

Engineering and Construction

SPECIFICATIONS

for the

KEARNS IMPROVEMENT DISTRICT

For new developments within the District

Adopted by the Board of Trustees

March, 2004

Revised August 2005

Note: These specifications are not to be used for Capital Improvement Projects or other projects funded by the District, nor do they include specifications for reservoirs, pump stations, transmission lines, or other capital improvement related construction.

**KEARNS IMPROVEMENT DISTRICT
ENGINEERING AND CONSTRUCTION SPECIFICATIONS
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SECTION 1

GENERAL

1.1. Definitions and References

1.1.1 AS-BUILT DRAWINGS: Drawings which depict the improvements as installed, including field changes, revisions, etc. Sometimes called "Record Drawings". See also Section 1.3, "DRAWINGS".

1.1.2 BONDS: Instruments of security, furnished by the DEVELOPER and his surety in accordance with the DISTRICT Policy to assure the installation of improvements or to guarantee their performance.

1.1.3 CONTRACTOR: The person, firm or corporation retained by the developer who is responsible for all construction work in the development.

1.1.4 DISTRICT: The Kearns Improvement District

1.1.5 DISTRICT ENGINEER: The Licensed Engineer, employed or retained by the DISTRICT, including such agents and assistants as are authorized to represent him, who represents the DISTRICT.

1.1.6 DRAWINGS: The part of the approved plans which show the characteristics and scope of the WORK to be performed and which have been approved by the DISTRICT ENGINEER. See also Section 1.3, "DRAWINGS".

1.1.7 ENGINEER: The company or firm and its employees retained by the developer providing the engineering services for the development; also referred to as project engineer or engineer of record.

1.1.8 INSPECTOR: The authorized agent of the DISTRICT or DISTRICT ENGINEER assigned to make detailed inspections of any or all portions of the water and sewer system construction.

1.1.9 LATERAL: The sewer line and appurtenances extending from 2 feet outside of the building to the public sewer, including the connection to the sewer main.

1.1.10 OWNER or DEVELOPER: Person, firm or corporation who initiates the project and authorizes expenditures for its construction.

1.1.11 PROJECT: The undertaking to be performed as provided in the DRAWINGS and SPECIFICATIONS.

1.1.12 SECONDARY WATER SYSTEM: A water system, separate from the culinary or potable system, which is intended to provide irrigation water to large users, such as parks, schools, churches and industrial users. The water used in such a system may be reuse water, canal water, well water, or combinations of such.

1.1.13 "SHALL"/"SHOULD": Where the term "shall" is used, it is intended to mean mandatory requirement. Other terms such as "should", "may", and "recommend" indicate discretionary use.

1.1.14 SPECIFICATIONS: Written description of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.1.15 SUBCONTRACTOR: An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other Subcontractor for the performance of a part of the WORK at the site.

1.1.16 SUBSTANTIAL COMPLETION: That date when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the DRAWINGS and SPECIFICATIONS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended. Such acceptance shall be the date when the Board of Trustees of the DISTRICT accepts the improvements.

1.1.17 SUPPLIER: Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

1.1.18 WORK: All labor necessary to produce the construction required by the DRAWINGS and SPECIFICATIONS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.1.19 AWWA References (use latest edition)

1.1.19.1 AWWA C104/A21.4, ANSI Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

1.1.19.2 AWWA C110/A21.10, ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3” through 48”, for Water.

1.1.19.3 AWWA C111/A21.11, ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

1.1.19.4 AWWA C151/A 21.51 ANSI Standard for Ductile Iron Piping, Centrifugally Cast, for Water or Other Liquids.

1.1.19.5 AWWA C500, Metal Seated Gate Valves for Water Supply Service.

1.1.19.6 AWWA C502, Dry-Barrel Fire Hydrants.

1.1.19.7 AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.1.19.8 AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

1.1.19.9 AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings 4 In. Through 12 In. for Water Distribution.

1.1.19.10 AWWA C909, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 12 In. for Water Distribution.

1.1.20 ASTM References (use latest edition)

1.1.20.1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

1.1.20.2 ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

1.1.20.3 ASTM A185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

1.1.20.4 ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

1.1.20.5 ASTM B62 Standard Specification for Composition Bronze or Ounce Metal Castings.

1.1.20.6 ASTM B88 Standard Specification for Seamless Copper Water Tube.

1.1.20.7 ASTM B124 Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.

1.1.20.8 ASTM C33 Standard Specification for Concrete Aggregates.

1.1.20.9 ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

1.1.20.10 ASTM C150 Standard Specification for Portland Cement.

1.1.20.11 ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete.

