been used on materials other than stainless steel.

D. STEEL REINFORCEMENT

- 1. All reinforcing steel shall be bent and formed accurately to shapes and lengths indicated in the plans and conform to ACI code requirements.
- 2. All reinforcing steel shall be placed and secured in position in accordance with the size and spacing shown in the plans and in accordance with "Manual of Standard Practice" of the Concrete Reinforcing Steel Institute using concrete or metal chairs, spacers, metal hangers, supporting wires and other approved devices. Concrete cubes shall be tied to reinforcing steel in foundations, Water Feature shells and adjacent earth masses to provide a minimum 3" clearance, except as noted in plans. Pipes, conduits, sleeves, etc. must be tied with wire to reinforcing steel.
- 3. Lap bars to develop full strength, and a minimum of 30 bar diameters in all cases.
- 4. All reinforcement shall be clean, free from loose mill scale, loose rust oil or other coatings interfering with bond.
- 5. All reinforcement installation shall be inspected and approved by an inspector of the jurisdictional authority before pouring concrete.

E. POND AND STREAM SEEPAGE CONTROL: GEOMEMBRANE LINER

- 1. Subgrade Preparation: The subgrade to receive geomembrane liner shall be free from loose dirt, angular rock, roots, vegetation, foreign materials and protrusions. All cracks and voids will be filled and the surface made level or uniformly sloping as indicated on plans. The subgrade shall be compacted in accordance with the Soils Engineer's recommendation ensure against settlement. The surface shall be steel wheel rolled prior to lining installation. The surface shall be firm, smooth, clean and dry. The Contractor shall dewater the area, as required.
- 2. As defined in Schedule A the geotextile underlayment shall be placed on the

- prepared base, with 4" minimum overlays.
3. The geomembrane shall be placed over the prepared base in a manner that requires minimum handling and seaming.
 4. The geomembrane liner shall be installed per manufacturer's recommendations, with 6" minimum sealed lap joints at the edge of all panels of liner material.
 5. The Contractor is responsible for protection of the installed lining. All persons walking on the liner shall wear soft shoes. The lining shall be fastened and secured at all times.
 6. All piping, structures and other projections through the lining shall be sealed with approved sealing methods.
 7. Cover Material, as shown on plans, shall be placed over the lining as soon after the placement of the liner. The cover material shall be applied using methods that will not cause, in the judgment of the Lake Engineer, damage to the lining.

F. CONCRETE AND MASONRY WORK

1. Structural wall footings shall be poured on engineered fill or natural ground, prepared per the approval of the Soils Engineer.
2. All expansion joints shall be installed as shown on Plans.
3. All concrete placement work shall be in accordance with ACI-301 and ACI-302.
4. Concrete tolerances for plumb and planes shall not exceed 1/4 inch in 10 feet, nor exceed 1 inch total and wall thicknesses as specified in the plans shall not vary by more than 1/2".
5. Forms and reinforcing steel shall be wetted with fog sprayers prior to placing concrete.
6. Vibrators shall be used to consolidate concrete around steel and eliminate air voids.
7. Cast-in-place equipment vault shall be constructed per concrete and steel reinforcement specified in structural plans.
8. Precast equipment vaults shall be installed to the elevations and location indicated on the plan and per manufacturer's recommendation. Shop drawing submittal is required for this item of work.
9. Curing
Curing shall be continually maintained for 7 days after placement of concrete. Perform curing by moist curing, moisture-retaining cover, by curing compound or by combination thereof.
10. Testing and Inspection
 - a. Notify Engineer and Testing Laboratory at least 48 hours prior to start of placement of concrete.
 - b. All testing, including preparation of samples, shall be done by Testing Laboratory retained by Owner
 - c. Take a sample from each 100 yards of concrete or fraction thereof, placed each day. Each sample shall consist of:
 - i) Four identical test cylinders made and stored in accordance with ASTM C-31
 - ii) Slump test in accordance with ASTM C143 at point concrete is discharged into forms

- iii) Air entrainment test
- iv) Temperature of concrete and air
Test samples in accordance with ASTM C-39. Test one sample at 7 days and two at 28 days with the extra cylinder held as spare. The strength level of the concrete will be acceptable if the averages of all sets of three consecutive 28 day strength tests result equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

G.1 AIR-PLACED CONCRETE- GUNITE

Air-Placed Concrete, Guniting and Shotcrete shall conform to Uniform Building Code (Current Edition) requirements, Sections 2621 and 4710, and American Concrete Institute Standard ACI 506.

