
APPENDIX A-6

TECHNICAL PROVISIONS FOR CONSTRUCTION OF WATER SYSTEM / FACILITIES

A-6.1 Piping and Plumbing

Treated Waterline Piping: Allowable treated waterline pipe materials shall be Ductile Iron Pipe and Polyvinyl Chloride (PVC) Pressure Pipe and Steel Pipe. Specifications for individual pipe materials are given below.

Design Conditions:

- A. Depth of cover to be a minimum of 42 inches.
- B. Trench width shall be a minimum of 1 pipe diameter plus 12 inches.
- C. 6" of 3/8" minus bedding under the pipe.
- D. Bedding tamped to 12 inches above pipe, load factor 1.5.
- E. Soil density 150 pounds per cubic foot.
- F. Bedding angle 90 degrees.
- G. Live load AASHTO H-20, 16,000- pound wheel load.
- H. Rigid pipe 1.5 factor of safety versus crushing.
- I. Flexible pipe allowable deflection – as specified by pipe manufacturer.
- J. Above design conditions apply to an empty conduit with no internal pressure.
- K. Ductile iron pipe shall be installed adjacent to and forty feet on either side of fuel tanks, fueling stations, or individual properties using volatile material on the property, unless soils testing are submitted showing no volatile material exist in the trench envelope.

Ductile Iron Pipe: Shall be fully gauged and labeled

Material – Ductile iron water pipe shall conform to AWWA C151 specifications. Ductile iron pipe shall be pressure class 350 for pipe sizes 12 inch and smaller, pressure class 300 for 14 to 20 inch, pressure class 200 for 24 inch pipe, and pressure class 150 for pipes 30 inches and larger. Higher pressure class shall be used where the working pressure of the pipe exceeds the pressure class shown.

Joints – Lengths of ductile iron pipe shall be joined by slip-on type joint or mechanical type joint as shown on the plans with rubber rings furnished by the manufacturer of the pipe and designed for use with the pipe being installed. Assembly of pipe and joints shall follow the manufacturer's instructions. After assembly of each slip-on joint the final location of rubber rings within each joint shall be checked by gauge as recommended by the manufacturer.

Joints between ductile iron pipe and fittings shall be slip-on type, mechanical type or flanged as shown on the plans. Slip-on type joints shall be sealed by means of rubber rings designed for use with the pipe being installed. Rubber rings resistant to fuels shall be used forty feet on either side of

property using or containing volatile materials.

Joints between ductile iron pipe and other types of pipe shall be made by means of the proper sized and type compression adapter.

Fittings - The fittings shall be designed to meet the design requirements of the adjacent pipe used. All fittings shall be smooth and free from defects.

Fittings shall be ductile iron or fabricated steel.

Fittings shall be manufactured in accordance with AWWA Standard C110, 111, 115, and 153. Ductile iron fittings shall be protected with a petroleum asphaltic lining and coating. Fabricated steel fittings shall be fusion epoxy lined and coated.

Bolts and nuts shall be carbon steel, ASTM A307, Grade A; hex head, or standard tee-head.

Polyvinyl Chloride (PVC) Pressure Pipe: All PVC pressure pipe shall have cast-iron-pipe-equivalent outside diameters.

Small Diameter PVC – Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches to 12 inches, shall conform to current AWWA C-900 and have Underwriters' Laboratories, Factory Mutual and NSF approval. All parts of C-900 not in conflict with these specifications shall apply in full force. PVC pipe shall be dimension ratio (DR) 18, class 150 for internal working pressures up to 130 psi; use DR 14, class 200 for internal working pressures between 130 psi and 180 psi. For internal working pressures greater than 180 psi, pipe DR/class shall be determined by the Engineer.

PVC pipe that has been exposed to the sun and become discolored shall not be installed if the date printed on the pipe indicates the pipe was manufactured two or more years prior to the installation date. If the date printed on the pipe has been destroyed or altered and the pipe is discolored, the pipe shall not be installed.

Large Diameter PVC – PVC pipe in sizes 14 inches through 24 inches, manufactured to AWWA C905 standard, shall be allowed. Use dimension ratio (DR), 18, pressure rating (PR) 165 for internal working pressures up to 130 psi; use DR 14, PR 200 for internal working pressures between 130 psi and 180 psi. For internal working pressures greater than 180 psi, pipe DR/PR shall be determined by the Engineer. AWWA C905 larger than 24 inches is not allowed.

PVC pipe that has been exposed to the sun and become discolored shall not be installed if the date printed on the pipe indicates the pipe was manufactured two or more years prior to the installation date. If the date printed on the pipe has been destroyed or altered and the pipe is discolored, the pipe shall not be installed.

Joints – Lengths of PVC shall be joined by a locked-in flexible elastomeric gasket coupling with bell and spigot configuration. Lubricants intended for use with PVC pipe shall be compatible with the plastic material and not adversely affect the potable quality of the water being transported.

Joints between PVC pipe and fittings shall be slip-on type or mechanical types as shown on the

plans. Slip-on type joints shall be sealed by means of rubber rings designated for use with the type of pipe being installed.

Joints between PVC pipe and other types of pipe shall be made by means of the proper sized compression type adaptor.

Fittings – Fittings shall be cast or ductile iron fittings.

Steel Pipe: Two types of steel pipe shall be allowed for 10 inch to 54 inch diameters:

Steel Cylinder Pipe – Steel pipe shall be steel cylinders, cement-mortar lined and coated. Steel pipe shall be manufactured in conformance with AWWA C200. Minimum steel wall thickness shall be 0.188 inches for pipes 10 inches to 36 inches and 0.2500 inches for pipes from 38 inches to 54 inches. Cement-Mortar lining and coating shall conform to AWWA C205. Prior to fabrication, the Contractor shall submit the manufacturer’s design calculations to the Engineer for approval.

Pretensioned Reinforced Concrete Steel Pipe – Steel pipe shall be pretensioned reinforced concrete steel cylinder pipe in conformance with AWWA C303. Prior to fabrication, the Contractor shall submit the manufacturer’s design calculations to the Engineer for approval.

Pipe Lengths – Pipeline laying lengths shall be standardized at lengths of either 20 feet or 40 feet except where shorter lengths are required for fittings, curves and closures.

Joints – Lengths of steel pipe shall be joined by a locked-in flexible elastomeric gasket coupling with bell and spigot configuration unless welded bell and spigot joints, mechanically coupled joints or bolted flanges are designated on the plans or in the specifications. Field welding shall conform to AWWA Specification C206. Flanges, bolts and gaskets shall conform to AWWA C207. Flanges shall be Class D or E. Each bell and spigot joint shall be sealed with a sand mortar. The mortar shall be applied on the interior and exterior according to the pipe manufacturer’s recommendations. Each joint shall be physically inspected by a District representative prior to closing the pipe trench.

Fittings – Joints between steel pipe and fittings shall be welded, slip-on type or mechanical type as shown on the plans. Slip-on type joints shall be sealed by means of rubber rings designated for use with the pipe being installed. Fittings shall be cement mortar coated and lined to a thickness equal to the coating on the adjacent pipe.

Repairs – All repairs shall be made subject to the approval of the Engineer, and any injury to the protective lining and coating of the pipe, or to the caulking or jointing material, shall be carefully and completely repaired.

Treated Water Service Piping: All service lines, valves, and fittings shall be in conformance with AWWA C800-89. 3/4-inch, and 1-inch meters shall be served with minimum 1-inch service piping. 1-1/2-inch and 2-inch meters shall be served with minimum 2-inch service piping. Allowable 1-inch service piping shall be Polyethylene PE3408, Type K copper or brass. Allowable 2-inch service piping shall be Polyethylene PE3408, Type K copper or brass.

All joints in copper and brass shall be inspected by NCS D before backfilling. Joints shall be bronze compression connections as manufactured by Mueller 110, Jones J-2600 series, Ford Pack Joint or certified equal. When soldered fittings are used, the solder and fittings shall be lead free and approved for potable water service.

- 2-inch service piping from the main shall have a 2-inch corporation stop valve.
- 3-inch and larger meters shall be served with 4 inch or larger piping.
- Meters three inches and larger shall have bypass piping around the meter. A ball valve shall be installed in the bypass pipeline. The ball valve shall be lockable.
- NCS D recommends that water sensitive services with less than three inch meters should have bypass piping equal in size to the service piping.

Specification for individual pipe materials are as follows;

Copper and Brass: Copper pipe shall be type K, hard or soft, IPS size in conformance with ASTM B88. Brass pipe shall be in conformance with ASTM B43.

Polyvinyl Chloride (PVC): Two inch diameter polyvinyl chloride pipe shall be Schedule 80, and shall conform to ASTM Designation D1784 for rigid PVC compounds. It shall bear the National Sanitation Foundation seal of approval and shall conform with the requirements of commercial standard 256 and ASTM D 2241.

Pipe shall be manufactured to Iron Pipe Size (IPS) dimensions and furnished in minimum standard lengths of 20 feet. 4 inch and larger diameter polyvinyl chloride shall conform to current AWWA C-900.

All chemical feed piping 3 inch and smaller shall be Schedule 80 PVC as specified in this section.

All PVC fittings shall be molded fittings manufactured of the same material as the pipe and shall be suitable for either solvent weld or screwed connections. Solvent weld type couplings and fittings shall be of a pressure rating greater than that of the pipe and shall be of a type recommended by the pipe manufacturer.

Polyethylene: Polyethylene (PE) pipe shall conform to AWWA C-901, Standard designation PE 3408, SDR 9, class 200 and shall be Iron Pipe Size.

Raw Water Piping: For pressure flow, allowable raw water pipe materials shall be reinforced concrete pressure pipe, steel pipe, ductile iron pipe, polyvinyl chloride (PVC) and fusion welded high- density polyethylene. For open channel flow, gauge steel pipe or corrugated high density

polyethylene pipe shall be allowed.

All bends exceeding 22-1/2 degrees shall have an approved standard manhole and there shall be a minimum of 10 feet of pipe between bends. Bends for pressure flow shall not exceed 45 degrees.

Specifications for individual pipe materials follow.

Reinforced Concrete Pressure Pipe (RCP): Materials – Reinforced concrete pressure pipe shall be of the class shown on the plans. The pipe shall be centrifugally cast reinforced concrete pipe. Reinforced concrete pressure pipe shall conform to the specifications of AWWA Designation C 302, except as provided herein. Prior to fabrication the contractor shall submit the manufacturer's design calculations to the Engineer for review.

Classes – Concrete pipe shall be specified by the maximum hydrostatic head: 25,50,75,100,125, or 150 feet measured to the centerline of the pipe and by the external loadings of 10, 15, 20 feet of earth over top of pipe, designated B, C, and D respectively. The typical nomenclature used herein for the various classes of pipe is B-50 = Concrete pressure pipe for 10 foot maximum cover and 50 foot maximum head. Pipe shall be laid and jointed in accordance with a manufacturer's recommendations.

Joints – Lengths of RCP pressure pipe shall be joined by a flexible elastomeric gasket and shall conform to the requirements of AWWA Designation C 392, Section 3.4, and shall be able to withstand expansion, contraction, and settlement.

Fittings and Specials – Fittings and specials shall be either fabricated steel with cement mortar coating and lining or constructed the same as the pipe. Prior to fabrication the contract shall submit the manufacturer's design calculations to the Engineer for review. Angle points and branch lines shall be constructed with an access manhole when practical.

Conductor Pipe: Conductor pipes shall conform to County and State requirements and these specifications. Pipe used as a conductor pipe shall be either welded steel pipe or corrugated metal pipe. The General Manager may specify which type shall be used in any instance. The protective lining and coating, if required by the General Manager shall be as shown on the improvement plans.

Welded Steel Pipe: Shall be manufactured of steel meeting the requirements of ASTM Designation A245, Commercial Grade. The method by which the pipe is manufactured shall comply with one or more of ASTM specifications: A134, A135, A139 or A211. The pipe shall be welded by either the electric-resistance or electric-fusion process, with either spiral seam welded joint or straight seam welded. All end joints shall be butt-welded.

When the conductor pipe is to be installed by boring and jacking, the wall thickness shall be 1/4 inch for sizes up to and including 24 inches in diameter, and 5/16 inch for sizes 27 inches to 36 inches in diameter.

Gauge Steel Pipe: Corrugated Steel pipe and Spiral Ribbed Steel pipe shall be allowed for non-pressure raw water collection applications. Corrugated steel pipe shall have a paved invert. All gauge steel pipe shall be hot dipped galvanized. All work and materials shall conform to Caltrans Standard Specifications, Section 66, except as modified herein.

The minimum steel thickness for supplied under this section shall be 14- gauge (0.079 inches).

Spiral Ribbed Steel Pipe: Spiral Ribbed Steel Pipe shall be fabricated with a continuous helical lock seam and with a continuous spirally wound rib projecting outward from the pipe shell and open to the interior in lieu of corrugation. The ribs shall be 3/4 inches in width and 3/4 inches in height and shall be spaced on a maximum of 7-1/2 inch centers. Lock seams shall develop the full strength of the pipe and shall be spaced equally distant between 2 adjacent ribs. The pipe shall be furnished with annular rerolled ends. Any pipe, which has been damaged, shall be repaired to the satisfaction of the Engineer or shall be rejected.

Coupling bands for ribbed steel pipe shall be 12- inch wide annular bands, manufactured from 0.064 -inch thick galvanized steel conforming to Section 66 of the State of California, Department of Transportation (Caltrans), Standard Specifications. The coupling bands shall be a hat shaped band or other approved design and shall be fitted with 7 inch wide gaskets fabricated from neoprene or butyl rubber or other durable, resilient material approved by the Engineer, and assembled in such a manner as to form a sealed joint.

Corrugated Steel Pipe: Coupling bands for corrugated metal pipe shall be 12 inches wide, galvanized, conforming to Section 66 of the State of California Department of Transportation, Standard Specifications and shall have a 12 inch wide neoprene gasket. Joints between corrugated metal pipe shall concrete encased.

Corrugated High Density Polyethylene Pipe: Corrugated High Density Polyethylene pipe (HDPE) shall be furnished and installed in accordance with this specification and the details and notes shown on the contract drawings.