1.1.20.12 ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

1.1.20.13 ASTM C478 Standard Specification for Pre-cast Reinforced Manhole Sections.

1.1.20.14 ASTM D3034 Standard Specification for Type PSM Poly(vinyl chloride) (PVC) Sewer Pipe and Fittings.

1.1.20.15 ASTM D3139 Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.1.20.16 ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.

1.1.21 Miscellaneous References

1.1.21.1 Federal Specification SS-S-210(A) Sealing Compound, Preformed Plastic, for Expansion Joints & Pipe Joints.

1.1.21.3 MSS SP-11 Gray-Iron and Ductile-Iron Tapping Sleeves.

1.1.21.4 AASHTO T-180 (Method D-Modified), Moisture-Density Relation of Soil using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop.

1.1.21.5 ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

1.1.21.6 ACI 305R Hot Weather Concreting

1.1.21.7 ACI 306R Cold Weather Concreting

1.1.21.8 ACI 347 Guide to Formwork for Concrete

1.1.22 Abbreviations

1.1.22.1 AWWA: American Water Works Association

1.1.22.2 ASTM: American Society for Testing and Materials

1.1.22.3 MSS: Manufacturer's Standardization Society

1.1.22.4 AASHTO: American Association of State Highway and Transportation Officials

1.1.22.5 ACI: American Concrete Institute

1.1.22.6 ANSI: American National Standards Institute

1.2. Design Criteria

1.2.1 Water Systems

1.2.1.1 Water lines shall be not less than 8" in diameter, except in cul-de-sacs not over 250 feet long, where the water line may be 6" diameter. In no case shall pipe be smaller than required to convey the water demand expected over the life of the structure, based on the DISTRICT'S capital facilities master plan.

1.2.1.2 Water meters shall be located within 5 feet of the middle of the lot unless otherwise approved by the DISTRICT ENGINEER.

1.2.1.3 Water lines shall be buried at a depth of not less than 48" from the top of pipe to finished surface.

1.2.1.4 Water lines shall be located on the north or east side of the street. The line shall in all cases be located under the driving surface of the road, and shall be not closer than 2'-6" to the lip of the gutter.

1.2.1.5 Fire hydrants shall be located in accordance with the Fire Department having jurisdiction. All cul-de-sacs shall have a fire hydrant located at the end of the water line to allow for flushing the line. Fire hydrants shall be provided with an auxiliary valve in the road adjacent to the hydrant.

1.2.1.6 Gate valves shall be located at all tees or crosses. At least two valves shall be provided at tees, and three at crosses. Tees serving only fire hydrants shall have an auxiliary valve, with no other valves required. No pipe shall extend more than 500 feet without a valve.

1.2.1.7 All changes in direction shall require the installation of appropriate thrust blocks to resist the water pressure acting against the fitting. Alternatives to thrust blocks must be approved by the DISTRICT ENGINEER. Pipe laid in a curve consistent with manufacturer's recommendations need not be provided with thrust blocks.

1.2.1.8 Meters larger than 1 inch shall be provided with a meter vault. The interior dimensions of the vault shall be subject to review and approval by the DISTRICT ENGINEER, and shall be sufficient to provide access and service to all devices required to be located in the vault.

1.2.1.9 Meters larger than two inches shall be compound unless used solely for irrigation purposes.

1.2.1.10 Backflow devices shall be provided as necessary to protect the public water system as required by State rule.

1.2.1.11 A frost-protected water sampling station of a type and manufacturer approved by the DISTRICT ENGINEER shall be provided in any development which, in all its phases, consists of 100 lots or more. For 300 or more lots, two such sampling stations shall be provided. The location shall be such as to minimize hazards from traffic, and shall be subject to approval.

1.2.2 Sewer Lines

1.2.2.1 Sewer lines shall be not less than 8" in diameter, nor shall they be smaller than that required to convey the volume of sewage intended to be carried in that line over the life of the installation, based on the DISTRICT'S capital facilities master plan.

1.2.2.2 Manholes shall be spaced at a distance of not more than 400 feet.

1.2.2.3 Sewer lines shall be constructed in a straight line between manholes. No horizontal curves are allowed. Sewers in public rights of way shall be near the centerline of the street, (generally 0' to 5' south or west of the centerline). The alignment shall be under the driving surface, and in no case closer than 3' to the lip of the gutter.

1.2.2.4 Sewer lines shall be located at a sufficient depth to allow all lots serviced by it to have basement sewers drained by gravity. In no case shall there be less than 4' from the top of the pipe to finished grade, unless specifically approved by the DISTRICT ENGINEER.

1.2.2.5 Where the project is required to provide new street improvements over the sewer alignment and the sewer will serve properties upstream of the project, the sewer main must be designed across the full property frontage or to the limits of the street improvements, whichever is greater.