1. Quality Assurance:
 - a. Applicator Qualifications: Contractor must have at least 3 years of experience in guniting construction and shall provide the Engineer with a list of at least 5 projects of this type and size which he has completed in a satisfactory manner.
 - b. Testing: Make three test cylinders for each day of guniting application. Test cylinders shall be made and stored in accordance with ASTM C-31. Test one cylinder at 7 days and two cylinders at 28 days per ASTM C-39.
2. Preparation:
 - a. Ground Wires: Install adequate ground wires prior to guniting to be used as screeds to establish the thickness and surface planes of the guniting work. Place ground wires so that they are tight and true to line and in a manner that they may be easily tightened.
 - b. Reinforcement: All reinforcement shall be clean, free from loose mill scale, loose rust oil or other coatings interfering with bond.
 - c. Call the Water Feature Engineer for an inspection of the wires and steel before beginning guniting operation.
3. Proportioning and Mixing:
 - a. Strength: The compressive strength of guniting shall be 2500 psi minimum at 28 days.
 - b. Mix guniting with a cement-sand ratio of 1 to 4-1/2 by volume. Make provisions for accurate measurements.
 - c. The materials shall be mixed dry except that sand shall contain between 3% and 6% moisture by weight, in an approved powerbatch mixer equipped with an approved device for accurately measuring the quantity of aggregate and the timing of the mixing operation. The materials shall be mixed at least 1-1/2 minutes during which time the mixer shall rotate at a peripheral speed of about 200 feet per minute. Any materials that have been mixed more than 45 minutes shall not be used.
 - d. The water content of the guniting at discharge shall not be greater than 3-1/2 gallons per sack of cement.

4. Application:
 - a. Gunitite shall not be placed when temperature is likely to rise above 100 degrees (F) or fall below 30 degrees (F).
 - b. Use cement gun or apparatus equipped with an air pressure gauge. All hoses and connections are to be tight. Hose shall not exceed 300 feet in length.
 - c. Gunitite shall be applied in shapes and thickness shown in drawings.
 - d. Hold the nozzle at right angles to the surface being gunitied. When placing gunitite around reinforcing steel, direct the material behind the bars on both sides. Care shall be taken to ensure all loose sand and rebound is removed from the surface prior to guniting. This is to be accomplished by the continuous use of a blow-off hose.
 - e. No rebound material shall be used in the structural shell of the Water Feature. Rebound may be used for backfilling.
 - f. Whenever a construction joint is necessary, finish the existing gunitite off at 45 degrees angle so that the adjoining material may be placed at right angles to the existing.
 - g. Gunitite tolerances for plumb and planes shall not exceed 1/4 inch in 10 feet, nor exceed 1 inch total and wall thicknesses as specified in the plans shall not vary by more than 1/2".
5. Curing and Cleaning
 - a. Gunitite shall be kept damp for at least 10 days after being placed. Curing method to be approved by the Water Feature Engineer.
 - b. The Contractor shall be responsible for the removal from the site of all gunitite debris, rebound and construction waste materials upon completion of the gunitite work.
 - c. Finished gunitite surfaces shall be cleaned to the approval of the Water Feature Engineer.

G.2 AIR-PLACED CONCRETE- SHOTCRETE

Air-Placed Concrete, Gunitite and Shotcrete shall conform to Uniform Building Code (Current Edition) requirements, Sections 2621 and 4710, and American Concrete Institute Standard ACI 506.

Only personnel skilled in the techniques of air placement of concrete shall be utilized for air-placed concrete construction.

Shotcrete shall be a proportioned combination of Portland cement, aggregate and water mixed by mechanical methods, pumped in a plastic state through a pipe or hose to the nozzle, where, by the addition of air, the mixture is forcibly propelled to the work.