HDPE couplings and fittings shall comply with all the requirements of AASHTO M0252-85I for 3 inch to 10 inch diameter and AASHTO M-294-85I for 12 inch to 24 inch diameter. Split couplings with gaskets shall be furnished. Due to anticipated field changes requiring cutting, pipe with integral couplings shall not be allowed. When HDPE with integral smooth lining is specified or called for on the plans it shall comply with all material and stiffness requirements of AASHTO M-294. For design purposes, the Mannings “n” shall be 0.012 for fusion welded HDPE and 0.020 for corrugated HDPE. HDPE shall not be placed directly on rock or other rigid materials. HDPE shall be installed per the pipe manufacturer’s recommendations.

A-6.2 Valves and Appurtenances

Treated waterline valves two inch through twelve inch shall be gate type. Gate valves four inch and larger shall be flange by flange connected to one flange by mechanical joint coupling.

Raw waterline valves shall be gate type. Raw water gate valves sixteen inch and larger shall have a two-inch minimum by-pass.

Gate Valves: Gate valves, 2 inch through 12 inch in diameter shall be resilient seated wedge type, 200 psi WOG rated, and conform to AWWA specification C509. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded or thermal setting epoxy coating which shall be a minimum 8 mils thick and per AWWA C550.

Valves shall have a smooth inside bore on the bottom half so that sediment cannot accumulate. Valves shall open counter-clockwise. Valves installed underground shall have a non-rising stem and a 2 inch square operating nut that is accessible through a valve box. Valves installed above ground shall have outside stem and yolk (OS&Y), rising stem, and be handwheel operated.

- Gate valves 1-1/2 inch and smaller shall be 85-5-5-5 bronze, handwheel operated, non-rising stem, 200 psi WOG.
- Treated waterline valves 2 inch through 10 inch shall be gate type. Gate valves 4 inch and larger shall be flange by flange.
- Raw waterline valves shall be gate type. Valves 16 inches and larger shall have a 2 inch minimum by-pass valve.
- For system compatibility, gate valves shall be manufactured by U.S. Pipe, Mueller, American Flow Control or American AVK.

Butterfly Valves: All butterfly valves shall be rubber seated conforming to the requirements of AWWA Specification C504. Valves shall be short body type.

Valve discs shall be constructed of alloy cast iron, ASTM A436 Type1 (Ni-Resist). All butterfly valves shall be operated manually and shall open counter-clockwise. Valves installed underground shall be traveling nut operated with all gearing fully encased with double stop feature and have a 2 inch square operating nut that is accessible through a valve box.

Valves installed above ground shall be flanged and be lever operated through 8 inches and handwheel operated for larger sizes. The handwheels shall have a minimum diameter of 18 inches and be fastened to the operating shaft with a cotter pin for easy removal.

Treated waterline valves 14 inches or larger shall be butterfly type. Butterfly valves 4 inches and larger shall be flanged with MJ X MJ as required. All interior ferrous surfaces shall be protected against corrosion by factory applied thermal setting epoxy coating which shall be a minimum 8 mils thick and per AWWA C550. Exterior ferrous surfaces shall be protected against corrosion by factory applied asphaltic coating.

Where a butterfly valve is placed at capped pipe, three foot section of pipe or a minimum pipe length long enough to exercise the valve shall be installed between the butterfly valve and the capped pipe.

For system compatibility, butterfly valves shall be manufactured by Pratt, or Mueller.

Angle Meter Stops: Angle meter stops shall be 85-5-5-5 bronze construction manufactured by Mueller, James Jones, or Ford. Inlet shall be iron pipe size compression or Mueller “insta-tite,” with a meter coupling nut outlet and locking wing.

Combination Air and Vacuum Release Valves: Air and vacuum release valves shall be combination air and vacuum release valves as manufactured by the Valve and Primer Corporation (APCO) 143-C, 145-C, etc, Crispin U-10, 20, etc. or Val-Matic 201C, 202C, etc., bronze or stainless steel trim.

Size shall be per these specifications. Engineering calculations shall be submitted on each combination air and vacuum release valve installed on steel pipe or plastic pipe greater than 12 inch diameter showing the adequacy of the valve to prevent pipe failure. Boxes shall be sized as necessary.

Provide 1 inch AVR V on line sizes up to 12 inches; 2 inch AVR V on line sizes 14 inches to 18 inches; and three inch AVR V on line sizes 20 inches to 30 inches. For line sizes larger than 30 inches, the AVR V size shall be determined by the Engineer or as shown on the plans.

Pipe taps for AVR V shall always be at actual high points of waterline. Where the pipeline raises suddenly to avoid another utility or other obstruction, an AVR V shall be placed at the high point if the centerline elevation rise of the high point is one pipe diameter above the centerline pipeline at the grade on either side of the high point.

Automatic Control Valves: Automatic control valves include pressure reducing, pressure relief, flow regulator, surge anticipation, pump control, and altitude valves. Unless otherwise approved by the Engineer, all automatic control valves shall be diaphragm actuated pilot controlled type and shall have globe style body, stainless steel trim, V-port seating, and be fusion epoxy lined and coated. The pilot system shall include pilot line and wye-strainers with blow-offs, opening and closing speed controls, position indicator, and pilot system isolation cocks.

Pressure Reducing Valves: Pressure reducing valves 2 inches and smaller shall be bronze body with stainless steel trim, self-contained, direct acting high capacity type with a built-in stainless steel strainer, have an adjustable outlet pressure setting, and be fully repairable in line. Valves shall be Cla-Val Model 990.

Pressure reducing valves larger than 2 inches shall be combination reducing / sustaining and diaphragm actuated pilot controlled type. Valves shall be Cla-Val Model 92-01.

For applications of pressure-reducing valves in which the differential pressure exceeds Cla-Val’s cavitation chart limit, the valve shall be Singer.

Pressure Relief Valves: Pressure relief valves shall be diaphragm actuated pilot controlled type designed to maintain a steady upstream pressure by relieving excess pressure without causing pipeline surges. Valves shall be Cla-Val Model 50-01.

Altitude Valves: Altitude valves shall be diaphragm actuated pilot controlled type with a single seat and a resilient disc for tight closure. If required by system hydraulics, the valve shall be the two-way flow type. For applications of altitude valves in which the differential pressure exceeds the manufacturer's cavitation chart limit, an orifice plate shall be installed downstream of the valve to dampen the cavitation per the manufacturer's recommendations. Valves shall be Cla-Val Model 210.

Ball Valves: Ball valves shall be metallic or plastic as described herein. Mueller 300 series or equal.

Metallic Ball Valves: Ball valves 2 inches and smaller and which are used in steel or copper piping systems shall have a bronze body and stem and Teflon ball and seating.

Plastic Ball Valves: Plastic ball valves used in PVC piping system shall be polyvinyl-chloride, normal impact, with Teflon seat ring. Valves 2 inches and smaller shall be provided with union type end connections and stub ends designed for socket welding. Valves larger than 2 inches shall be flanged.

Globe Valves: Globe valves 3 inches and smaller shall have a bronze body with a replaceable composition disc. Valves shall be globe or angle pattern as required. Globe valves larger than 3 inches shall be iron body with yoke bonnet and bronze trim. Globe valves shall have designed working pressure of WOG-200 psi.

Solenoid Valves: Solenoid valves shall be two-way, full line size, diaphragm type, 125 minimum psi body pressure, 5 psi minimum operating differential, for use with cold water or air. Valve shall be suitable for 115 volt, 60 Hz AC power supply, and shall be as manufactured by Automatic Switch Company, Model 8210, or equal.

All solenoid valves shall have manual operators, encapsulated coils and shall have electrical characteristics as indicated on the drawings. All valves shall be mounted horizontally.

Swing Check Valves: Swing check valves 1-1/2 inches and smaller shall be all bronze, regrinding type designed for a working pressure of 150 psi.

Swing check valves for waterlines 2 inches and larger shall be iron body, brass trimmed, designed for a working pressure of not less than 350 psi. They shall be of the balanced, swing gate type with a clear opening at least equal to that of the connecting pipe and shall have an external lever and counter weight.

Swing check valves shall be rubber flapper type, Apco, Valve and Primer Corporation, Mueller, or Crane.

Valve Boxes: Valve boxes shall be provided for all underground valves and shall be precast concrete, Brooks or Christy G5 Traffic Valve Boxes. Lids shall be cast iron traffic type G5C and marked "WATER." If noted on plans, additional markings may be necessary.

Tapping Valves: Flanged gate valves shall be used for hot tapping waterlines. All gate valves shall conform to gate valves in these Specifications.

Tapping Sleeves/Saddles: Tapping sleeves shall be entirely Type 304 Stainless Steel, including the flange, nuts & bolts, and must have a tapped test outlet and plug, as manufactured by JCM, Ford, or Romac. Mueller ductile iron tapping saddles shall be allowed.

Flange Gaskets: Flanges 4 inches through 36 inches shall be 1/8-inch thick drop in type SBR as manufactured by U.S. Pipe or approved equal. No bonding agent (i.e., Permatex) shall be used on the flange or gasket. The flange face shall be free of any foreign matter and/or rough surface.

Nuts and Bolts: Nuts and bolts shall be cadmium plated, zinc coated. Threads shall be coated with "Loctyte" anti-seize. The bolt shall extend at least 3 threads through the nut.

Service Saddles: Service saddles shall be 85-5-5-5 bronze construction with wide strap and iron pipe thread. PVC C-900 1-inch service saddles shall be Mueller BR2B, Smith Blair 397, Jones J996, Ford S90, Romac 101B, or equal; 2-inch service saddles shall be Jones J979, Mueller BR2B, or Romac 202B, or equal.

Service saddles for Asbestos Cement, Cast and Ductile Iron, and Steel pipe shall be double strap bronze Mueller BR2B, Smith Blair 313, Ford 202B, Jones J-979 or equal.

Corporation Stops: Corporation Stops shall be of 85-5-5-5 bronze construction as manufactured by the James Jones Company, Mueller Company, or Ford. Inlet threads shall be male iron pipe threads. Outlet shall be iron pipe size compression, or Mueller "Insta-tite."

The corporation stop shut off shall be located between the side of the pipe at the 3 or 9 o'clock position.

A-6.3 Water Meters

Meters shall be as described below:

Meters 3/4 inch to 2 inches: Water meters 3/4 inch to 2 inches shall be in conformance with AWWA C700 except as modified under this specification, and as manufactured by Sensus, Badger, Schlumberger or approved equal. Meters shall be positive displacement of the rotating disc or oscillating piston type. Unless otherwise specified, water service meters shall be 3/4 inch X 3/4 inch and shall be 7 1/2 inch lay to fit 15-inch Mueller Thermacoil box or 9 inch lay to fit 18" Mueller Thermacoil box.

The meters main case and register housing shall be all bronze with removable bottom cap. The bottom cap shall be secured with 316 stainless steel bolts and washers, 4 bolts on a 3/4 inch meter

and 6 bolts on a 1 inch meter. Residential meter registers shall read in U.S. gallons and shall be straight reading roll sealed magnetic drive with readout and a hardened glass lens. Commercial meters shall be the same and read in cubic feet. The register shall be permanently hermetically sealed without the use of O-rings or gaskets. The register housing shall attach to the meter case by a bayonet attachment and be secured with a seal pin to prevent tampering. The register assembly shall count in any position and shall be removable from the main case without otherwise disassembling the meter. All meters shall have the direction of flow and the serial number stamped on the main case and shall read from the inlet with the hinge pin over the outlet and shall have the serial number stamped on the register housing. All meters shall be guaranteed for 1 year on material and workmanship. The meter accuracy and register shall be guaranteed for 10 years. Meters shall be capable of being retrofitted for reading by telephone or cable systems.

Meters 3 inch and Larger: Water meters 3 inches and larger shall be in conformance with AWWA C702 except as modified under this specification. Meters shall be manufactured by Sensus or approved equal. Meters shall be a flanged single register high performance compound meters. The meter shall have a test plug on the downstream end of the meter.

Water Meter Bypass: Three inch (3") meters or larger shall have meter bypass piping. The bypass piping size shall be:

<u>METER SIZE</u>	<u>MINIMUM BYPASS PIPING</u>
3"	2"
4"	2"
6"	4"
8"	4"

The actual size of the bypass piping shall be determined by the Engineer. A lockable ball valve shall be installed in the bypass pipeline. The lock shall be provided by the Agency.

Meter Boxes: For meters 3/4 inch and smaller, meter boxes shall be Mueller Thermacoil bury boxes, 15 inch diameter X 42 inch bury, 15 inch X 4 inch insulation pad, and non-locking lid marked "WATER". For 1 inch to 2 inch meters, meter boxes shall be Mueller Thermacoil bury boxes, 18 inch diameter X 42 inch bury, 18 inch X 4 inch insulation pad, and non-locking lid marked "WATER", or, Christy B30 or B36 utility box with metal self-closing reading port sized to allow adequate room for the meter, and the lid shall have a metal self-closing reading port. In all cases, the meter box shall be large enough for proper placement and reading of meter.

Valve Riser Extensions: 8-inch diameter PVC conforming to AWWA Section C-900 water pipe or SDR 35 fitted with debris catcher type cap.

Strainers: Unless otherwise noted, air and gas line strainers shall be Y-pattern bronze body, with 40 mesh screen packed with copper or stainless steel wool. Air line strainers shall be fitted with a brass blowoff cock.

Unless otherwise noted, waterline strainers shall be Y-pattern, iron body with 20 mesh heavy gauge stainless steel screen, and have a tapped blow-off connection with a brass nipple and brass ball valve.

Pressure Gauges: Unless otherwise noted, pressure gauges shall be stainless steel bourdon type with a 4-1/2 inch diameter dial and black aluminite cases suitable for mounting as required. Calibration shall be in 2 psi increments. Pressure range and calibrations shall be as required and the dial shall be engraved with the units in which the gauge is calibrated. All pressure gauges shall be equipped with bronze ball valve type shutoff cocks and glycerin filled.

Pressure gauges shall be rated for service intended, including negative pressure (vacuum gauge or compound gauge).