1.2.2.6 When a sewer main extension ends at a manhole and the sewer can reasonably be expected to be extended further in the future, include in the design a 3' long stub out of the manhole with a plug or cap for future connection. Size and slope of the stub shall be consistent with good engineering design practices.

1.2.2.7 Connect new mains to the existing system at existing manholes or by constructing a new manhole over the point of connection.

1.2.2.8 The sewer must be designed with a slope to be able to serve its entire tributary area. Slopes shall not be less than the following:

<u>Sewer pipe size</u>	<u>Minimum Slope</u>
8"	0.004
10"	0.0028
12"	0.0022

Other sewer pipe sizes or slopes are subject to specific review and approval by the DISTRICT ENGINEER.

1.2.2.9 Where two sewer lines converge in one manhole, and the design flow of one is more than three times the design flow of the other, the invert of the line with smaller flow shall be placed at the top of the pipe with the larger flow, unless a different elevation is approved by the DISTRICT ENGINEER.

1.2.3 SECONDARY WATER SYSTEMS

1.2.3.1 Water lines shall be placed at or near the centerline of the road. They shall be located in a trench separate from the water line.

1.2.3.2 Water lines shall be placed at a depth of not less than 36" below finished grade, and should not be deeper than 54" below finished grade.

1.2.3.3 Pipes sizes shall be determined by the DISTRICT ENGINEER.

1.2.3.5 Unless otherwise directed by the DISTRICT ENGINEER, secondary water laterals shall not be provided to individual residences.

1.2.3.6 Provision shall be made to drain the SECONDARY WATER SYSTEM into an approved storm drain or other facility, unless the pipe is placed at least 48" below grade at all locations.

1.2.3.7 SECONDARY WATER SYSTEMS may not be required in all developments. Where such systems are required, the DISTRICT ENGINEER shall notify the developer as part of the project review process.

1.3. Drawings

1.3.1 DRAWINGS shall be prepared on D sized drawings, shall be drawn to scale, and shall provide sufficient detail to allow construction of the required improvements with no other information other than that provided in the SPECIFICATIONS and DRAWINGS. Plan and profile drawings shall be provided, showing existing and final contours. A material take-off, listing the quantities of proposed pipe, manholes, valves, hydrants, etc., shall be provided for bond calculation purposes.

1.3.2 In case of conflict between the DRAWINGS and SPECIFICATIONS, the DRAWINGS shall govern. Figure dimensions on DRAWINGS shall govern over scale dimensions, and detailed DRAWINGS shall govern over general DRAWINGS.

1.3.3 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the DISTRICT ENGINEER. They shall also be reported to the ENGINEER who shall promptly correct such inconsistencies or ambiguities. WORK done by the CONTRACTOR after his discovery, and before resolution, of such discrepancies, inconsistencies or ambiguities, is at the CONTRACTOR'S risk.

1.3.4 DRAWINGS will be reviewed by the DISTRICT ENGINEER, and the ENGINEER will be informed of any required corrections. Upon receipt of 4 sets of DRAWINGS not requiring further corrections, the DRAWINGS will be stamped approved, and will, together with these SPECIFICATIONS, become the design upon which all construction shall be based.

1.3.5 AS-BUILT DRAWINGS

1.3.5.1 Upon completion of the work, the ENGINEER shall prepare a set of AS-BUILT DRAWINGS which incorporate all field changes. Upon approval and acceptance of the AS-BUILT DRAWINGS, and, as a condition of bond reduction, the ENGINEER shall provide a digital copy by electronic means, to the DISTRICT suitable for incorporation into the DISTRICT'S GIS System.

1.3.5.2 Two dimensional ties are required to the 2x4 lateral marker. These ties shall be from the two front property corners, or a "nail-in-curb" projected from the property corner, from the same side of the roadway, unless other points of reference are specifically approved by the DISTRICT ENGINEER.

1.3.5.3 Stationing at all laterals and manholes is required to be shown with regard to actual field conditions.

1.3.5.4 Any changes differing appreciably from the approved design drawings (i.e. sewer line and manholes relocated to opposite sides of roadways; sewer line shortened or lengthened 5 feet or greater; invert elevation changes) shall be shown graphically correct to reflect field conditions.

1.3.5.5 All items shown on the profile, including slopes, inverts, and lengths, are required to be changed to reflect field conditions. These items are also required to be shown graphically correct.

1.3.5.6 The ENGINEER shall provide written certification that a field survey of existing "as-built" sanitary sewer and waterline information assessment (field verifiable information) has been performed.

The ENGINEER shall certify that, to the best of his/her knowledge and available information, which has been incorporated into the AS-BUILT DRAWINGS, all construction and procedures have been completed in general accordance with the DISTRICT Final Design Approved DRAWINGS and any approved revisions. The ENGINEER shall provide his/her stamp and signature on all AS-BUILT DRAWINGS.