1. Quality Assurance:
 - a. Applicator Qualifications: Contractor must have at least 3 years of

- experience in Shotcrete construction and at least 5 projects of this type and size which have completed in a satisfactory manner. xx A written submittal to the Owner is formal submittal is required
- b. The Contractor shall make the work accessible to facilitate the preparation of test specimens.
 - c. Testing: Make three test cylinders for each day of gunite application. Test cylinders shall be made and stored in accordance with ASTM C-31.
 - d. The compression test cylinders shall be prepared by the Contractor in the presence of the Engineer in 6 inch diameter by 12 inch long containers of 3/4 inch square hardware cloth, utilizing the same mix, air pressure, water pressure and nozzle tip as for the material placed in the structure. Cylinders shall be cured in accordance with ASTM C 31 and ASTM C39.
 - e. One of the three test specimen cylinders shall be tested at 7 days; the remaining two specimen cylinders shall be tested at 28 days per ASTM C-39 by a certified Materials Testing organization.
2. Preparation:
- a. Earth subgrade for air-placed concrete shall be neatly trimmed to line and grade and shall be free of all loose material. The subgrade shall be compacted to a minimum 90% Relative Density per ASTM D 1557.
 - b. Ground Wires: Install adequate ground wires prior to shotcreting to be used as screeds to establish the thickness and surface planes of the shotcrete work. Place ground wires so that they are tight and true to line and in a manner that they may be easily tightened.
 - c. Reinforcement:
Mortar blocks, metal chairs, clips or spacers with wire ties or other acceptable means shall be used to secure the reinforcement firmly in the position shown on the plans.
All reinforcement shall be clean, free from loose mill scale, loose rust oil or other coatings interfering with bond.
 - d. Call the Water Feature Engineer for an inspection of the wires and steel before beginning shotcrete operation.
3. Proportioning and Mixing:
- a. Mix Design:
Contractor shall submit proposed Shotcrete concrete mix design to Engineer at least 10 days prior to placement.
 - b. Strength:
The compressive strength of shotcrete shall be 3250 psi minimum at 28 days.
 - c. The concrete used in the shotcrete application shall comply with the following:
 - 1) 650 pounds of cement per cubic yard
 - 2) Combined aggregate gradation per either D or E following:

<u>Sieve Size</u>	<u>Percentage Passing Sieves</u>	
	D	E
3/4"	100	100
3/8"	92-100	90-100
No.4	42-60	60-80
No.8	33-47	50-70
No.16	22-38	33-53
No.30	17-25	19-35
No.50	6-12	5-15
No.100	1- 5	2- 6
No.200	0- 2	0- 2

4. Equipment

- a. The pump system utilized to convey premixed concrete shall deliver a uniform and uninterrupted flow of material, without segregation or loss of ingredients.
- b. The main run from the pump to the work shall be at least 3 inch diameter steel pipe or flexible hose reduced to 2 inch diameter at the point of expulsion. Aluminum pipe will not be permitted.
- c. The air compressor shall have the capacity to deliver at least 100 cubic feet per minute for each operating nozzle.

5. Application:

- a. All surfaces shall be dampened before application and material shall not be applied to a surface on which free water is visible.
- b. Shotcrete shall not be placed when temperature is likely to rise above 100 degrees (F) or fall below 30 degrees (F).
- c. Use cement gun or apparatus equipped with an air pressure gauge. All hoses and connections are to be tight. Hose shall not exceed 300 feet in length.
- d. Shotcrete shall be applied in shapes and thickness shown in drawings.
- e. Hold the nozzle at right angles to the surface being shotcreted. When placing shotcrete around reinforcing steel, direct the material behind the bars on both sides. Care shall be taken to ensure all loose sand and rebound is removed from the surface prior to shotcreting. This is to be accomplished by the continuous use of a blow-off hose.
- f. No rebound material shall be used in the structural shell of the Water Feature. Rebound may be used for backfilling.
- g. Expansion joints shall be formed at the locations designated on the plans
- h. Upon reaching the thickness and shape outlined by the forms and ground wires, the surface shall be rodded off to true line and grade. Low spots or depressions shall be brought up to proper grade by placing additional air-placed material. Ground wires shall then be removed. Rodding and working with a wood float shall be held to a minimum.
- i. Guniting tolerances for plumb and planes shall not exceed 1/4 inch in 10 feet, nor exceed 1 inch total and wall thicknesses as specified in the plans shall not vary by more than 1/2".

6. Curing and Cleaning
 - a. Shotcrete shall be kept damp for at least 10 days after being placed. Curing method to be approved by the Water Feature Engineer.
 - b. The Contractor shall be responsible for the removal from the site of all shotcrete debris, rebound and construction waste materials upon completion of the guniting work.
 - c. Finished guniting surfaces shall be cleaned to the approval of the Water Feature Engineer.