Locating Cable and Tape: Direct Burial copper cable, No. 10 THHN insulated, shall be taped to the top of all pipe (except 1 and 2-inch service piping) before backfilling. The cable shall be taped to the top of the pipe 5-feet on center with 2-inch duct tape or nylon ties. The pipe shall be clean and dry before the tape is applied. The cable shall be produced from the vendor, complete with an approved epoxy splice kit. Cable joints shall be spliced in accordance with the manufacturer's instructions to form a set of continuous electrical conductors throughout the pipe system. Where pipe branches occur, the cable shall be branched also so that cable is provided to the surface at each valve, fire hydrant, blow-off, air/vacuum release valve, backflow prevention device, or other facilities. 3-inch wide, blue, Waterline Warning Tape shall be installed 12 inches above the top of all pipes, including 1 and 2-inch service piping.

Flexible Couplings: Flexible couplings shall have a minimum pressure rating equal to the pipe class. Care shall be taken to see that smooth surfaces have been provided on the pipe so that the coupling can be properly fitted.

Flanged Coupling Adapters: All flanged coupling adapters must be flanged by mechanical joint. Flanges, bolting, and gaskets shall conform to the requirements for the pipe or valve to which the adaptor is attached. The flange class shall match that of the pipe or valve. Flanges must be the same size as the valve flanges. Romac FCA501 or equal.

Rubber Expansion Joints: Rubber expansion joints, which allow expansion and control vibration when connecting rigid piping to pumps and other mechanical equipment, shall be Perflex 980, series 110 or 111, Holz Rubber Company, Lodi, California.

Water Facility Markers: Water facility markers shall be installed in all unpaved areas as detailed in the Standard Drawings, Water Facility Marker, Figure 20, page 169.

Restrained Joints: Restrained joints shall be designed such that the joint has the same lateral strength as the pipeline and/or can restrain the maximum test force exerted on the pipeline. All restraining systems shall be tightened with an adjustable torque wrench to the manufacturer's recommended torque. The location and minimum required development length shall be clearly identified on the plans per Standard Drawing SA001. The Engineer shall certify the method and the required development length of restraint.

All fire hydrant laterals shall be fully restrained ductile iron pipe, or C-900 class II. The hydrant bury elbows shall have thrust blocks per Standard Drawing SA015 in addition to the restrained joints.

All horizontal and vertical angle points 11 ¼ degrees or more shall be restrained the full development length.

All tees and crosses shall be restrained the full development length.

All in-line valves and dead end pipelines shall be restrained the full development length.

Restraint shall be provided by Star Pipe Products All Grip Series, Uni-flange 1300 or 900 Series, or approved equal for PVC pipe. Restraint shall be provided by EBAA Iron 2100 or 1200 or 1100 SD or 1000 or 800 or 100 Series, or Star Pipe Products Stargrip Series, or Uni-flange 1300 Series, or approved equal for ductile iron pipe. “One Bolt” and “Aqua Grip” are also acceptable.

Tie-in Sleeves: All tie-ins shall be completed with cast or ductile iron 12-inch minimum length mechanical joint sleeves. Bolting and gaskets shall conform to the requirements for the pipe to which the sleeve is attached.

Backflow Devices: All backflow prevention assemblies shall be installed in accordance with Section 8, Cross Connection Control.

A-6.4 Installation and Testing

Location of Existing and New Utilities: Location of all utilities shown on plans is approximate. At least 2 working days prior to starting work on the project, the Contractor shall contact Underground Service alert (USA) at (800) 227-2600 for location. The locations of various utilities shown on the plans are solely an accommodation to the Contractor without any representation or guarantee concerning completeness and/or accuracy. The Contractor is responsible for ascertaining the locations of, and providing protection for, all utilities to be encountered in the performance of the required work.

Quality Control: The Contractor shall use appropriate quality control procedures to ensure that all pipe and fittings shall be of the first grade and quality conforming to these Specifications. Pipe shall be stored and transported in a proper manner and kept clean after delivery to the job site. All work on pipe shall be performed in a skillful and professional manner.

Laying of Pipe: Pipe shall be laid and joined in accordance with manufacturer’s and/or Engineer’s direction. Necessary facilities including slings shall be provided for lowering and properly placing pipe sections into trench without damage. A minimum of 42 inches compacted earth fill shall cover all main and service pipelines. Cover less than 42 inches or in vehicular traveled ways may require heavier walled pipe as listed in Appendix A-5, page 67.

The pipe shall be laid in conformity to the prescribed line and grade. The prescribed grade shall be set using the appropriate surveying tools (i.e., transit, rod, laser, etc.). In case any discrepancy exists from the prescribed alignment, the work shall be stopped and the discrepancy immediately corrected.

Each section of pipe shall be thoroughly cleaned before it is lowered into the trench. If clean pipe sections and fittings cannot be placed in the trench without getting dirt into open pipe, the Engineer may require a piece of material to tied over the ends of the pipe or fitting until it has

been lowered into position in the trench. After the pipe has been lowered into the trench, all foreign matter shall be completely brushed from the pipe ends before assembly.

The pipe shall be cut to provide closure pieces of correct lengths to permit the proper location of the pipe sections, or to locate valves, fittings, and appurtenant structures where specified on plans.

The pipe and fittings shall be laid to the lines and grades specified on plans, and centered in the trench. All pipe to be laid upgrade for grades in excess of 10%. All horizontal and/or vertical bends consisting of 11-1/4 degrees or more shall be thrust with concrete as shown in the Standard Drawings, Figures 21 and 22, pages 171 and 173.

The alignment and elevation of the pipeline as shown on the drawings are designed to avoid conflict with new and existing underground utilities as far as their locations are known which is the responsibility of others.

Trenches must be kept dry until pipe has been laid, joints closed and backfill completed to a depth of 1 foot above top of pipe. Crushed rock for drainage and/or bedding shall be provided as necessary.

Temporary water tight plugs shall be provided for closure of the open ends of the pipelines each time pipe laying activity stops and at the end of each working day to prevent the entry of dirt and/or other contaminants.

Bedding and Backfill Placement: All backfill shall be carefully placed and spread in uniform horizontal layers (lifts) not exceeding 12 inches per lift. Backfill shall be placed to about the same elevation on both sides of the pipe to prevent unequal loading and displacement of pipe. Backfill shall be placed to minimum depth of 30 inches above the top of the pipe unless shown otherwise on plans.

Connections to Existing Pipelines: All connections to existing pipelines shall be made as shown on the plans and in accordance with these Specifications.

Where the existing main is not provided with fittings for connecting to the new main, connections shall be made either by hot tap or cutting and inserting sections of pipe and fittings, as shown on the plans or as directed by the Engineer.

For hot tap installations, the tapping saddle shall have a test plug and shall be air tested at 50 psi for 5 minutes. Tapping valves shall be flange by flange. All hot taps shall be witnessed by the Agency Inspector.

When deemed necessary by the District representative, shutdowns of existing in-service pipeline and other distribution facilities shall be made by the Agency as required to complete pipeline connections. A shutdown shall be for as short a period as possible and shall be scheduled by the District representative. The amount of lead-time necessary for shutdown and connection to existing mains varies with each job and must be planned accordingly. In no case shall a shutdown and/or connection be scheduled with less than 3 days notice. Absolutely no connection operations shall occur prior to passing pressure and bacteria tests. Interference with the operation of the Agency's distribution system shall be kept at a minimum. While an existing pipeline is shut down, the connection work shall be performed without interruption, continuing after regular working hours if

necessary, until completed, unless otherwise directed by the District representative. In some cases, shutdowns must occur at times other than normal working hours and/or days.

In all cases, shutdowns shall be made under the direction of the District representative. The Agency shall close all valves in making a shutdown and shall open all valves to restore pressure to the existing main, as well as initiate pressure to the new installation.

The District representative shall be notified at least 11 working days prior to any connection operations so that advance preparation on the part of the Agency can be made, and shall confirm such advance notice in writing.

Abandonment of Existing Facilities: Existing facilities shall be abandoned as indicated on the plans and specifications. Ends of pipelines to be abandoned in place shall be mechanically restrained by flange or valve and cement thrust block installed if required.

Hydrostatic Testing: Backfill shall meet and pass all compaction requirements and subgrade shall be completed prior to hydrostatic testing. The District representative shall be notified forty eight (48) hours prior to testing and must approve any water placement in any portion of the pipeline. The pipeline shall be filled with water and all air evacuated.

For treated water lines the pressure shall then be slowly increased to 150 psi or 150% of working pressure, whichever is greater. The test pressure shall be maintained for at least 3 hours. Accurate means shall be provided for measuring the quantity of water required to maintain full pressure on the line for the test period. The maximum allowable leakage shall be per the pipe manufacturer's recommendations or as directed by the District representative.

For raw water collection piping the maximum allowable leakage shall be 2.5 gallons per inch diameter, per 1000 lineal foot, per 24 hours. RCP shall be tested to the class rating of the pipe at the lowest point in elevation in the test section.

All or part of the pipeline may be drained as necessary to repair leaks. All leaks shall be repaired in a manner approved by the District representative and retested before being accepted by the Agency. The Contractor shall provide all labor, equipment, and materials, required for filling and testing the pipelines. After successful completion of the hydrostatic test, the chlorination flushing, bacteriological test and high velocity flushing may be completed.

Disinfection / Chlorination and Flushing: After successful completion of the hydrostatic test, the Contractor shall chlorinate the pipeline per AWWA C651-86 by completely filling the main and appurtenances with water having a minimum of 50 parts per million (ppm) and a maximum of 100 parts per million (ppm) of available chlorine from calcium hypochlorite. The only disinfection method allowed shall be the continuous-feed method. The chlorinated water shall be retained in the main for at least 24 hours. At the end of this 24 hour period the treated water in all portions of the main and appurtenances shall have a residual of not less than 25 parts per million (ppm).

After chlorination the pipeline shall be flushed per AWWA C651-86 Section 6.2. The water shall then remain unmoved for a minimum of forty eight (48) hours after which the Agency shall collect bacteriological samples which shall be tested for coliform of less than 2.2 parts per million (ppm) by an independent laboratory.

The number and location of samples shall be determined by the District representative and shall be randomly chosen from fire hydrants and services. If emergency work is under way, disinfection is to be per AWWA C651-86 Section 9.

The Contractor shall make the necessary piping connections and furnish and install all necessary equipment required for the high velocity flushing operations. The Contractor shall provide for safe and legal disposal of water from flushing. The Contractor shall remove all temporary flushing facilities. All costs for chlorination and flushing shall be paid by the Contractor.

Continuity Testing: The Contractor shall test for the continuity of the locating wire at time of final walk- thru. The Contractor shall provide all labor, equipment, and materials required for testing the continuity of the locating wire at each meter, valve, fire hydrant, blow off, and AVR. Should continuity not be present and/or observed the Contractor shall repair, replace, and retest as necessary, entirely at Contractor's expense.

Drilling Service Taps: PVC service taps shall be drilled using a sharp shell cutter such that the entire plug and remains are extruded from the pipe.

A-6.5 Earthwork - Trenching

Scope of Work: This work shall consist of: performing all operations necessary to excavate earth, rock or other material of whatever nature including removal of water regardless of character or subsurface condition necessary for the construction of the project facilities; placing backfill for all facilities including site grading, structures, transmission piping, roadwork; removing and replacing unsuitable material; placing embankment material for all required project facilities; other earthwork shown on the plans and indicated in the specifications including excavating and backfilling all structures, trenches and depressions resulting from the removal of obstructions, removing and replacing unsuitable material.

Bracing and Shoring: Sufficient bracing and shoring shall be installed in trenches to insure the safety of workers, and to protect and facilitate the work. Where practicable all such bracing and shoring shall be removed from the trench as the backfilling proceeds. All bracing and shoring shall comply with current Construction Safety Orders of the California Occupational Health and Safety Administration.

When shoring is used in the trench, the fill shall be carried to a height sufficient to prevent the surrounding ground from cracking or caving into the trench before the shoring is removed.

When for any reason, pipe laying is discontinued for an hour or more, the open end of all pipelines shall be closed with a close-fitting stopper or taped closed.

The jointing of pipe with this type of joints shall be made by approved methods and recommendations of the manufacturer care being used to prevent chipping or cracking of either end of the pipe during installation.

Pipe shall be protected during handling against impact shock and free fall. The rubber gasket joints shall be cleaned prior to the seating of the gasket. The gasket shall be wiped clean and shall be fitted

snugly in the gasket seat. A thin film of lubricant shall be applied to the inside surface of the gasket which will come in contact with the plain end of the pipe, if necessary apply the same lubricant to the plain end of the pipe. Use only a lubricant recommended by the pipe manufacturer.

Mechanical compactors shall not be used directly over the pipe with less than 1 foot of cover.

Paving over trenches shall not be placed until an authorized District representative has inspected the backfill. Trench surfacing and trench restoration in Placer/Nevada County, or State of California right-of-way shall conform to the requirements of the agency having jurisdiction.

Backfill around vaults and the pit excavated for boring operations shall be made in the same manner as above specified for trenches, except as otherwise provided under underground vaults.

If at any time during the period of responsibility there shall be any settlement of the trenches, cracking of the newly applied pavement, or separation of the newly applied pavement from the existing pavement requiring repairs to be made in any street highway, or easement, or should any other defect appear in the system due to the contractor's operations, the owner or their agent shall promptly repair all defects in accordance with the requirements of the responsible agency.

Excavation and Bedding: Unless otherwise specified, the excavation for water pipe shall be an open trench, excavated to 12 inches below bottom of pipe grade and 12 inches from each side. The native soil in the trench bottom shall be compacted to 90 percent relative compaction before placement of Class 1 Backfill for pipeline bedding.

Pipe trenches shall not be left open farther than 300 feet in advance of pipe laying operations or 200 feet to the rear thereof, unless otherwise permitted by the General Manager.

All trench excavation within asphalt paved areas shall be saw cut in neat parallel lines 6 inches wider than each side of the trench width of excavation. When the existing pavement is concrete, it shall be sawed to a neat line 6 inches wider on each side than the trench width.