1.3.5.7 The AS-BUILT DRAWINGS shall include all sheets which comprise the original set of DRAWINGS.

1.3.5.8 Type and size of pipe installed shall be indicated on the AS-BUILT DRAWINGS.

1.3.5.9 The location of “as-built” sewer and water lines within easements or platted Rights-of-way shall be verified. If revised easements are required, a signed copy of easements shall be submitted with the AS-BUILT DRAWINGS.

1.3.5.10 “As-built” or final manhole rim elevations are not required to be presented on the AS-BUILT DRAWINGS.

1.3.5.11 Any pertinent field information obtained by the CONTRACTOR shall be required to be shown on the AS-BUILT DRAWINGS.

1.4. Preconstruction Meeting

1.4.1 A preconstruction meeting shall be held prior to starting work on the PROJECT. The DEVELOPER, the CONTRACTOR, and the ENGINEER shall attend at the DISTRICT offices, with the INSPECTOR, the DISTRICT ENGINEER, and other DISTRICT staff.

1.4.2 Prerequisite to the preconstruction meeting is the payment of any required fees, and the posting of any required BONDS. Absent these submittals, a preconstruction meeting may not be held without prior approval of the DISTRICT ENGINEER.

1.4.3 The meeting shall be held at a time designated by the DISTRICT ENGINEER.

1.5 Rights-Of-Way and Easements

1.5.1 The DEVELOPER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the approved DRAWINGS and SPECIFICATIONS, unless otherwise mutually agreed. The requirements of the Utility Extension Agreement shall prevail in all such matters.

1.5.2 The DEVELOPER shall record the subdivision plat with the County Recorder, which plat shall indicate all easements and rights-of-way necessary for the installation of the PROJECT improvements. One copy of the plat shall be submitted to the DISTRICT with the design drawings for approval.

1.5.3 The DEVELOPER shall record with the County Recorder any other off-site easements that are required to complete the PROJECT, and provide a copy of the recorded easement to the DISTRICT before bond reduction. Such easements shall be clearly in favor of the DISTRICT, allowing access for maintenance, repair, excavation, etc., shall be prepared in a form acceptable to the DISTRICT and shall be graphically shown on the DRAWINGS

1.5.4 Easements shall be of sufficient width to allow for maintenance, repair, and replacement of the improvements installed there.

1.6. Correction of Work

1.6.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the DISTRICT ENGINEER for failure to comply with the approved PLANS and SPECIFICATIONS

whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the approved PLANS and SPECIFICATIONS.

1.6.2 All removal and replacement work shall be done at the CONTRACTOR'S expense.

1.6.3 The DISTRICT ENGINEER shall have authority to cause further work to be suspended or stopped until remedial action on substandard work has been undertaken or completed.

1.7 Warranty

1.7.1 Upon acceptance of the improvements by the DISTRICT, the CONTRACTOR shall warrant and guarantee that the improvements provided and every part thereof will remain in good condition for a period of not less than 18 months. Also, the CONTRACTOR shall furnish a BOND in an amount of 20 percent of the calculated BOND amount for all improvements. This BOND shall remain in effect for the full period of the guarantee specified and shall be executed in favor of the DISTRICT and shall be in a form acceptable to the DISTRICT. Under normal circumstances this bond will be a retention of 20% of the original bond submitted to guarantee performance.

1.7.2 The period of this guarantee shall be eighteen (18) months for all sewer and water construction. This guarantee period shall begin on the date of SUBSTANTIAL COMPLETION and conditional acceptance by the DISTRICT.

1.7.3 The CONTRACTOR agrees to make all repairs and/or replacements for all defects in workmanship, materials and equipment during the guarantee period, ordinary wear and tear and acts of God excepted, without additional charge or cost to the District.

The CONTRACTOR shall maintain all improvements until the date of SUBSTANTIAL COMPLETION, at which time the DISTRICT will assume normal maintenance

1.7.4 The determination of the necessity for repairs required by Section 1.7.3 rests entirely with the DISTRICT, whose decision shall be final and obligatory upon the CONTRACTOR.

1.8 Surveys

1.8.1 The DEVELOPER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK together with a suitable number of bench marks adjacent to the WORK as shown in the SPECIFICATIONS and DRAWINGS. The CONTRACTOR shall develop and make all detail surveys needed for construction such as slope, stakes, batter boards, and other working points, lines, elevations and cut sheets.

The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall re-establish such points and shall be responsible for any mistakes that may be caused by their loss or disturbance. The points and stakes shall be provided until the INSPECTOR has accepted the work.

1.8.2 Prior to commencement of work under this PROJECT, the DEVELOPER shall establish lot corner stakes showing plan and elevation references to curb and gutter and sidewalks.