H. PLASTER

1. Surfaces Preparation:
 - a. Surfaces to receive plaster shall be cleaned, removing all laitance, existing paint, and other foreign material, and exposing a clean, rough surface. All debris shall be removed from the Water Feature and swept clean. At the time of starting plastering, said surfaces shall be uniformly moist and approved by Water Feature Engineer.
 - b. All new tile is to be carefully masked and protected during cleaning and other preparation procedures.
 - c. Once the prepared surface has been thoroughly blasted, undercut, and cleaned, it must be inspected by the Water Feature Engineer before the Contractor can proceed.
 - d. All surfaces to receive plaster shall be uniformly moist before plaster is applied.
2. Proportioning and Mixing:
 - a. Plaster shall be proportioned with 2 parts white Portland Cement to 3 parts white marble aggregate.
 - b. Plaster shall be mixed 10 to 15 minutes until the mixture is completely smooth.
 - c. Plaster shall be applied within 30 minutes from the time of initial mixing.
3. Application:
 - a. The entire surface shall be damp prior to placing plaster.
 - b. Scratch Coat: Apply bonding agent, following manufacturer's recommendation, to walls and floor with stiff broom, follow with scratch coat of plaster. Apply scratch coat with steel trowels using sufficient pressure to obtain a good bond. Float to an even texture leaving the surface even with the face of the tile and fittings. Apply the scratch coat to the Water Feature floor with a stiff broom. Gun application may be used. Screed Maximum depression of 1/8 inch permissible.
 - c. Finish coat:
 - 1) The finish coat shall follow the scratch coat almost immediately as the two coats are to be monolithic. During hot weather the finish coat shall immediately follow the scratch coat.
 - 2) In applying finish coat stagger all joints to avoid straight lines. Start at the steps and proceed from the toe of the trowel to the right. Apply plaster to walls first. When the Water Feature is half-covered by a draw-up coat, finishers will drop back and start

- trowelling the walls and floor, using an 18 inch steel trowel.
- 3) Start trowelling floor along the walls and cove, bringing floor and cover together using a rubber float with a small amount of water. The scaffolding should be removed as soon as the walls are smooth. This will allow patching of holes made by steel jacks before the walls and floor have set hard. Holes left by knee boards should be closed with a rubber float before trowelling, remove dirt and dust with a fine hair broom ahead of finishing to avoid black streaks.
 - 4) In trowelling use line, even easy strokes, as extremely hard trowelling may darken the finish. No water should be used in the final trowelling operation, as it will show a mottled finish. The surface of the plaster, when completed, should be smooth, dense and even, without cat faces or trowel marks. Blisters that appear during the plaster operation may be punctured with the corner of a trowel and trowelled until blisters are removed.
 - 5) The final treatment to close any checks that may appear is a light dusting of pure white cement, brushed with a soft broom evenly and lightly over the entire area. Particular must be taken to remove all excess cement dustings from the Water Feature by repeated brooming. If finish is too damp, this may be done the following morning.
 - 6) Curing
When the plaster has reached its initial set, the Water Feature shall then be filled with water. Care shall be taken not to scour or effect the finish of the fresh plaster by the water force when filling is commenced. Under no circumstances allow the water to be turned off during the filling operation as this will form a stain completely around the Water Feature at the water level
 - 7) Patching and Cleaning
All plaster work which unacceptable shall be cut out and patched in a manner which is satisfactory to the Water Feature Engineer.

I. TILE

1. Inspection:

- a. Inspect previous work to ensure that the gunite is thoroughly clean of all loose or foreign material and ready to receive tile. Do not proceed until such work is completed.
- b. Verify that ceramic tile and specialty items may be installed in accordance with the original design. Verify that finish dimensions can be achieved.
- c. Set tile with a joint uniformly 3/16" in width. The joint width tolerance shall not exceed 1/16". Cutting of tiles on curves, radii, etc. is required to maintain these joint width tolerances. Tamp each tile in place and bring true to the finished surface. All horizontal joints to be level and all vertical joints plumb. All surfaces shall be true and plumb, with edges of all tile aligned and all tiles flush.

- d. Rub cuts smooth with a fine stone and set with uniform joint.
 - e. As soon as mortar setting bed has set sufficiently, wash tiles with water and grout joints with non-staining white Portland Cement grout. Force grout into joints, finish flush with all surplus grout removed and face of tiles left clean.
2. Cleaning:
- a. Upon completion of the tile work, thoroughly clean all tile and Water Feature accessories set in the tile. Remove and replace cracked, broken, or defective pieced and replace with new material. Remove all debris from the site and dispose of legally.