Whenever the bottom of the trench is soft, yielding, or unsuitable as a foundation for the pipe, sufficient crushed rock or coarse clean gravel shall be rammed into the soft material. If such treatment does not provide a proper foundation, the unsuitable material shall be removed to a depth such that when replaced with bedding material, it will provide a stable foundation.

Whenever the trench bottom is in rocky material, the trench shall be excavated to 12 inches below the bottom of the pipe and/or 6 inches below the outside diameter of the bell, whichever is greater, and backfilled to grade with imported bedding material thoroughly compacted into place.

Water stop impervious plugs (trench cutoff blocks) shall be installed in trenches where Class 4 Backfill is used, in all areas of ground water movement, and in all trenches containing pipeline slopes of 10 percent or greater.

The location and spacing of trench cut-off blocks for private building laterals shall be the responsibility of and shall be determined by the owner or their agent. The General Manager shall determine the location and spacing of trench cut-off blocks for Water System mains. Trench cut-off blocks shall be constructed as shown in the Standard Drawings, Trench Cut-Off Block, Figure 23, page 175.

Boring or Jacked Casing: The work contemplated under this heading consists of placing cast iron pipe or other pipe of approved material, usually in a conductor pipe, under a paved roadway, street or railroad to a true line and grade as shown on the improvement plans, by means of boring or jacking operations. The General Manager prior to proceeding with the work shall approve the equipment and method of operation.

The excavation for the boring operation shall be kept to a minimum but shall be of sufficient dimensions to satisfactorily complete the work. If so required, bracing and shoring shall be provided to adequately protect the workmen and the roadway or railroad.

The conductor pipe shall be placed closely behind and in conjunction with the boring operation. The bored hole shall be not more than 0.1 foot in diameter larger than the conductor pipe. Guide rails shall be accurately set to line and grade so as to achieve close adherence to the line and grade shown on the improvement plans.

The pipe to be placed inside the conductor pipe shall have a non-rigid joint and shall be installed by the use of suitable wood skids. Clean sand shall then be sluiced or blown into the conductor pipe to a depth of not less than half the diameter of the water pipe.

Where tunneling is permitted, backfill shall be made with clean damp sand, tamped and compacted to insure a non-yielding, uniform foundation for the entire length of the tunnel.

Trench Backfill Pipelines: Class 1 Backfill for water system pipelines and related appurtenances that are constructed for the District shall have a minimum specific gravity of 2.5.

Backfill from a point at least 1 foot over the top of the pipe to finish grade shall be made with Class 2 or Class 3 Backfill. When the water trench lies within the right-of-way of a street Backfill around and to at least 1 foot over pipe shall be made with Class 1 Backfill material compacted as placed. A difference in level on either side of the pipe not to exceed 4 inches shall be maintained to hold the pipe firmly in place. this backfill shall be Class 2. Class 3 Backfill may be used in areas outside the pavement of streets and highways involved.

In connection with backfill, the following tests shall be made in conformance with the requirements set forth in these Specifications:

<u>Tests</u>	<u>Test Method No. California or ASTM</u>
Relative Compaction	ASTM D1557 & D1556
Sand Equivalent	217
Resistance (R-Value)	301
Sieve Analysis	202

Backfill for residential units or for pipes less than 3" in diameter requires use of material with a maximum sieve size of 3/8-inch minus only.

Backfill shall not be placed until the pipe or other facility has been inspected by an authorized District Representative and approved for backfilling. The percentage composition by weight as determined by laboratory sieves shall conform to the following requirements:

Class 1 Backfill

<u>Sieve Sizes</u>	<u>Percentage Passing Sieves</u>
3/8"	100

Sand equivalent not less than 20.

Bulk Specific Gravity of Class 1 Backfill shall be at least 2.5.

Class 2 Backfill

<u>Sieve Sizes</u>	<u>Percentage Passing Sieves</u>
1"	100
3/4"	90-100
No. 4	35-60
No. 30	10-30
No. 200	2-9

Sand equivalent not less than 20. Bulk Specific Gravity of Class 2 Backfill shall be at least 2.6.

Class 3 Native Backfill

<u>Sieve Sizes</u>	<u>Percentage Passing Sieves</u>
3"	100

Sand equivalent not less than 20.

Class 4 Backfill

<u>Sieve Size</u>	<u>Percentage Passing Sieves</u>
1"	90-100
3/4"	70-100
1/2"	25-60
3/8"	10-40
#4	0-10
#8	0-5

Bulk Specific Gravity shall be at least 2.5

Material for Class 1, Class 2, Class 3, and Class 4 Backfill shall be placed in uniform horizontal layers not exceeding 1 foot in thickness before compaction, and shall be brought up uniformly on all sides of the trench. If the contractor can satisfactorily demonstrate to the General Manager an alternative method of placing the backfill so that all requirements, other than the layer thickness, are met, the General Manager will permit the contractor to use the alternative method. Under no circumstance will the contractor use the alternative method unless the General Manager's approval is obtained in writing.

The District reserves the right to perform compaction tests, or have compaction tests performed through a licensed, geotechnical, testing firm, to verify compaction of the backfilled trench section. All tests by the District will be performed in such a manner as will not unnecessarily delay the work. The owner or their agent shall be required to reimburse the District for the initial tests performed. If subsequent tests are required due to compaction failures, the owner or their agent shall pay for all subsequent compaction tests.

The use of backfill material other than Class 1, Class 2, and Class 3 is not permitted unless approval is granted, in writing, from the General Manager.

Class 4 Backfill material may be substituted for Class 1 Backfill, if approved by the General Manager or their designated representative in writing, under the following conditions:

- When large amounts of groundwater are encountered within the trench section, or;
- When trench depths exceed 12 feet in depth *and* placement of Class 1 Backfill material at the prescribed relative compaction is not possible.

If Class 4 Backfill material is substituted for Class 1 material, 140 NC filter fabric, or equivalent, must be placed on top of the Class 4 Backfill before proceeding with additional approved backfill.

Groundwater may not be removed from the trench and by use of any part of the existing or new water system piping or facilities. Groundwater must be eliminated from trench prior to installation of water pipe and the pipe must be protected from groundwater at all phases of construction.

- The contractor must eliminate or control groundwater prior to pipe installation utilizing methods that meet or exceed Federal, State or local requirements.
- If high concentrations of silts are suspended in the groundwater, settling basins may be required before the water is pumped or diverted to daylight.

Initial backfill shall be to 1 foot of the vertical outside diameter of the pipe in 8-inch maximum lifts.

Backfill material shall be "shovel sliced" on both sides of the pipe, with care to assure that the spaces under the pipe haunches have been filled.

Field repairs to P.V.C. are not acceptable unless the General Manager has given his/her prior approval for each repair.

Mechanical compactors shall not be used directly over the pipe with less than 1 foot of cover.

Paving over trenches shall not be placed until an authorized District representative has inspected the backfill. Trench surfacing and trench restoration in Placer/Nevada County, or State of California right-of-way shall conform to the requirements of the agency having jurisdiction.

Backfill around vaults and the pit excavated for boring operations shall be made in the same manner as above specified for trenches, except as otherwise provided under underground vaults.

If at any time during the period of responsibility there shall be any settlement of the trenches, cracking of the newly applied pavement, or separation of the newly applied pavement from the existing pavement requiring repairs to be made in any street highway, or easement, or should any other defect appear in the system due to the contractor's operations, the owner or their agent shall promptly repair all defects in accordance with the requirements of the responsible agency.

Trench Backfill Mains: Class 1 Backfill for Water System main pipelines and related appurtenances that are constructed for the District shall have a minimum specific gravity of 2.5. Trench backfill methods and materials for mains, shall be as specified for water pipelines with the following exceptions:

- The height of backfill over the pipe before testing shall not be less than 12 inches.
- Thrust blocks shall be in place before the pipeline is hydrostatically tested.
- All joints, bends, angles, or fittings shall be left exposed until testing has been completed.

Every precaution shall be taken against floating the pipe. In case of such floating, the contractor shall replace the pipe to its proper location at his/her own expense, and replace any damaged pipe.

Trench Section, Paved Areas: Pipeline shall be bedded on twelve inches of Class 1 Backfill compacted to 90 percent relative compaction. Class 1 Backfill shall also extend a minimum 12 inches above top of pipe, compacted to 90 percent relative compaction. In the event that heavy groundwater is encountered in the excavated trench, Class 4 Backfill may be substituted for Class 1 Backfill as outlined above.

Class 2 Backfill shall be placed from 12 inches above top of pipe to 1 inch below bottom of existing asphalt pavement. All Class 2 Backfill shall be compacted to 95 percent relative compaction.

Trench Section, Roadway Shoulders adjacent to Paved Areas: Pipeline shall be bedded on 12 inches of Class 1 Backfill compacted to 90 percent relative compaction. Class 1 Backfill shall also extend a minimum 12 inches above top of pipe and compacted to 90 percent relative compaction. In the event that heavy groundwater is encountered in the excavated trench, Class 4 Backfill may be substituted for Class 1 Backfill as outlined above.

Class 2 Backfill shall be placed from 12 inches above top of pipe to finished grade. Class 2 Backfill placed from 12 inches above top of pipe to 12 inches below finished grade shall be compacted to 90 percent relative compaction, with Class 2 Backfill placed from 12 inches below finished grade to finished grade compacted to 95 percent relative compaction.

Class 3 Backfill may be substituted for Class 2 Backfill up to one foot below finished grade. Class 3 Backfill shall be compacted to 90 percent relative compaction.

Trench Section, Unpaved Areas: Pipeline shall be bedded on 6 inches of Class 1 Backfill compacted to 95 percent relative compaction. Class 1 material shall also extend a minimum 12 inches above top of pipe, compacted to 95 percent relative compaction. In the event that heavy groundwater is encountered in the excavated trench, Class 4 Backfill may be substituted for Class 1 Backfill as outlined above. Class 2 or Class 3 Native Backfill shall be placed from 12 inches above top of pipe to finished grade. Class 2 or Class 3 Native Backfill shall be compacted to 90 percent relative compaction.

A-6.6 Fire Hydrants

Construction: Fire hydrants shall be of the dry-barrel type according to AWWA C502. Manufacturer shall be Mueller Super Centurion 250, dry barrel type or approved equal. Fire hydrants shall have one 5-1/4" and two 2-1/2" national standard thread hose connections. All hose connections shall be provided with ductile iron nozzle caps with metal chains. Nozzle cap nuts shall be the same shape and size as operating nuts. The stem shall have a breakaway coupling. The upper standpipe shall be 28" in height. The bottom base connection shall be 6" flanged. The barrel shall have a "breakable" flanged connection to the upper and lower standpipe sections. Both standpipe sections shall be manufactured of ductile iron.

Operating Nuts: Operating nuts shall be 1-1/2" pentagons. The operating nut shall rotate counter-clockwise to open. Operating nuts shall be equipped with weathershields.

Pressure Rating: Fire hydrants shall be tested to 500 psig and shall be suitable for a continuous working pressure of 250 psig.

Exterior Coating of Upper Standpipe: The exterior surfaces of the upper standpipe shall have a three coat paint system conforming to the requirements of AWWA C502. The paint system shall consist of one primer coat and two finish coats of alkyd-based gloss enamel. Color of the finished coats shall be "Hydrant Red".

Exterior Coating of Lower Standpipe: The exterior surfaces of the lower standpipe shall have an asphaltic coating approximately 1 mil thick.

Interior Coating: The interior surfaces of the fire hydrant shall be coating with black asphalt paint conforming to Federal Specification TT-C-494B. Fire hydrants shall be Mueller Model Super Centurion 250. No equals or substitutes will be accepted. All fire hydrants shall be installed in strict accordance with the manufacturer's published recommendations, AWWA Standards, and all applicable codes. All hydrants shall be spaced a maximum of 300 feet unless CONTRACTOR has received prior written approval signed by the DISTRICT Fire Chief. Fire hydrant laterals shall be installed as indicated in the Approved Drawings. All joints along the hydrant lateral shall be fully restrained ductile iron or Blue Brute pipe, using joint restraint methods as indicated in drawings. The hydrant bury elbows shall have thrust blocks per in addition to the restrained joints. All horizontal and vertical angle points 11-1/4 degrees or more shall be restrained the full development length. All fire hydrants shall be installed in strict accordance with the manufacturer's published recommendations, AWWA Standards, and all applicable codes.

All tees and crosses: shall be restrained the full development length.

All in-line valves: and **dead end pipelines** shall be restrained the full development length.

Tie-in Sleeves: All tie-ins shall be completed with cast or ductile iron 12-inch minimum length mechanical joint sleeves. Bolting and gaskets shall conform to the requirements for the pipe to which the sleeve is attached.

Restrained Joints: Restrained joints shall be designed such that the joint has the same lateral strength as the pipeline and/or can restrain the maximum test force exerted on the pipeline. All restraining systems shall be tightened with an adjustable torque wrench to the manufacturer's recommended torque. The District representative shall certify the method and the required development length of restraint.

Castings: All castings for pressure reducing station, control valves, or other purposes, shall be tough grey iron, free from cracks, holes, swells and cold sheets and be of workmanlike finish, and shall conform to the pertinent Standard Drawing. Any cast iron rings, frames or covers shall meet the requirements of Specification ASTM Designation A48, Class 40. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the castings, without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned.

All frames and entrance covers shall fit tightly to the seat and shall not rock. All materials, which do not fit neatly and bear firmly in the frame will be rejected.

Pump Stations: Pump stations shall have a duplex pump configuration with controls designed to run primary or secondary pumps. Controls shall include Hand-Off-Auto switches and running lights for each pump. Pump electrical supply shall be three phase for pumps rated at 7 horsepower or more where possible. Pumps shall be sized for the ultimate design peak flow (including fire flows) of the area being serviced by the station and retain a 20 PSI minimum residual at that flow.

Pump Motors: The motors shall be designed for continuous operation at full load with a temperature rise of not more than 40 degrees centigrade above ambient temperature. Motors shall be capable of frequent starts each hour as required to meet the flow requirements without overheating. Motors shall also be rated for the altitude at which they are to be installed.