1.8.3 Additional stakes shall be provided by the CONTRACTOR where the INSPECTOR determines that lot corner stakes established by the DEVELOPER are insufficient to adequately define line and grade; such as at intersections, and beyond the limits of the PROJECT. More particularly, alignment and grade data shall be provided to include the following:

1.8.3.1 Sanitary Sewer Lines. Offset and depth of cut measurements for sewer lines shall be provided for laser instrument setting at manholes, 50-feet therefrom, at the midpoint of the span between manholes, and at the next manhole. If laser instruments are not used, see section 1.9.2, "CONTRACTOR'S Responsibility".

1.8.3.2 Water lines. Offsets to water lines and appurtenances in subdivisions shall be referenced from lot corner or curb and gutter stakes. For water line extensions beyond PROJECT boundaries, or in developments other than subdivisions, line stakes shall be provided at valves, bends, hydrants and not to exceed 100-feet.

1.9 Contractor's Responsibility

1.9.1 The CONTRACTOR shall be responsible for the accuracy of the measurements from the stakes or marks to the work.

1.9.2 Where laser instruments are not used to maintain alignment and grade, the CONTRACTOR shall establish additional alignment and grade stakes as required for proper execution of the work. These additional stakes shall be established from the control stakes.

Where string line is used to maintain grade instead of laser equipment, the CONTRACTOR shall at all times have a minimum of 150-feet of string line stretched ahead of the work and 100-feet behind. String lines in lieu of laser equipment shall not be permitted for sewer line placement.

1.9.3 The CONTRACTOR shall be responsible for the accuracy of all stakes for alignment and grade established by the CONTRACTOR.

1.9.4 The CONTRACTOR shall be responsible for the protection of all control stakes established by the ENGINEER.

1.9.5 Finish grade elevation for manholes, fire hydrants, etc. shall be transferred from property corners and curb elevations, or as directed by the INSPECTOR.

1.10 Permits

Permits and licenses of a temporary nature necessary for the prosecution of the work shall be secured and paid for by the CONTRACTOR. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the SPECIFICATIONS and DRAWINGS are at variance therewith, he shall promptly notify the DISTRICT ENGINEER in writing. Permanent easements and rights-of-way shall be secured by the DEVELOPER, as described in the Development Extension Agreement and Section 1.5.

SECTION 2 MATERIALS

2.1 Water System

2.1.1 Pipe: This section covers water transmission pipe and fittings for the pressurized transmission and distribution of potable water for municipal service.

2.1.1.1 PVC

2.1.1.1.1 Polyvinyl Chloride (PVC) Pipe shall meet or exceed the requirements of AWWA C900 or AWWA C909. The pipe shall be homogeneous throughout; and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be uniform as commercially practicable in color, opacity, density and other physical properties. Pipe surfaces shall be free from nicks, scratches, gouges and other imperfection that might weaken the pipe wall or cause leakage at joints. The PVC pipe shall bear the seal of approval of the National Sanitation Foundation for potable water service.

2.1.1.1.2 Pressure class rated pipe shall provide not less than the following allowable working pressures as determined by AWWA C900 or AWWA C909:

Allowable Working Pressure Pressure Class	psi	Minimum Dimension Ratio (DR)
150	150	18
200	200	14

2.1.1.1.3 The dimensions and tolerances of the pipe barrel and bell ends shall conform to the applicable requirements of AWWA C900 or AWWA C909 for the pressure-class specified for cast iron outside diameter pipe.

2.1.1.1.4 All fittings and accessories shall be as manufactured or recommended by the pipe manufacturer, or approved equal, and have bell and spigot configurations identical to that of the pipe. The pipe fittings may be manufactured from PVC, ductile iron or welded steel, and shall have strength equal to or greater than the pipe to which they attach. Fittings shall be installed as specified by the manufacturer.

2.1.1.1.5 The pipe and fittings shall be furnished with integrally thickened bell and spigot ends; for joining with a solid, uniform cross-sectional elastomeric gasket as the sealing element. Couplings are not permitted. The gasket shall be contained within the bell end. The gasket shall not be required to support the weight of the pipe when two sections are joined; but shall serve only as a seal, and shall conform to ASTM D3139. The critical sealing dimensions of the bell, spigot, and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to effect a positive seal under all combinations of the joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent welded joints are not permitted unless written approval is obtained from the DISTRICT ENGINEER prior to welding the joint.

2.1.1.1.6 Special Requirements.

2.1.1.1.6.1 Marking on the pipe shall include the nominal cast iron pipe size, AWWA C900 or AWWA C909 Class and dimension ratio (DR), the NSF seal of approval, and the manufacturer's name or trademark. Marking interval shall be not more than 5 feet.