J. JOINT SEALANT (ELASTOMERIC)

- 1. Elastomeric Joint Sealant shall be chemical cure, non-sag, permanently flexible polyurethane sealant conforming to U.S. Federal Specification TT-S-00227E, Types I and II, Class A, ASTM C-920-79, Type M, Class 25, Grade P and NS.
- 2. Sealant shall be installed by a Contractor who is approved in writing by the sealant manufacturer to apply specified material. Submittals are required.
- 3. All joint walls must be sound, clean, dry and free from oil, grease and frost. Curing compound residues and any other foreign matter must be thoroughly removed.
- 4. All joints shall be first primed per manufacturer's specifications prior to application of elastomeric sealant.
- 5. The two component sealant shall be added together per manufacturer specified proportions and mixed in a pail using a low speed drill (400-600 RPM) for 4-5 minutes minimum to achieve a uniform color and consistency. Avoid entrapment of air during mixing.
- 6. Apply sealant at temperatures within the 40-100° F range. Load the mixed non-sag grade sealant into a bulk gun. Place the application gun nozzle into the bottom of the joints. Keeping the nozzle deep in the sealant, continue with a steady flow of sealant preceding the nozzle to avoid air entrapment. Avoid overlapping of sealant. Tool joints as required.

K. ELECTRICAL

- 1. The Contract shall verify the available electrical Voltage, Phase and Frequency at the project site **BEFORE** ordering pumps, compressors, electrical controls, etc. This verification must be made prior to ordering any electrical components. In the event that the electrical Voltage, Phase and Frequency is different from that shown on plans, the Contractor shall immediately bring this to the attention of the Water Feature Engineer.
- 2. Owner shall supply main circuit breakers and electrical supply to the motor control center panel(s), and any necessary power transformers. Contractor shall furnish and install Motor Control Center panels for the control of motors and other equipment as shown on the plans.
- 3. Contractor shall provide for each motor (or group of motors):
 - a. Combination starter with thermal magnetic protection.
 - 1) For motors 25 H.P and less, full voltage magnetic type required

- 2) For motors more than 25 H.P., solid state reduced voltage required
 - b. H.O.A. Switch(es) and Running Lights
 - c. Nema 3R enclosure(s), vandal resistant, deadfront construction for outdoor installation only.
 - d. Time Clocks: 24HR. Skip-A-Day, for control, Astro-dial for lighting.
 - e. Auxiliary contactors for interconnection of equipment and controls, relays, programmable solid-state timeclocks and/or other timing devices and interconnection to project Energy Management System
 - f. Nema 3R remote disconnect per NEC 430-H, 430-102.
 - g. Electrical control system shall be U.L. listed and comply with all applicable national and electrical codes.
 - h. All wire and cable shall be per NEC table 310-16, copper, 60° column size 12 minimum for power, 14 for control.
 - i. Control transformer(s) properly sized to accommodate control and auxiliary devices.
4. Submittals of shop drawings, prepared by a licensed Electrical Engineer, shall be required.
 5. Where applicable, Contractor shall electrically interlock recirculation pump motor starters with Filter console to provide control for each motor from the console.
 6. Contractor shall electrically interlock automatic chemical controller with Filter console to provide chemical feed control via console power supply.
 7. Contractor shall electrically interlock automatic chemical controller chemical feed pumps control via console power supply on systems with Triton sand filters.
 8. The Contractor shall be responsible for making the connections to the power source and to the Water Feature equipment.
 9. All materials and installation shall conform to the latest National Electrical Code and all applicable local codes.
 10. Bonding
In accordance with Section 680-22 of the 1990 edition of the National Electrical Code Handbook, the following parts shall be connected to a common bonding grid:
 - a. All metallic parts of the Water Feature structure including the reinforcing parts of the Water Feature shell, coping stones and deck.
 - b. All forming shells
 - c. All metal fittings within and attached to the Water Feature structure.
 - d. Metal parts of electric equipment associated with the Water Feature water circulating system, including pump motors.
 - e. Metal sheathed cables and raceways, metal piping, and all fixed metal parts that are within 5 feet horizontally of the inside walls of the Water Feature, and within 12 feet above the maximum water level of the Water Feature, or any observation stand, towers or platforms, or from any diving structures, and that are not separated from the Water Feature by a permanent barrier.
 - f. Safety rope hooks are not required to be bonded.