Underground Vault Installation: Vaults shall be watertight structures constructed in accordance with the details shown on the improvement plans as specified herein and as directed by the General Manager. Precast vaults shall be constructed of precast reinforced sections, tapered reinforced concrete sections, adjustment rings, with cast-in-place bases in accordance with the Standard Specifications and ASTM Specification C478-64T. Portland cement shall be Type II, conforming to the requirements of ASTM Designation C-150.

Precast vaults shall be used in lieu of cast in place vaults whenever possible.

The ends of barrel sections, tapered sections and adjustment rings shall be of such design and construction that when properly laid they shall have a smooth and uniform surface. Each joint shall be sealed with Kent Seal, or Ram-Nek sealant and primer to prevent infiltration or exfiltration. Ram-Nek shall be neatly trimmed after assembly.

Underground Vaults in paved areas shall have at least one, 2-inch grade ring installed on the top vault section man-way entrance. The man-way frame and cover shall be placed on top of the grade ring as prescribed herein. The throat of the man-ways shall be made of precast concrete grade rings of the proper inside diameter and height. If fine adjustments are needed a concrete mixture fortified with "Xypex Xycrylic Admix" or equal may be used. The maximum depth permitted shall be 12 inches between the cone and frame. Adjustment using concrete mix shall not exceed 2 inches.

When adjusting an existing manway to grade and the total depth of the throat from the top of the frame to the bottom of the throat exceeds 24 inches, the upper portion of the vault shall be removed and reconstructed so that the final adjusted height of the throat is not greater than 12 inches.

The tops of the vault frame elevations shown on the improvement plans are approximate only. In general, the finished grade of the vault frame and lid shall be set a maximum of 0.1 foot below the existing ground. Finished grade in paved areas should meet the appropriate Placer County/ Nevada or State of California specifications.

Whenever the excavation for an underground vault exceeds the outside diameter of the vault by 10 inches, measured along a radius line, the backfill shall be placed in layers not to exceed 8-inches uniformly around the structure and mechanically tamped to relative compaction of not less than 95 percent for each layer.

Precast Vault Sections: The vault sections, adjustment rings and tapered sections with tongue and groove joints shall conform to ASTM Designation C478, except that cement and aggregate shall conform to the requirements of Structural Concrete, Appendix A-6.10, page 110. Concrete for poured portions of manholes shall conform to Structural Concrete, Appendix A-6.10, page 110. Metal forms shall be used in the manufacture of the precast sections so as to obtain smooth surfaces. The concrete shall be well compacted by being centrifugally spun, vibrated, or mechanically tamped.

Vault Frame and Cover: Cast iron frames and covers as specified shall be furnished and installed by the contractor in accordance with the applicable portions of the Standard Specifications, except as herein modified. Cast iron frames and covers shall be matched and marked in pairs before delivery to the work. Vault covers shall fit into their respective frames without rocking. Vault frames and covers located within easements shall be the bolted down type, bolts shall be stainless steel with an anti seize compound applied to all male threads. Miscellaneous iron and steel for use in the construction of vaults shall be furnished and installed in accordance with the details shown on the improvement plans.

Internal Chimney Seals: All new construction vaults or replacement of existing vaults with grade rings may require installation of an internal rubber seal as specified. A rubber seal extension to include any additional heights of vault grade rings and/or frames not covered by the seal itself, shall be used as directed. The internal rubber seal and seal extensions shall be as manufactured by Cretex Specialty Products, or approved equal. The seals and extensions shall have a minimum thickness of 3/16 inches and shall be extruded from a highgrade rubber compound conforming to the applicable requirements of ASTM C923. The bands used for compressing the seal and extension against the vault lid shall be fabricated from 16 gauge stainless steel conforming to ASTM A240 type 304, any screws, bolts or nuts used on this band shall be stainless steel conforming to ASTM F593, type 304.

External Vault Seals: When manholes are located within an area of high groundwater, adjacent to a lake or stream, or within an area of standing water, the exterior manhole joints and surface shall be sealed with an external concrete sealant. Exterior manhole walls shall be sealed with a liquid cold-applied waterproofing membrane system such as Sonneborn ® HLM 5000®, or equivalent. Exterior joints shall be sealed with an elastomeric based external concrete joint wrap such as Henry RUB'R-NEK®, or equivalent.

Vault Temporary Construction Cover: Temporary covers of 3/8 inch steel plate of sufficient size to adequately cover the opening shall be placed on the cone of a manhole until paving is completed. Suitable locating ribs shall be welded to the underside of the cover to hold it in place during the grading and paving operations.

Connection to Existing Vault: Connections through existing vault walls shall be made by core drilling into the wall of the manhole. Pipe penetration through the manhole wall shall be sealed with a watertight seal by one of the following:

- equipping the pipe with a modular mechanical type seal (“Link-Seal”, or equivalent), consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and manhole wall opening. Links shall be loosely assembled with stainless steel bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the manhole wall opening.
- inserting the pipe through the core drilled opening, and packing the opening around the pipe with Kent seal or Ram-Nek and primer, then covering with a stiff mix of cement mortar, thoroughly compacted. The mortar shall be composed of one part Type II Portland cement and three parts clean sand. The mortar shall be troweled smooth and flush with the interior surface of the manhole.

Connection of a pipeline to an existing vault that has a stub-out shall be accomplished with flanged coupling only. No circle clamps or flexible rubber couplings are allowed.

The use of impact hammers to break into a manhole/vault wall is prohibited.

Underground Vault Testing: If deemed necessary by the District, any or all vaults shall be tested for leakage by one of the following procedures:

Vacuum Test: Vacuum test equipment shall be used per the manufacturers specifications. A vacuum of 10 inch Hg should be drawn on the manhole, and the time for the vacuum to drop to 9 inch Hg shall be measured. For simplification in the field, a "rule of thumb" for this drop in vacuum shall be conservatively established at 60 seconds for a 48-inch diameter manhole; 75 seconds for a 60-inch diameter manhole; and 90 seconds for a 72-inch diameter manhole.

A-6.7 Pavement Restoration

Asphalt Concrete Pavement Restoration: The contractor shall perform asphalt concrete patching and pavement restoration work in accordance with State of California Department of Transportation Standard Specifications, Section 39, and Contract Drawings and documents.

This work shall consist of furnishing and installing tack seal (see "Binder" below) at all joints and feathered areas and furnish and install asphaltic concrete purchased at a central mixing plant and approved by the District and as specified herein in all areas affected by trenching and construction activities under this contract.

Asphalt concrete is designated as Type A and shall meet the requirements Section 39 of the State of California Department of Transportation Standard Specifications (July 1992) Type A Asphalt Concrete or, as designed by the District. Asphalt concrete shall be produced in a batch mixing plant, a continuous pugmill mixing plant or a dryer-drum mixing plant. Proportioning shall be either by hot-feed control or cold-feed control.

Asphalts: Asphalt binder to be mixed with aggregate shall be Grade AR4000. The amount of asphalt binder to be mixed with the aggregate will be specified in the special provisions.

Liquid asphalt for prime coat shall conform to the provisions in "Liquid Asphalts", and shall be SC-250.

Aggregates: All aggregates shall be clean and free from decomposed materials, organic material and other deleterious substances.

Coarse aggregate is material retained on the No.4 sieve; fine aggregate is material passing the No.4 sieve; and supplemental fine aggregate is added fine material passing the No. 30 sieve, including dust from dust collectors.

Unless otherwise specified in the special provisions, the aggregate grading to the various types of asphalt concrete shall conform to the following:

<u>Type</u>	<u>Grading</u>
A, AR-4000	1/2" minus maximum

The combined aggregate, prior to the addition of asphalt binder, shall conform to the requirements of this section. Conformance with the grading requirements will be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between the coarse and fine portions of the aggregate or between blends of different aggregates.

In the tables below, the symbol "X" is the gradation, which the contractor proposes to furnish for the specific sieve. The proposed gradation shall meet the gradation shown in the table under "Limits of Proposed Gradation". Changes from one mix design to another shall not be made during the progress of the work unless permitted by the District representative. However, changes in proportions to conform to the approved mix design shall not be considered changes in mix design.

AGGREGATE GRADING REQUIREMENTS

Type A Asphalt Concrete
Percentage Passing

1/2" Maximum, Medium

Sieve Compliance	Limits of	Operating	Contract	Sizes	Gradation	Range
1/2"		100	100			
3/8"		80-95	75-100			
No.4	59-66	X±5	X±8			
No.8	43-49	X±5	X±8			
No.30	22-27	X±5	X±8			
No.200		3-8	0-11			

Subgrade: Immediately prior to applying prime coat or paint binder, or immediately prior to placing the asphalt concrete when a prime coat or paint binder is not required, the subgrade to receive asphalt concrete shall conform to the compaction requirement and elevation tolerances specified for the material involved and shall be free of loose or extraneous material. If the asphalt concrete is to be placed on an existing base or pavement which was not constructed as part of the contract, the contractor shall clean the surface by sweeping, flushing or other means to remove all loose particles of paving, all dirt and all other extraneous material immediately before applying the prime coat or paint binder.

Prime Coat and Binder: Edges of existing pavement being joined and surface being overlaid shall receive a tack coat of SS1H bituminous binder or equivalent.

Prime coat shall be applied at the approximate total rate of 0.25 gallons per square yard of surface covered.

Prime coat shall be applied at a temperature conforming to the range of temperatures provided in the State of California Department of Transportation Standard Specifications, Section 93-1.03, "Mixing and Applying," for distributor application of the grade of liquid asphalt being used.

A paint binder shall be furnished and applied to all vertical surfaces of existing pavement, curbs, gutters, and additional material, to a pavement to be surfaced, and to other surfaces designated by the District representative.

Paint binder shall be applied in one application at a rate of from 0.02 to 0.10 gallon per square yard of surface covered.

Spreading Equipment: Asphalt pavers shall be self-propelled mechanical spreading and finishing equipment, provided with a screed or strike-off assembly capable of distributing the material to not less than the full width of a traffic lane if necessary.

Compacting Equipment: A minimum of one steel-tired, two-axle tandem roller weighing not less than 8 tons nor more than 10 tons shall be used for each asphalt paver to compact Open Graded asphalt concrete.

Temporary Paving: The owner or their agent shall comply with all general temporary paving requirements and special requirements of the Placer County, and the State of California Department of Transportation. Temporary paving (cold patch) shall be placed to grade over all backfilled trenches located within primary roadways until permanent paving is installed.

Temperature Requirements: Type B asphalt concrete shall be placed only when the atmospheric temperature is above 50 degrees Fahrenheit.

Asphalt concrete and asphalt concrete base shall not be placed when the underlying layer or surface is frozen, or when, in the opinion of the District representative, weather conditions will prevent the proper handling, finishing, or compaction of the mixtures.

Spreading: When directed by the District representative, paint binder shall be applied to any layer in advance of spreading the next layer.

Before placing the top layer adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face and to a neat line. Transverse joints shall be tested with a 12-foot straightedge and shall be cut back as required to conform to the requirements as specified in Pavement Restoration, Appendix A-6.7, Compacting, page 107. Connections to existing surfacing shall be feathered to conform to the requirements for smoothness. Longitudinal joints shall be trimmed to a vertical face and to a neat line if the edges of the previously laid surfacing are, in the opinion of the District representative, in such condition that the quality of the completed joint will be affected.

All layers shall be spread with an asphalt paver. Asphalt pavers shall be operated in such a manner as to insure continuous and uniform movement of the paver and shall lay a mat, which will provide a lift of not less than 2.5 inches in the compacted state. Compacted thickness over 2.5 inches requires separate lifts.

Compacting: A pass shall be one movement of a roller in either direction. A “coverage” shall be as many passes as are necessary to cover the entire width being paved. Overlap between passes during any coverage, made to insure compaction without displacement of material in accordance with good rolling practice, shall be considered to be part of the coverage being made and not part of subsequent coverage. Each coverage shall be completed before subsequent coverages are started.

Rolling shall commence at the lower edge and shall progress toward the highest portion, and shall be performed so that cracking, shoving or displacement will be avoided.

The completed surfacing shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. Any ridges, indentations or other objectionable marks left in the surface of the asphalt concrete by blading or other equipment shall be eliminated by rolling or other means. The use of any equipment that leaves ridges, indentations, or other objectionable marks in the asphalt concrete shall be discontinued, and the contractor shall furnish acceptable equipment.

When a straightedge 12 feet long is laid on the finished surface and parallel with the centerline, the surface shall not vary more than 0.01 foot from the lower edge of the straightedge. The transverse slope of the finished surface shall be uniform to a degree such that no depressions greater than 0.02 foot are present when tested with a straightedge 12-feet long laid in a direction transverse to the center line and extending from edge to edge of a 12-foot traffic lane. Contractor shall furnish the 12-foot straight edge.

Manhole/Vaults/Valve box Lid Adjustments: When manholes/vaults or valve boxes are adjusted to pavement grade, they shall be 1/2 to 3/4 inch below adjacent pavement surface. Asphalt concrete shall be neatly *tapered* from the final pavement grade to the manhole/vault or valve boxes frame and cover. If the manhole/vault or valve boxes are located within 2 feet of the edge of the pavement, in earth shoulders or earth flow-line areas, asphalt concrete shall be placed to a minimum 2 feet around the manhole/vault or valve box and paved out at 45 degrees to the edge of existing pavement.

A-6.8 Clean Up

During the progress of the work, the owner or their agent shall keep the entire job site in a clean and orderly condition. Excess or unsuitable backfill material, broken pipe or other waste material shall be removed from the job site. The contractor shall remove spillage resulting from hauling operations along or across existing streets or roads immediately. All gutters and roadside ditches shall be kept clean and free from obstructions. Any deviation from this practice shall have prior approval from the General Manager.

Before final acceptance of the work, the owner or their agent shall carefully clean up the work and premises, remove all temporary structures built for the work, and remove all surplus construction materials and rubbish of all kinds from the grounds which he has occupied and leave them in a neat condition.

A-6.9 Environmental Considerations

Water Pollution: The owner or their agent shall exercise every reasonable precaution to protect ditch conduits, streams, lakes and reservoirs from pollution with fuels, oils, bituminous, chemicals, concrete and other harmful materials and shall conduct and schedule his/her operations so as to avoid or minimize muddying and silting of said conduits, streams, lakes and reservoirs.