2.1.1.1.6.2 PVC pipe is permitted for 12" and smaller pipe sizes; 14" and larger pipe shall be ductile iron, unless specifically approved by the DISTRICT ENGINEER.

2.1.1.1.6.3 A tracer wire must be included to facilitate location of the pipe after burial.

2.1.1.2 Ductile Iron

2.1.1.2.1 Pipe shall conform to all requirements of the latest revision of AWWA C151/A 21.51.

2.1.1.2.2 Minimum thickness for Ductile Iron Pipe shall be Class 51 for sizes less than 6-inch, and Class 50 for 6-inch and larger, unless otherwise shown on the approved plans.

2.1.1.2.3 Joints.

2.1.1.2.3.1 Mechanical Joints. All mechanical joints shall meet requirements of AWWA C110/A21.10 and AWWA C111/A21.11. All gasket surfaces shall be smooth, except for specified masking, and free from imperfections. Gaskets shall conform to tests in accordance with specifications, and shall be not over one year old. Bolts shall meet all requirements of the above specification, honoring all characteristics, tolerances and tests.

2.1.1.2.3.2 Push-on Joints. All push-on joints shall meet the requirements of AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old. Lubricants shall be non-toxic and have no deteriorating effects on gasket material. It shall not impart taste to water in a pipe. Lubricants shall conform in every way to AWWA C111/A21.11.

2.1.1.2.3.3 Flanged Joints. Flanged joints shall be bolted firmly with machine, stub or cap bolts of proper size. Flanges shall be cast integrally with the pipe; or shall be screwed on for threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. All flanges shall meet requirements of AWWA C110/A21.10. Unless otherwise specified, bolts and nuts shall be made of the best quality steel and have clean, well fitting threads. Bolts shall be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange; and shall be of a length so that when installed, no more than 3/8-inch or less than 1/8-inch extends past face to nut. A gasket of proper size shall be installed for each flanged joint: ring type or full face as shown on the drawings.

2.1.1.2.3.4 Compression Joints. Compression joints shall be mechanical joint sleeve, Smith-Blair 441; or flange adapter, Smith-Blair Type 900; or approved equal.

2.1.1.2.4 Linings and Coatings. All ductile iron pipe shall have cement mortar lining and conform to AWWA C104/A21.4. All ductile iron pipe shall be coated with coal tar pitch varnish.

2.1.1.2.5 Fittings.

2.1.1.2.5.1 Mechanical Joint Fittings. Mechanical joint fittings shall conform to AWWA C110/A21.10 and shall be coated with coal tar pitch varnish.

2.1.1.2.5.2 Push-on Fittings. Push-on fittings shall conform to AWWA C111/A21.11 and shall be coated with coal tar pitch varnish.

2.1.1.2.5.3 Flanged Fittings. Flanged fittings shall conform to AWWA C110/A21.10 and shall be coated with coal tar pitch varnish.

2.1.1.3 HDPE

High Density Polyethylene Pipe (HDPE) shall not be permitted without written approval of the DISTRICT ENGINEER. DEVELOPERS proposing such pipe shall be required to provide a specification for review and approval by the DISTRICT. If approved, a tracer wire must be included to facilitate location after burial.

2.1.1.4 Copper

2.1.1.4.1 Pipe. Copper pipe and tubing shall conform to ASTM B88. Copper pipe for direct burial or concrete encasement shall be Type "K" soft copper. Copper pipe for other exposure shall be Type "L" hard drawn copper.

2.1.1.4.2 Fittings. Fittings for pipe ½-inch and larger shall be pure wrought copper (no bronze or brass) of the solder-joint type. The fittings shall have a thickness of not less than the thickness of the pipe. The use of flare-type joints and compression couplings is also acceptable. Solder for use on solder-joint fittings shall be Sil-fos or equal soldering alloy. Lead-tin solder shall not be used under any circumstances. Joints shall be made strictly in accordance with the manufacturer's instructions.

2.1.1.5 Polyethylene. Polyethylene pipe shall not be permitted for water service connections between the water main and the meter without written approval of the DISTRICT ENGINEER. DEVELOPERS proposing such pipe shall be required to provide a specification for review and approval by the DISTRICT. If approved, a tracer wire must be included to facilitate location after burial.

2.1.2 Hydrants

2.1.2.1 General. Fire hydrants shall be provided with auxiliary gate valves and cast iron valve boxes as indicated on the drawings and specified herein. Hydrants shall conform to requirements of AWWA C502, as supplemented and modified herein.

2.1.2.2 Hydrants shall be as manufactured by Mueller, or approved equal.

2.1.2.3 Hydrants shall have 5-inch size main valve opening.

2.1.2.4 Hydrants shall be designed for 200 psig minimum working pressure. Hydrants shall be constructed in three sections with bolted joints; and the entire internal operating mechanism shall be repairable from above ground without any digging, when the hydrant is in place.