The bonding grid used may be the structural reinforcing steel of a concrete Water Feature where the reinforcing rods are bonded together by the usual steel wire ties, or a No. 8 or larger solid copper conductor, insulated, covered or bare.

11. **Grounding**
In accordance with Section 680-24 of the 1990 edition of the National Electrical Code Handbook, the following equipment shall be grounded:
 - a. Wet niche and dry niche underwater lighting fixtures
 - b. All electrical equipment located within 5 feet of the inside wall of the Water Feature.
 - c. All electrical equipment associated with the recirculating system of the Water Feature.
 - d. Junction boxes.
 - e. Transformer enclosures
 - f. Ground fault circuit interrupters
 - g. Panelboards that are not part of the service equipment and that supply any electric equipment associated with the Water Feature.Grounding conductors must terminate at the grounding bus of a service panel or subpanel, and the conductor must not be smaller than No.12 AWG. For underwater lighting, grounding conductors must be run in rigid metal, intermediate metal or rigid non-metallic conduits.
12. Floor mounted MCCs shall be on a 3" high concrete housekeeping pad. Pad shall be the size of the base of the switchboard, or larger where more than one future section is indicated on the Drawings. Bolt equipment securely to pad.
13. Incoming cables shall enter control center from bottom or top as required by individual installation. Provide cable ties for cables from point of entrance to respective device terminals.
14. Termination of conduits entering the top of control centers shall constitute a tight and continuous metal-to-metal contact by penetrating the finish paint on enclosure. Conduits entering the bottom shall be provide with grounding bushings with neoprene throat inserts. Each bushing shall be connected to the MCC ground bus with an AWG #4 insulated ground conductor.
15. The contractor shall make connections to all motors and equipment for the Water Feature required for a complete and operational electrical system in conformance with all applicable codes. Electrical service connection to MCC shall be supplied by Owner. MCC connection to individual equipment components provided under this section shall be in accordance with Electrical Specifications. Refer to Electrical Sections for conductor and conduit sizing and other requirements.. Wiring to meet NEC requirements, UL and all local standards and codes.

L. OPERATIONAL TESTING AND SYSTEM COMMISSIONING

1. The Contractor is responsible for the Water Feature fill up with water supplied by the Owner and the Water Feature operational testing.
2. The Contractor is responsible for the scheduling, coordinating, performing and documenting the Commissioning work described herein.
3. The Contractor shall provide all labor, material, instrumentation. equipment,

technical services of the Equipment Manufacturer's representative, etc. necessary for the system commissioning work which includes:

- a. Complete activation of the system,
 - b. Calibration, testing and performance verification of all system's components and the system as a unit, including pretesting, adjusting and balancing,
 - c. Verification of performance of the system through all specified modes of operation and control, sequences of operation and under specific conditions, and
 - d. Rectification of deficiencies and Retesting
4. The Contractor shall prepare and submit for approval a Water Feature Plan and Schedule which shall conform to the requirements of the overall project schedule and shall include a detailed schedule of all individual testing activity.
 5. The Equipment and System to be tested shall include, but not limited to:
 - a. Entire Water Feature functioning as integrated systems
 - b. Pumps, Filters, Chemical controllers, Motor controllers, Electrical panels, Pipe Installation, etc.Equipment commissioning will require the participation of the Equipment's Manufacturer's technical Representative.
 6. The tests shall be witnessed by the Water Feature Engineer. When the testing has been completed satisfactorily, the Contractor shall complete the testing form and submit forward to the Consultant and Owner's Representatives. Test which have not been witnessed shall not be accepted and shall be repeated. The involvement of the Consultant and the Owner's Representative in the commissioning work shall not void any guaranties or warranties

M. SYSTEM GUARANTEE

1. The entire Water Feature shall be unconditionally guaranteed by the Contractor as to material and workmanship for a period of one year following the date of final acceptance of the work.
2. The entire Water Feature system shall exhibit no excessive measurable loss from seepage. Should excessive loss occur, the Contractor shall be responsible for locating and eliminating the leakage at no additional cost to the Owner.
3. The Contractor shall repair defects that is caused by ground subsidence or settlements that occur within one year of Owner's acceptance of the Water Feature.

N. WATER FEATURE PLANS & "AS-BUILT" DRAWINGS

1. The Contractor shall have available at the project site at all times throughout construction two sets of the Water Features Engineer's plans, on which up to date records of as built installations and all deviations of pipe, routings, pipe fitting modifications, etc. are clearly marked. The Contractor shall submit one set of reproducible and two sets of mark up "As-Built" Plans of the installed system to the Owner at the completion of the project.