Nothing in these Standards shall relieve the owner or their agent of the responsibility for compliance with Sections 5650 and 12015, California Fish and Game Code, or other applicable statutes relating to prevention or abatement of water pollution.

Erosion control features shall be constructed concurrently with other work and at the earliest practicable time. Care shall be exercised to preserve vegetation beyond the limits of construction.

When borrow material is obtained from other than commercially operated sources, erosion of the borrow site during and after completion of the work shall not result in water pollution. The material source shall be constructed, where practicable, so that water will not collect or stand therein.

The requirements of this section shall apply to all work performed within the District and to all noncommercial operated borrow or disposal sites used for work within the District. The word "stream" as hereinafter used shall be construed to mean ditch, conduit, stream, river, lake or reservoir.

The owner or their agent shall be completely responsible for compliance with all local, District, town, county, state, and federal regulations pertaining to water pollution and soil erosion including the payment of any fines or penalties imposed by any governmental agency as a result of work performed by or for the owner or their agent.

Stream Zones: Where working areas encroach on live streams, barriers adequate to prevent the flow of muddy water into streams shall be constructed and maintained between working areas and streams, and during the construction of such barriers, the muddying of streams shall be held to a minimum.

Prior to the removal of material from an area beneath a flowing stream, a bypass channel shall be constructed in a location, which will carry the stream free from mud or silt around the material removal operation.

Should the operations of the owner or their agent require transportation of materials across live streams, such operations shall be conducted without muddying the stream. Mechanized equipment shall not be operated in the channels of such live streams except as may be necessary to construct crossings or barriers and fills at channel alterations.

When operations are completed, the flow of streams shall be returned as nearly as possible to the original meandering thread without creating the possibility of future bank erosion.

Material derived from the work shall not be deposited in a live stream channel where it could be washed away by high stream flows.

Erosion Control: This work shall consist of incorporating straw and/or mulch, fertilizing, and seeding all water pipeline excavation and backfill areas; all easements, which are disturbed by pipelines, ditches or access roads, shall also be seeded. Areas designated as waste or borrow areas shall be seeded after final cleanup of said areas is finished.

Seeding: Seed shall be uniformly distributed over the seedbed area. The seed mixture chosen shall be one which is suitable for dry soils at an elevation of 5,000 to 6,000 feet and meets the specifications for purity and viability as given in Chapter XI-C of the Tahoe Regional Planning Agency's Handbook of Best Management Practices.

The seeding operation shall be accomplished promptly after the cleanup of an area is completed, in no case shall the seeding operation of an exposed or disturbed area be allowed to stand fallow through winter until the following construction season.

Fertilizer: Fertilizer shall be applied at a rate so as to provide 80 pounds of available nitrogen per acre and 100 pounds of available phosphoric acid (p2o5) per acre.

Mulch: Wood fiber mulch shall be applied to all areas at the rate of 1,500 pounds per acre. The mulch shall be applied in a slurry with the seed and fertilizer. Straw mulch shall be a cereal grain straw, not rotted and free of noxious weeds. Straw mulch shall be applied on areas as specified in

the following paragraphs at the rate of 2 tons per acre. Mulching shall follow immediately after seeding.

Erosion control shall be used on all trench excavation outside of the paved Placer County, or State of California right-of-ways.

In addition, should the cross slope grade parallel with the trench be greater than 15 percent, Douglas Fir or Cedar 1 x 8 inch boards shall be placed normal to the pipe trench on 10 foot centers with 2 inches exposed above grade and extended 6 inches into original ground on each side before seeding.

A-6.10 Structural Concrete

Provide and install all cast-in-place concrete, as shown and as specified, including but not limited to the following:

- Accessories to be embedded in cast-in-place concrete, anchor bolts, etc.;
- Cutting, patching, finishing and curing of cast-in-place concrete;
- Coordination with all trades with regard to requirements for special bases, sleeves, chases, inserts, finishes, or provisions of any nature;
- Treatment of finished concrete surface.

Quality Assurance: Qualification of Workmen: experienced and skilled concrete workmen working under the supervision of an experienced concrete contractor shall complete all concrete work.

Reference Standards: The following references and standards are hereby made a part of this section. Nothing contained herein shall be construed as permitting work that is contrary to code requirements or governing rules and regulations.

ACI - American Concrete Institute.

- ACI 301 - "Specification for Structural Concrete for Buildings."
- ACI 304 - "Recommended practice for Measuring, Mixing and Placing Concrete."
- ACI 305 - "Recommended Practice for Hot Weather Concreting."
- ACI 306 - "Recommended Practice for Cold Weather Concreting."
- ACI 309 - "Recommendation Practice for Consolidation of Concrete."
- ACS 318 - "Building Code Requirements for Reinforced Concrete."

- ASTM - "American Society for Testing and Materials."
- C 31 - "Making and Curing Concrete Test Specimens in the Field."
- C 33 - "Standard Specification for Concrete Aggregates."
- C 39 - "Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens."
- C 88 - "Standard Specification for Method of Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate."
- C 94 - "Standard Specification for Ready-Mixed Concrete."
- C 143 - "Standard Method of Test for Slump of Portland Cement Concrete."
- C 150 - "Standard Specification of Portland Cement."
- C 157 - "Standard Method of Test for Length Change of Hardened Mortar and Concrete."
- C 171 - "Standard Specification for Sheet Materials for Curing Concrete."
- C 172 - "Sampling Fresh Concrete."
- C 233 - "Testing Air-Entraining Admixtures for Concrete."
- C 260 - "Standard Specifications for Air-Entraining Admixtures for Concrete."
- C 309 - "Standard Specification for Liquid Membrane - Forming Compounds for Curing Concrete."
- C 494 - "Standard Specifications for Chemical Admixtures for Concrete."
- C 2419 - "Standard Specification for Method of Test for Sand - Equivalent Value of Soil and Fine Aggregate."
- E 329 - "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction."

UBC - Uniform Building Code, Standards:

Testing Agency: Any testing Agency utilized during the course of the project should conform to the following: All reports and certificates prepared by the Testing Agency shall be signed by a Professional Engineer registered to practice as a Civil Engineer in the State of California. Test methods shall comply with the codes and standards listed.

Source Quality Control: The Testing Agency shall perform tests and/or assemble the necessary data, indicating conformance with specifications as follows:

- Mix Designs - Furnish a list of proportions for each proposed mix.
- Strength - For each mix, submit data showing that the proposed mix will attain the required strength in accordance with the requirements of these specifications.
- Aggregate - For each aggregate used, submit data showing that it complies with ASTM C33. Include gradation, deleterious materials, specific gravity and soundness. For coarse aggregates in mixes for site work, include abrasion.
- Cement - Furnish mill tests for all cement used. Submit this data to the District for review prior to delivering any concrete materials to the site. Mix designs, test, etc., required by this specification need not be made specifically for this job, provided that data submitted is current within the last 12 months and that in the judgment of the Testing laboratory the test data correctly describes the materials proposed for use.
- Provide all necessary controls during batching, mixing, and placement of concrete.

The owner will perform and report on the following:

- Review mix designs, certificates of compliance, and samples of materials proposed for use;
- Test and inspect materials, as necessary, in accordance with ACI 318, for compliance with requirements;
- Take samples as required from sources designated by contractor;
- Inspect batch plant prior to any Work to verify following:
 - 1) Plant is equipped with approved metering devices for determining moisture content of fine aggregate.
 - 2) Other plant quality controls are adequate.
- Compression Tests: During progress of Work, take not less than five identical test specimens for standard cylinder tests at job site for each 100 cubic yards or less of class "A" and "B" concrete placed per day (except 50 cubic yards or less at underpinning), in accordance with requirements of ASTM C 31 and C 172. Make standard 7 and 28 days after casting. Keep fifth cylinder as a check cylinder for further tests if required.
- Slump Tests: Make slump tests per ATM C 143 at time of making each set of cylinder specimens and for each truckload.
- Air Entrainment Tests: Make air entrainment test for each truckload.

Submittals: Submit mix designs for approval by owner prior to placement of any concrete.

Submit improvement plans and schedule concrete placement operations before commencing Work. Show all construction, contraction and expansion joints.

Product Delivery, Storage and Handling: Protect cement from moisture and rotate stock to insure fresh materials.

Protect cement from moisture and rotate stock to insure fresh materials.

Alternative Procedures: Concrete may be placed by pumping provided that pumping equipment is suitable for proposed use and provided that specific "pump mixes" are submitted with data showing that they comply with the requirements of these specifications and subject to approval of Testing Laboratory.

Concrete Mix: Class "A" - Stone aggregate concrete for use in foundations: 3/4 inch maximum size aggregate, specified minimum 28 day strength of 4,000-pounds per square inch, slump 3-inches, +/-1-inch, 4-8 percent air entrainment, maximum water/cement ratio of 0.43.

Concrete mixes shall comply with ASTM C94. Proportioning shall comply with Alternative 3, mixing and transporting shall comply with requirements for Truck-Mixed Concrete.

Materials: Portland Cement: Type II, ASTM C 150, with use of at least 2 years with proposed aggregates without detrimental reaction. Cement shall not exceed 150 degrees Fahrenheit at time of use. Use one brand of cement throughout the Work.

Standard Weight Aggregates: ASTM C 33 from approved pits. The Maximum size used in a particular location shall be consistent with the form and dimensions of the section being placed, with the location and spacing of the reinforcing steel and with the method of vibration. The aggregate sizes shall be such as will produce dense, uniform concrete, free of rock pockets, honeycombs, or other irregularities. Aggregates for stone concrete shall conform to UBC Standard No., 26-2, except as modified by this section. Any suitable individual grading of coarse aggregates may be used, provided a workable and durably sound mix is obtained. Fine and coarse aggregate for stone concrete shall be clean, hard, fine grained, ground crushed rock or washed gravel or a combination of both, free from oil, organic matter, or other deleterious substances containing not more than 2 percent by weight of shale or cherty material.

Water: Clean and free of deleterious materials such as acids, alkalis, salts, oils, or organic substances.

Admixtures: Only if acceptable by Northstar Community Services District.

- Water Reducing Admixtures: ASTM C 494, Type A; Grace Construction Materials "WRDA"; Master Builders' "Pozzolith"; Sonneborn-Contech's "Trimix" or equal.
- Air Entraining Admixtures: ASTM C 260; Protec (Autolene Lubricant Company), MB-VR (The Master Builders' Company), or Plastiment (Sika Chemical Corp.).

Epoxy Materials:

- Epoxy Adhesive: Ceilcote No. 348, Concesive LPL 1001, or equal.

- Epoxy Grout: Ceilcote No. 648, Grace Vibro-Foil Grout Master Builder's Masterflow No. 713 Grout, or equal.

Grout for Base Plates: Master Builder's "Embeco 636 Grout"; Conrad Sovig's "Perma Grout"; Master Builders' "Masterflow 713", or equal.

Vapor Barrier: St. Regis Paper Company's Sisal Kraft Division "Moistop", or equal, in sheets as wide as possible to avoid joints. Provide manufacturer's recommended tape for all seams, joints, and repairs.

Hardeners: Clear, Dust-on Type: Base price on application of 50 pounds per 100 square feet. Same as Conrad Sovig's "K-Natural"; Upco Company's "Hydromat"; Lambert Corp.'s "Colorhard"; or equal.

Drypack Mortar for Form Tie-Holes and Patching: Composed of one part Portland Cement and two parts of fine aggregate and water.

Cement Mortar for Sacking: 5-1/2 parts sand, 2-1/2 parts Portland Cement, 1-1/2 parts lime hydrate by volume, plus water.

Concrete Curing Requirements:

- Seven-day full water cure.
- Manufactured curing compounds may be used in addition to the 7-day full water cure upon written approval of the General Manager.

Pre-molded Joint Filler: ASTM D 1751.

Polyvinyl Waterstop: Neoprene, center bulb type, or equal.

Inspection: Prior to placement of concrete, contractor shall be responsible for the examination and acceptance of all conditions affecting the proper installation of their work and shall not proceed until all unsatisfactory conditions have been corrected including the following:

- Approval of compaction tests of fill and backfill.
- Completion of the placement of drainage fills or slab base.
- Completion of form work.
- Placement of reinforcement.
- Placement of embedded items.
- Completion of review of form work and reinforcing.

Slab on Grade and Footing: Vapor Barrier: Place completely over capillary break material subgrade. Lap joints 6 inches minimum, and continuously tape. Fit tightly to penetrations, and continuously tape. Install continuous tape at all edge conditions.

Sand Cushion: Place a 2-inch sand cushion on top of membrane immediately after placing membrane.

Clean and roughen all construction joint surfaces by removing laitance and exposing sound aggregate. Thoroughly clean and moisten contact surfaces before placing fresh concrete.

Cleaning and wetting forms and subgrade: Remove foreign matter accumulated in forms, rigidly close ports and openings left in the form work immediately prior to starting concrete placing. Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce suction and maintain workability of the concrete mix. Thoroughly clean tools used in transporting, placing, and consolidating concrete immediately after each use. Wet subgrade surfaces, immediately prior to placing slabs on grade.

Placing Concrete: Transport concrete from batching plant to place of final deposit as rapidly as practicable. Place concrete before initial set has occurred and in no event after it has contained water for more than 90 minutes and 45 minutes when concrete temperature exceeds 85 degrees Fahrenheit. Convey concrete from mixer to forms as rapidly as possible and deposit as nearly as practicable in its final position by methods, which will prevent segregation or loss of ingredients. Thoroughly vibrate and tamp concrete so that all parts of forms are filled and so that no voids remain in mass or on surface. Take special care to work concrete through and around reinforcing steel. Deposit concrete in horizontal layers not over 8-inches deep. Use spouts, elephant trunks or other approved means as necessary to avoid segregation when dropping concrete. Free fall shall not exceed 5 feet unless approved by the District prior to placement.

Use as many vibrators and tampers as necessary to secure desired results for different parts of structure. Make extra vibrators available during placing of concrete, ready for service in case any vibrator in use fails.