2.1.2.4.1 Hydrants shall have two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle. Nozzle threads shall be National Standard.

2.1.2.4.2 Inlet connections shall be mechanical joints or flanged, conforming to AWWA C110.

2.1.2.4.3 The hydrant shall have a breakable flange, at ground level when installed: flange and internal mechanism shall be designed so that, in case of accidental breaking, the hydrant sections will separate without damage to the barrel, and the main valve will remain closed to prevent flooding. Safety flanges depending only on notched bolts for frangibility will not be acceptable.

2.1.2.4.4 Opening Rotation. Operating nut shall turn counterclockwise to open the main valve.

2.1.2.4.5 Drain Valve. The drain valve shall be threaded, NPT.

2.1.2.5 Buried portions of the hydrant shall be painted with two coats of coal tar enamel. Exposed portions shall be painted with a primer coat and a finish coat which shall be vermilion red.

2.1.2.6 An auxiliary gate valve and cast iron valve box shall be supplied. The valve shall be the same size as the hydrant inlet connection, and the valve and valve box shall conform to requirements for valves, Section 2.1.6.

2.1.2.7 Concrete for thrust blocks and collars shall be as specified in Section 2.3.

2.1.3 Water Service Connections.

2.1.3.1 Service connections shall be made by means of a service saddle, brass double strapping tapping saddle Ford 202B series or approved equal on PVC mains. Direct taps may be used with approval of the DISTRICT ENGINEER.

2.1.3.2 The corporation stop shall be a Ford 700B or approved equal, of the same size as the diameter of the water service lateral.

2.1.3.3 The yoke or setter shall be Ford 70 Series Coppersetter, model VBHC72-21W-11-33, or approved equal. Model may be adjusted as required for meter size.

2.1.4 Meter boxes. Meter boxes for 5/8" meters in 3/4 inch setters shall be 18" diameter precast concrete, provided with a cast iron lid suitable for wand reading of meters, and with "Water Meter" cast into the top. White ADS meter boxes may be utilized with prior approval of the DISTRICT ENGINEER.

2.1.5 Valve Boxes. All valves to be buried shall have cast iron valve boxes, firmly supported and maintained, centered and plumb over the wrench nut of the valve. The boxes shall be of the extension type with 39- to 60-inch extension. Boxes shall be equal to those manufactured by Tyler Pipe Industries #664-S, or approved equal. Lids shall have the designation "Water" and "K.I.D." cast into them.

2.1.6 Valves. Valves shall be bronze-mounted, double-disc, iron body gate valves, and, when so indicated or specified, shall have enclosed spur or bevel gearing. Valves shall have minimum working pressure rating of 150 psi. Valves shall be non-rising stem, unless rising stems are indicated on the drawings. Valves shall meet the requirements of AWWA Specification C-500, except as modified herein. Valves shall operate drip tight with full pressure on either side of the valve and no pressure on the other side. Packing and gearing shall be replaceable while the valve is in service. End connections shall be flanged, push-on joint, mechanical joint, or slip joint.

2.1.6.1 The flanges and drilling shall conform to dimensions of ANSI Standards for Class 125 or Class 250, for cold water. The joints shall be manufactured to conform with requirements of AWWA C110/A21.10.

2.1.6.2 Valves shall be so designed that the gates and stem are clear of the full specified diameter when open.

2.1.6.3 All valves shall turn clockwise to close.

2.1.6.4 When so indicated or specified, valves shall have cut steel spur gears or bevel gears in a factory-installed, enclosed gear case. The case shall be air, water, and oil tight with seals on all shafts. A worm gear position indicator shall be provided with geared valves.

2.1.6.5 The operating nut or wrench nut shall be cast iron, and shall be carefully fitted to the top of the valve stem, secured to the stem by a threaded nut; with threads' ½-inch minimum, National Coarse. The operating nut shall be 1-15/16-inch square at the top, 2-inch square at the base, and at least 1-3/4-inch high. There shall be a round flange at the base with a distinct arrow cast on the nut, and lettering to indicate direction to close or open.

2.1.6.6 The stems for all valves shall be of corrosion resistant material.

2.1.7 Fittings. All pipe fittings shall be suitable to the pipe to which they are connected, and shall be installed in accordance with the manufacturer's recommendations.

2.1.8 Bedding. All water piping shall be bedded in sand.

2.1.9 Vaults. Vaults shall be constructed of concrete, either cast-in-place or pre-cast. They shall be constructed to the dimensions shown on and otherwise in conformance with the approved plans. Concrete shall conform to the requirements of Section 2.3.