O. MAINTENANCE OF THE SYSTEM DURING THE OPERATIONAL TESTING PHASE

The Contractor shall provide a maintenance service to the system at the commencement of the operational phase, using the services of a professional Water Features maintenance firm and maintaining the systems per guidelines established by the Water Features Engineer. The Contractor shall maintain the Water Features for a 90 Day period after system start up.

P. MAINTENANCE MANUALS

The Contractor shall provide to the Owner after the final inspection a binder containing all the Water Feature System Components and product information regarding installation, operation and maintenance procedures, service manuals and instructions as received from the supplying manufacturers during the project's construction.

SCHEDULE A: PRODUCTS SPECIFIED BY BRAND NAME OR SUPPLIER

A. WAFER TYPE SPRING LOADED CHECK VALVES

- 1) Center Line, P.O.Box 3477, Tulsa, OK 74101
Center Line Series CLC. Standard Construction
- 2) Marlin Valve Company, 9129 Irvington Blvd, Houston, TX 77022,
Duo-Check II #12MMP
- 3) Stockham Valve & Fitting, P.O.Box 10326, Birmingham AL 35202
Fig. #WG-970 SERIES

B. WAFER TYPE BUTTERFLY VALVES

- 1) Center Line, P.O.Box 3477, Tulsa, OK 74101
Center Line Series "A"
- 2) Crane Company, 475 N. Gary Avenue, Carol Stream, IL 60188
Catalog No. 12BXZ
- 3) Stockham Valve & Fitting, P.O.Box 10326, Birmingham AL 35202
Fig. #LG512-B53-E Wafer Style, Fig. #LG712-BS3-E Lug Style

C. GEOTEXTILE FABRIC

- 1) Trevira/Spunbond Business Group, P.O. Box 5887, Spartanburg, SC 92304-5884
Trevira Type - 20 Oz./sq.yd. weight
- 2) Mirafi, Inc. 22672 Lambert St., Suite 602, El Toro, CA 92630
Mirafi 1120 N
- 3) Amoco Fabrics and Fiber Co., 900 Circle 75 Parkway, Suite 300, Atlanta,
Georgia 30339, Amoco Underliner Fabric, 20 Oz./sq.yd. weight

D. JOINT SEALANT (ELASTOMERIC)

- 1) Sonneborn Building Products
Chemrex Inc., 889 Valley Park Dr., Shakopee, MN 55379
"Sonolastic" two part Elastomeric Gun-Grade Polysulfide Sealant

E. GEOMEMBRANE LINER

36 Mil Hypalon Potable Grade Chlorosulfonated Polyethylene Reinforced Liner

- 1) CMS INDUSTRIES (FORMALLY PALCO LINING)

7571 Santa Rita Circle, Stanton, CA 90680
(714) 898-0867

- 2) WATERSAVER COMPANY, INC.
P.O. BOX 16465, Denver, CO 80216
(800) 525-2424 (303) 289-1818
- 3) STAFF INDUSTRIES, INC.
240 Chene Street, Detroit, Michigan 48207
(800) 526-1368 (313) 259-1818

F. CONCRETE SEALING WATERPROOFING:

THORO SYSTEM PRODUCTS

780 N.W. 38th Street.
Miami, FL 33166 (305) 592-2081
Thorseal for masonry & concrete
Installed per manufacture requirements.

XYPEX CHEMICAL CORPORATION

13731 Mayfield Place
Richmond. B.C., Canada V6V 2G9
(604) 273-5265
Xypex Concrete Waterproofing
Installed per manufacture requirements.

G. FUSECOTE

The protective coating shall be fused thermosetting epoxy powder with a thickness range of 5 to 8 mils.

H. BIOFILTER GRAVEL:

(Nominally) "3/8" Crushed RockGravel" (WASHED)

which shall meet ASTM #C131 standards

Required Gradation:

90-100% pass 3/8" screen

30-60% pass #4 sieve

0-10% pass #8 sieve

0 % pass #16 sieve

Available:

FST SAND & GRAVEL, INC.
P.O. Box 2798
Corona, CA 91718
(714) 371-8440

or

E.D.S. SAND & GRAVEL, INC.
10491 Orange Park Blvd.
Orange, CA 92669
(714) 997-8365