For vibrating of concrete, use a mechanical internal vibrator having a frequency of not less than 4,000 impulses per minute. Place vibrating element directly in concrete and not attached to either inside or outside of forms or to reinforcing steel. Do not over vibrate concrete.

Provide runways for buggies or other approved means of conveying concrete into place to prevent displacement of forms or reinforcement. Do not run buggies directly over reinforcing steel or on planks supported directly by reinforcing steel. Take care not to displace reinforcement, anchor bolts or other materials that are to be embedded in concrete.

Where placing of concrete has been stopped for a sufficient period of time so that shrinkage or warp has separated forms and concrete, draw forms into firm contact with concrete before placing additional concrete. Prevent any shoulder or ledge being formed at a cold joint.

Bring surfaces to be finished to proper grade, strike off finish in a workmanlike manner. Ensure smooth level surfaces.

Add no water when placing concrete.

Finishing Concrete: Sidewalks, Exterior Slabs on Grade and Curbs:

- Compact, screed, level, and tamp with a grid tamper to raise a thin mortar bed to the surface. Steel trowel and medium broom after concrete has hardened sufficiently to prevent the drawing of moisture to the surface. Do not dust with dry materials. Avoid excessive tamping and surface mortar.
- Tool mark slabs where shown. Round all edges to a 1/2-inch radius.

Curing Concrete: During initial 7 days of curing, concrete and form-work shall be kept continuously moist so that a film of water remains on the concrete or form work surface. This may be accomplished through continuously fogging or spraying with water or with moisture retaining fabric coverings. Any covering must be free of any substance that would be harmful to the concrete or the curing process. New fabric coverings should be thoroughly rinsed in water prior to use.

Weather Protection:

Cold Weather Requirements:

- Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306. Use no frozen materials or materials containing snow or ice.
All reinforcement, forms, fillers, and ground with which the concrete is to come in contact shall be free from snow or ice. Whenever the temperature of the surrounding air is below 40 degrees Fahrenheit, all concrete placed in the forms shall have a temperature of 45 degrees Fahrenheit or higher after placement. Provide adequate means for maintaining this temperature for 4 days. Provide any additional time necessary to ensure proper curing of the concrete as directed. The housing, covering, or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing.

Hot-Weather Requirements:

- In hot weather, take suitable precautions to avoid drying of concrete prior to finishing operations. Provide windbreaks, sun-shades, fog sprays, or other devices as directed and as required.
- Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 90 degrees Fahrenheit, unless the Architect permits higher temperatures.

Defective Work: Any concrete work not formed as shown or not true to the intended alignment or not plumb or level where so intended, or not true to the intended grades and levels or that has voids or rack pockets that have not been filled, or that has any sawdust, wood, or debris embedded in it, or does not fully conform to the Specifications will be deemed to be defective. Concrete finish which is not properly surfaced as specified, or which varies more than 1/4 inch from the required finish grade (except floors having drains), or which has any roughened top surfaces, or which does not

connect properly to the adjoining work will be deemed to be defective. Defective work shall be removed and be replaced with workmanship and materials complying with the requirements of the Contract Documents at no increase in Contract Price and with no time extension allowed.

Patching and Grinding: Formed Surfaces: Patch tie holes and defective areas immediately after form removal. Bonding grout approximately one part Portland Cement to one part fine sand passing a #30 sieve, mixed to creamy consistency. Patching mortar shall be made of the same material and approximately the same proportions as used for concrete, except that coarse aggregate shall be omitted and mortar shall consist of not more than one part Portland Cement to 2-1/2 parts damp loose sand by volume. Combine white and gray Portland Cement as necessary to match color of surrounding concrete. Use no more mixing water than necessary for handling and placing. Mix patching mortar in advance and allow to stand with frequent mixing with trowel without adding water until it has reached the stiffest consistency that will permit placing. Remove honeycombed and other defective concrete down to sound concrete. Dampen area to be patched and at least 6 inches surrounding the area. After water has evaporated from surface, a coat of bonding grout shall be well brushed into the surface. When the bonding grout begins to lose water sheen, apply patching mortar, thoroughly consolidate and strike off slightly higher than surrounding surface. All patching mortar shall set undisturbed for at least 1 hour before final finishing. Do not finish patches for 7 days. Tie holes shall be cleaned, dampened, and solidly filled with patching mortar. All areas to be repaired or grouted are to be inspected by the owner and architect prior to repair.

Slabs on Grade: After entire slab is finished, shrinkage cracks may appear which shall be patched as follows:

- Where the slab is not exposed or where appearance is not important, fill cracks larger than 1/32 inch wide with cement grout and strike off level with surface.
- Where slab is exposed and appearance is important, repair all unsightly cracks in a manner satisfactory in appearance to the Architect. If this cannot be accomplished, then the concrete shall be considered defective.

Wall Finishes:

- Sack all exposed exterior wall surfaces to fill only superficial air voids and irregularities which are larger than 1/4 inch in diameter with a cement mortar grout, remove all excess grout by sacking without use of water. Take care in application of grout and in sacking excess grout from surface in order that all voids are filled without a thickness of grout being built up on adjacent concrete surface. The resultant finish and texture of concrete shall match existing finish and texture.

Clean Up: Wash and mop clean all interior finish surfaces and sweep and hose clean exterior surfaces after removal of protective covering. Leave all finish surfaces clean and free from oil, paint, plaster, stain and foreign substances and in approved condition.

Reinforcement: Bar reinforcement shall be deformed, and shall be intermediate grade conforming to the "Billett-Steel Bars for Concrete Reinforcement" (ASTM Designation A15), and be of the shape and dimensions shown on the improvement plans. Before any reinforcing steel is delivered to the job site, two sets of prints of the shop drawings shall be submitted to the General Manager for

his/her approval, showing the number, length, and a dimensioned bending diagram of all steel bars and rods. Such approval is intended only as an additional precaution against errors and the responsibility for furnishing and placing steel in accordance with the details shown on the improvement plans and as specified shall still remain with the contractor.

A-6.15 Pump Station Structures

Doors: All man doors shall be hollow metal with all steel door frame. Minimum size 3068. Doors shall be of adequate size to move interior equipment in and out for maintenance.

Clearance Requirements: Where works are to be constructed within vaults, houses, or other enclosing structures, the desired minimum horizontal clearance around, outside of, and between the extreme dimensions of appurtenances such as pipes, valves, fittings, flanges, pumps, tanks, and auxiliary equipment shall be 24 inches; the desired minimum horizontal clearance between said extreme dimensions and the vertical walls or enclosing surfaces of said structures shall be 24 inches; and the desired minimum vertical clearance under and between said extreme dimensions and the horizontal floors or bottom surfaces shall be 18 inches. Electrical equipment clearances shall be per the current National Electrical Code.

Floor Drains: The floor or bottom areas of the above-mentioned structures shall be drained by means of sloping floors, catch basins with grates, and drain lines constructed to terminate at an approved location, and will not recirculate into the enclosing structure. The catch basin grates shall have a free flowing area of not less than 50 square inches, and the minimum drain line shall be 4-inch size. Where gravity discharge through a drain line is not feasible, a power driven sump pump or line pump, automatically activated by a liquid level sensing device, shall be installed.

The enclosing structures shall be designed so that precipitation, surface water, and ground water cannot enter said structure. Floors shall be at least 6 inches above outside ground level. The Outside ground level shall have adequate storm drainage facilities not connected to the Water System.

Materials and Workmanship: All materials used or incorporated in any works to be accepted by the District shall be new and the best market quality. All work shall be completed in the best, most thorough, substantial and workmanlike manner.

All material, labor and finished work shall be subject to the approval of the General Manager as to its quality and fitness, and shall be immediately removed if it does not meet with his/her approval.

Improvement Plans: The owner or their agent shall submit to the General Manager two prints of all structure plans for his/her review. These improvement plans shall be on 24 x 36 inch sheets.

All structures above ground shall be compatible architecturally with existing or future conditions and shall be approved as to appearance prior to final structure design.

Insulation: Insulation shall be placed if required. The owner or their agent shall submit to the General Manager insulation calculations based upon a low temperature of minus 28 degrees Fahrenheit.

Surface Treatment: The structures surface treatments shall be approved by the General Manager.

Loads: The minimum vertical snow load applicable to the design of roofs and similar surfaces including water tanks shall conform to the following schedule or to current County of Placer Code.

Normal
Elevation of Structure Snow Load

5500 and greater, but less than 6000 220 PSF

6000 and greater, but less than 6500 260 PSF

6500 and greater, but less than 7000 300 PSF

7000 and greater, but less than 7500 340 PSF

Wind loads shall conform to the uniform building code. Two sets of calculations shall be sent to the General Manager.

Concrete: All concrete used in District structures shall conform to Structural Concrete, Appendix A-6.10, page 110, of this specification.

Excavation and Backfill: the General Manager shall approve excavation and backfill for buildings and structures.

The owner or their agent shall, at no expense to the District, take compaction tests one for each 100 cubic yards of structure backfill by an approved commercial testing laboratory with two copies of the results sent to the General Manager.

The moisture density test shall be ASTM D1557, Method A. The in place density shall be determined by ASTM D1556.

Access Roads and Site Work: Access roads to District Water System facilities shall be of an all weather type with a minimum width of 12 feet of traveled way with 2 feet compacted shoulders. This width may be increased if length or locations become a consideration to the District.

The road grades shall be a maximum of 8 percent. Grades in excess of 8% may be approved by the General Manager or District Engineer on a case by case basis. The structural section for access roads and parking areas shall be a minimum of 10 inches of aggregate base Class 2, and 3 inches of compacted asphalt concrete.

Roadway and site drainage shall be to County of Placer specifications.

Tops of all excavation slopes and toe of embankment slopes shall have "V" type ditches draining the runoff away from the site area.

All structure sites shall allow for a minimum of 320 square feet of parking and adequate room to turn around where necessary.

The District will require free title to all structure sites and a recorded access easement on the road extending a minimum of 5 feet beyond any construction limits.

Welding: All welding shall conform to the welding handbook of the American Welding Society, and as modified herein.

Welder Qualification: All welders working on any portion of work to be incorporated in the District Water System shall be certified as specified below and as may be required by the General Manager.

Fabrication and testing of test specimens for qualification of welding procedures and qualification of welding operators shall be completed at no cost to the District.

Test reports shall be submitted to the General Manager in triplicate and approved by him in writing prior to start of fabrication. Test reports shall become the property of the District.

The General Manager may require tested specimens to be furnished to him for review after testing. In the event that test specimens are not satisfactory, the welder will be disqualified.

The contractor shall advise the General Manager in advance of testing weld specimens and shall provide access to the test area so that the General Manager may witness testing. Contractor shall bear all costs of such inspection.

Welder qualification tests will be evaluated in accordance with requirements of the AWS except that radiographic examinations will not be used in lieu of the guided bend tests. Radiographic examinations may be used as a supplement to other tests and should they indicate that a test weld is unsound, the General Manager may disqualify the welder.

In lieu of the AWS requirements, qualification tests for tack welding will be the same as the qualification tests required for butt welding material up to and including 3/4 inch thick.

All certification tests shall be performed at the owner or their agent's expense by a commercial testing laboratory approved by the General Manager.

Welding Testing: If in the opinion of the General Manager, the workmanship or the welds are of such a type or nature as to require testing, the owner or their agent shall have the necessary tests performed by a commercial testing laboratory at the owner or their agent's expense with the results delivered to the General Manager.

Pipelines and Fittings: All piping and appurtenances shall be installed in the position and to accurate lines, elevations, and grades as shown on the improvement plans or specified herein. All pipelines shall be rigidly supported and braced by approved hangers, brackets, or other devices. When temporary supports are used, they shall be sufficiently rigid to prevent any shifting or distortion of the piping or related work.

Pipe shall be cleaned of dirt and scale prior to installation and all joints swabbed clean before jointing. All fittings necessary for the satisfactory alignment and arrangement of piping and all necessary unions and cleanouts shall be adequately supported throughout and the weight thereof shall be carried independently of the pump casings or the equipment. All pipe work shall be mounted in a truly workmanlike manner with pipe work parallel with vertical and horizontal axis of

reference. All sections of pipe shall be rigidly bolted or joined together after being cut accurately to length in such a manner as to relieve any and all parts of equipment of undue strain resulting from closure of flanged or other joints or connections. Equipment shall be so positioned and aligned that no strain shall be induced within the equipment during or subsequent to the installation of pipe work. Threaded joints shall be made up with the best quality pure lead paste or approved equal, carefully and smoothly placed on the male threads only. All screwed joints shall be made tight with tongs and wrenches; caulking of any kind will not be permitted.

Use of thread cement or caulking to make joints tight is prohibited. All cut ends shall be reamed to full bore before assembly.

Flanged joints shall be made up square, with even pressure on the gaskets, and shall be watertight. Gaskets shall be heat quality rubber packing not less than 1/16 inch thick and compatible with wastewater applications. All gaskets shall be the full width of the flanges to which they are applied.

All piping within structure shall have bolted flanged joints except as authorized by the General Manager.

The owner or their agent shall, if requested by the District, demonstrate the disassembly and reassembly of the station piping.

Bolts and nuts for flanged joints shall be made of the best quality of defined iron or mild steel and shall have sound, well fitting threads. Bolts shall be provided with hexagonal chamfered heads and nuts. The underside of all bolt heads and nuts shall have true surfaces at right angles to the axis of the bolts. The lengths of the bolts shall be such that after joints are made up, the bolts shall protrude through the nuts, but in no case shall they protrude more than 1/2 inch. All bolts shall have an anti seize compound applied to all male threads.

Dehumidifiers, Heating, Ventilation, and Air Conditioning: Where necessary these types of equipment shall be installed such that the control of the environment within pumping stations and/or other District structures may be controlled.

Heaters shall be required in structures where cold sensitive equipment is located. Cabinets containing cold sensitive equipment shall be equipped with heat strips or heat ventilation. Piping located above ground or in such a manner that exposure to extreme cold would be evident if the heating system failed shall be avoided.

Dehumidifiers where required shall conform to the following. The moisture removing capability of the dehumidifier shall vary with the temperature and relative humidity. The minimum capacity rating at 80 degrees Fahrenheit shall be 15.5 pints per day at 60 percent relative humidity. The maximum capacity at 80 degrees Fahrenheit shall be 25 pints per day at 90 percent humidity. The dehumidifier shall be controlled automatically by an adjustable humidistat and low air temperature cut out with contacts of adequate capacity for the dehumidifier motor.

Ventilation shall be accomplished by using a ventilating blower with sufficient capacity in cubic feet per minute to ventilate the enclosing structure. Minimum guidelines for air changes per hour shall be taken from the current publication of NFPA 820, *Standard for Fire Protection in Water Treatment Pumping Facilities*. Telemetry equipment shall be connected to the gas detection system

to remotely notify District personnel in the event there is a detection of dangerous levels of explosive gases.

Air conditioning shall be installed if the horsepower requirements of the pump motors are such that overheating will be a consideration. The General Manager shall approve air-conditioning type and size.

Calculations for environmental conditions within the pump station shall be submitted with pump station improvement plans.

A-6.16 Pump Station Electrical Work

These Standards cover in general the Districts requirements. The developer shall have his/her engineers specify in additional detail all necessary items of electrical work not mentioned herein.

Materials: All materials shall be new, of the quality herein specified, free from defects and approved by the Underwriters' Laboratories for the purpose for which they are used. Materials shall be of uniform type and make throughout.

Equipment Identification: All panelboards, remote control switches, push buttons, terminal boxes, etc., shall be properly identified with a descriptive nameplate. Nameplate shall be made of 1/16-inch laminated plastic with black background and white letters. Size of letters shall be 1/8 inch high for equipment in device box or boxes and 1/4 inch high for panel board, terminal can, or larger items. Letters shall be machine engraved. Punched strip tape type nameplates and cardholders in any form are not acceptable.

Working Space: Provide adequate working space around electrical equipment in compliance with the National Electrical Code. In general, provide 6-1/2 foot of headroom and 42-inch minimum clear workspace in front of panelboards and controls.

Wire: Installed in conduit and control panels shall be stranded copper with 600 volt type "THHN" or "THWN" insulation. Direct burial cable shall not be allowed.

All other wires shall be stranded type copper wire of not less than 98 percent conductivity. Wires shall bear the Underwriters' label, be color-coded and be marked with gauge, type, and manufacturer's name on 24 inch centers. Wire splices and joints are allowed only in readily accessible junction boxes. #10 AWG or smaller shall be twisted together electrically and mechanically secured and insulated with approved type insulated electrical spring connectors Scotchlok or Ideal. Threaded type wire nut, porcelain or bakelite are not acceptable. Joints and connections for #8 AWG, or larger, shall be made with Burndy, T & B or approved equal, solderless tool applied pressure lugs and connectors. Un-insulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire and all irregular surfaces properly padded with "Scotchfill" putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1 or H.K. Porter #107.

Lace or wire tie conductors together in a neat and workmanlike manner in panelboards, wireways, raceways, pull boxes, and similar locations. Plastic wiring ducts are preferred as an alternate to lace or wire ties.

#12 AWG wire shall be the minimum size wire used for lighting and power circuits. Wires run in conduit shall conform to code regulations as to number of wires and conduit size. All wire ends shall be identified with Thomas & Betts WM-A-Z and/or WM-0-45 or approved equal. Identification shall be as shown on the electrical drawings.

Outlet Boxes: Shall be galvanized or sherardized, one-piece pressed steel type. Boxes for fixtures shall be not less than 4 inches and be equipped with fixture stud. Boxes shall be at least 1-1/2 inches deep. Boxes must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes in unfinished areas, installed exposed, shall be cast type "condulet" for switches and convenience outlets. Exposed boxes mounted below 6 feet from finished floor shall be cast type. **All** outlet plug-ins shall be ground fault circuit interrupter protected.

Codes, Rules, Regulations: All work shall be in full accordance with the latest edition of the National Electrical Code, California Electrical Code, and all state, federal, local, and other laws including the requirements of the serving utility company. However, when these specifications call for materials or construction of a better quality or larger sizes than required by the above mentioned rules and regulations, the provisions of the specifications shall take precedence.

Pilot Lights: Shall be of the oil-tight type and shall have push-to-test feature. Color of lens shall be red unless noted otherwise on drawings.

Switchboard Motor Controls: Shall generally consist of the following components: main circuit breaker; combination drawout circuit breakers and full voltage or soft-start motor starters; dry transformers; 120-volt, or as required panelboards; and all appurtenances.

The switchboard/motor controls shall consist of vertical sections to accommodate the circuit breakers, motor starters and control devices. The control structures shall be free-standing, designed and tested in accordance with the latest NEMA ICS 1970 standards, and shall be metal enclosed indoor type, completely interwired in accordance with steel with NEMA Class I Type B standards. Fabrication shall be of code gauge steel with 1-1/2 x 1-1/2 inch welded structural steel angles at the top and bottom of the frames. Control cabinets shall be designed for multiple alignment with continuous main horizontal bus and multiple sections riveted together.

Doors and blank cover plates shall be code gauge steel with gaskets around each door except panelboard. Doors shall use semi-concealed piano type hinges and be secured with slotted head, one-quarter turn captive speed fasteners or approved equal.

All bus bars shall be rectangular and formed of alcan tin-plated copper supported on fiberglass insulators and be properly braced to withstand mechanical stresses of not less than 22,000 amperes. Each combination, starting unit shall be mounted on a chassis, having a height as required by the particular size of the combination starter and circuit breaker unit. The chassis shall be so housed and constructed as to isolate the components from adjoining circuits. All motor starters shall be of the magnetic type for across-the-line starting with ambient compensated thermal and adjustable overload

protection in each phase. Overload heaters shall be sized for the load they are protecting. Motor starters and circuit breakers shall be I.T.E., Square D, or approved equal. Each combination starter shall be protected by a molded case circuit breaker having an interrupting capacity of not less than 14,000 amperes (symmetrical) and/or as called for on the drawings.

Adjustable time delay relays shall be provided, where shown on drawings, to start motors in sequence to limit starting demand on commercial power. Ammeters shall be used as necessary.

Time delay relays, control power transformers and auxiliary relays as necessary shall be provided in each cubicle and each internal and external component shall be clearly identified.

Components shall be mounted on removable back panels, drilled and tapped from the front. They shall not protrude into or restrict wireways. Push buttons, selector switches, meters and pilot lights shall be visible and operable externally, through gasketed, die-cut openings in the unit door. Thermal overload protective devices in combination starters and branch circuit protective devices shall have an external operating device. The circuit breaker shall be interlocked with the door so that the circuit must be de-energized before the door can be opened. A semi-concealed interlock "defeater" arrangement shall be provided. Provisions shall be made for padlocking the breakers with a minimum of three padlocks in the "on or off" position.

All plug-in equipment not mounted horizontally shall have readily removable physical restraining devices to prevent their vibrating loose and falling out.

A wiring diagram specifically detailed for each cubicle shall be furnished and installed inside each cubicle in a door-mounted holder.

A continuous ground bus shall extend through all motor control centers. Provide space heaters and thermostats with a calibrated dial adjustment in each section.

All motor control centers and switchboards shall be mounted on 1-1/2 inch concrete slab raised above normal floor level. Grouting will not be accepted. Provide anchor bolts. At locations shown on improvement plans, maintain a minimum of 2-inch air space between rear of switchboards and concrete or metal walls. The 1-1/2 inch concrete pads shall be provided under this section of the specifications to fit the exact size and shape of the switchboards.

Identification of electrical interior controls shall be of a plastic coated material, or other permanent type of marking, as approved by the General Manager. Dymo tape is not accepted. The permanently attached marking shall be attached to each of the following, but not necessarily limited to such: relays, timers, terminal blocks, starters, control transformers, etc. Identification of each item shall correspond to wiring diagram of final shop drawings.

A qualified representative of each manufactured item shall make final adjustments of equipment.

Lighting Fixtures and Lamps: Shall be as shown in the Fixture Schedule complete with lamps listed therein, and shall be U.L. approved, listed and labeled for use as installed. All fixtures of a kind shall be of identical manufacture, appearance and finish. Fixtures shall be located where shown on improvement plans. Where structural conditions require slight deviations, resulting layout shall be symmetrical and as approved by the General Manager.

Bussing: All bussing shall be of copper with sizes based on current code requirements or a current carrying capacity of not over 1,000 amperes per square inch of cross-section. Bars shall be ¼-inch thickness minimum. All contact surfaces shall be cleaned bright and silver-plated by submergence in an electrolytic bath. Busses shall be rigidly supported and thoroughly braced to match short circuit values of the main circuit breaker.

Circuit Breakers: The main and distribution circuit breakers shall be molded case type with trip ratings as called for in the schedule on the drawing.

Each circuit breaker shall be identified with an engraved laminated phenolic plate showing the load served or the function of the breaker. The nameplate shall be attached with oval head machine screws tapped into the front of the board, or some other equally effective means.

Grounding: Ground fittings shall be of approved manufactured type, installed and connected to conform with Code requirements. The neutral conductors and noncurrent-carrying parts of equipment at each installation shall be grounded in accordance with the applicable Code. Ground conductor shall be copper having a current capacity per N.E.C., but not smaller than No. 6 AWG. Exercise every precaution to obtain good contact at all panelboards, outlets, etc. Where it is not possible to obtain good contact, the conduits shall be bonded around the boxes with an insulated conductor, No. 6 AWG or larger, connected to the conduits by means of approved clamps. **All** outlet plug-ins shall be ground fault circuit interrupter protected.

All equipment cases, motor frames, etc., shall be completely grounded to satisfy the requirements of the N.E.C. and the Electrical Safety Orders.

Conduits: Rigid Steel Conduit shall be standard weight, mild steel pipe, zinc coated on the outside by a hot dipping, sherardizing, or metalizing process. The inside and outside of the conduit shall be finished with a protective coating.

Fittings, such as couplings, elbows, bends, etc., shall be subject to the same requirements as for rigid steel conduit. All couplings and unions shall be the threaded type assembled with red leaded joints made absolutely tight to exclude water. Unions shall be Crouse Hinds UNY or UNF or approved equal.

Electrical Metallic Pipe (E.M.T.) shall be cold rolled steel pipe with zinc coating on the outside and a protective enamel coating on the inside.

Fittings shall meet the same requirements for finish and material as E.M.T. They shall be the watertight compression type requiring the tightening of a nut. Indenters will not be allowed.

A flexible conduit shall be liquid tight except where used with a recessed light fixture. Conduit shall be galvanized with extruded polyvinyl covering and with watertight connectors. Minimum size shall be 1/2 inch except where supplied as part of approved manufactured assemblies.

All conduits shall be rigid, except that E.M.T. may be used at the following locations:

- In dry locations in furred spaces.

- In partitions other than concrete or solid masonry.
- For exposed work indoor above 6 feet.

Conduits installed in contact with the ground, in sand or gravel-fill shall be rigid steel with two protective coverings of Koppers' Bitumastic #50 or equal, applied after couplings and fittings are in place, each coat not less than 1/32 inch thick when dry. Conduit shall be run concealed in areas having finished ceilings and in furred walls. Conduit may be run exposed where so permitted by the General Manager. Exposed conduit below 6 feet shall be rigid type. Conduit run exposed shall be neatly installed parallel and at right angles to the structural members.

Conduit shall be fastened to the structure with pipe clamps. Conduits up to and including 1-1/2 inch trade size shall be supported at 5 foot intervals or less.

Cap conduit during construction by means of manufactured seals; swab out conduits before wires are pulled in.

Make watertight conduits projecting through roof by proper flashing.

Water Facilities Electrical Equipment: The electrical equipment used in the underground vaults or placed in water facilities must meet the National Electrical Code (NEC) requirements for Class I, Division I, groups C and D hazardous atmospheres. If sensors or other electrical equipment is used that does not meet the NEC requirements for hazardous atmospheres, they shall be electrically isolated with approved intrinsically safe barriers.

Telemetry: Will be required where treatment, storage, some transmission facilities, pump stations or well systems and other types of mechanical facilities are to be incorporated into the District Water System. The owner or their agent shall include a complete telemetry system, which shall conform to the existing District telemetry plans, and system. The General Manager shall approve the proposed system.

Tests: Upon completion of construction and adjustment of all equipment, all systems shall be tested under the direction of the General Manager to demonstrate that all equipment furnished and installed and/or connected under the provisions of these standards shall function electrically in the manner required.

All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and between phase conductors and ground not less than the requirements of the National Electrical Code. All circuits shall be tested for proper neutral connections.

As-Built Drawings and Operating Manuals: Shall be furnished in three bound sets, covering the following items:

- "As-Built" drawings of contract electrical documents showing clearly exact locations of all underground conduits as installed. All deviations from contract drawings shall be shown. The contractor on revised transparent ozalid prints of original tracings shall present this

information. As-built drawings shall be presented at completion of project and before final payment is due.

- "As-Built" drawings of all switchboards, panelboards, wiring diagrams and control equipment.
- Detailed control wiring diagrams, both schematic and construction wiring for all switchboards, motor starters, transformers. Included herein shall be copies of individual cubicle wiring diagrams posted inside motor starter cubicles as noted under switchboard specifications. All wires, connections, terminals, etc. shall have an individual identification code.
- Complete instruction, maintenance and overhaul manuals, clearly showing and explaining operation and overhaul of all starters, circuit breakers, controls and all electrical equipment.
- Renewal parts lists for all equipment requiring maintenance, adjustment or repairs.
- Complete step-by-step sequential explanation of relay contact and device operation for all controls. The written explanation shall be clearly coordinated to device symbols and numbers on the elementary wiring diagrams.
- Complete step-by-step sequential instructions and precautions for system start-up as well as system shut down.
- All material called for in c. through f. above shall be bound and indexed in stiff back, loose leaf, plastic covered binder.

Guarantee: The owner or their agent shall leave the entire electrical system in proper working order and shall, at their own expense, replace any work, material, or equipment furnished by him which develops defects within 1 year from the date of acceptance.