2.2 Sewer System

2.2.1 Pipe. This specification identifies pipe and fittings suitable for non-pressure drainage of wastewater.

2.2.1.1 PVC Sewer pipe

2.2.1.1.1 All PVC Pipe and fittings shall be suitable for use as gravity sewer conduit. Provisions shall be made for contraction and expansion at each joint with a rubber ring, and the pipe shall be constructed with integral-wall bell-and-spigot push-on type joints. All PVC gravity sewer pipe and fittings shall meet or exceed all of the requirements of ASTM D3034. Minimum wall thickness shall be SDR-35.

2.2.1.2 Fittings. All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal, and shall have bell and spigot configuration's compatible with that of the pipe. The fittings shall be manufactured of the same materials as the pipe to which they attach, and shall be installed as specified by the pipe manufacturer.

2.2.1.3 Joints. The pipe and fittings shall be furnished with push-on type bell and spigot ends for joining with a solid, uniform cross-sectional rubber gasket as the sealing element. The rubber gasket shall meet the requirements of ASTM 3212. The bell shall consist of an integral wall section with the rubber gasket factory-assembled and securely locked to prevent displacement. The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's

standard dimensions and tolerances. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to effect a positive seal under all combinations of the joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent welded joints will not be allowed for pipe sizes greater than 6" unless written approval is obtained from the DISTRICT ENGINEER prior to welding the joint.

2.2.1.4 Each pipe shall be clearly marked at 5-foot intervals to show the manufacturer's name or trademark, nominal pipe size, ASTM Designation, and have the material designation "PVC". All fittings shall be marked in a similar manner.

2.2.2 Manholes

2.2.2.1 Pre-cast Sections. Except as otherwise specified herein or indicated on the drawings, manholes shall be constructed using pre-cast base, riser, cone or flat slab top, and grade ring sections conforming to ASTM C478, Pre-cast Reinforced Manhole Sections.

2.2.2.2 Concrete. Cast-in-place concrete, and grout, shall conform to applicable requirements of Section 2.3.

2.2.2.3 Base. Pre-cast base shall be manufactured by W.R. White Company, or Amcor, Inc., or approved equal.

2.2.2.4 Riser. Riser section(s), extending from the top of the base to the bottom of the cone section or flat slab top, shall be pre-cast sections.

2.2.2.5 Top Sections. Manhole tops shall be pre-cast sections, either eccentric cone sections or flat slab tops. Top opening shall be 30-inches minimum. Flat slab tops shall be used only where indicated on the drawings. Design shall be based on H-20 live load and one-foot maximum earth cover.

2.2.2.6 Joints. Wall joints, except grade rings, shall have male and female ends so that when the riser(s) and top are assembled, the interior wall surface of the manhole shall be a uniform and continuous surface within the tolerance of ASTM C478. Joints between pre-cast sections, except grade rings, shall be sealed with preformed plastic gaskets conforming to Federal Specifications SS-S-210(A), or with approved bituminous mastic sealant. Plastic gaskets shall be RUB'R-NEK L-T-M as manufactured by K.T. Snyder Company of Houston, Texas, or approved equal.

2.2.2.7 Frames and Covers. Frames and covers shall have a 22-3/4-inch diameter clear opening; and shall be gravity, solid, non-rocking, heavy duty type meeting requirements for standard manhole rings and covers. Covers shall have pickholes for opening. Covers shall have 3/4" diameter vent holes. Castings shall be of uniform quality free of porosity, hard spots, and shrinkage defects. Covers shall have a low profile waffle pattern similar to D&L Supply A 1181-WP and shall have "Sewer" and "Kearns Improvement District" cast into them.

2.2.2.8 Manhole Steps. Provide plastic encased steel steps in walls, at spacing and orientation indicated on standard drawings, MANHOLE DETAILS. Steps shall be cast in place and shall be copolymer polypropylene-encased, 60,000 psi tensile strength steel, Model PS1-PF manhole steps as manufactured by M.A. Industries, Inc., or approved equal.

2.2.2.9 Drop Manholes. Drop manholes shall not be permitted without specific approval of the DISTRICT ENGINEER.

2.2.3 Laterals. Sewer laterals to customer properties shall be located at a depth and location so as to provide gravity service to any portion of the property.

2.3 Concrete

2.3.1 General. Concrete for use in the WORK shall conform to the requirements of this section.

2.3.2 Materials

2.3.2.1 Cement. Cement shall conform to ASTM C150. Type II low-alkali cement shall be used for all work, except that Type III low-alkali shall be used when the ambient temperature is lower than 40 degrees F.

2.3.2.2 Aggregates Concrete aggregates shall conform to the requirements of ASTM C33.

2.3.2.2.1 Fine Aggregates. Fine aggregate shall be within the following limits when tested in accordance with ASTM C136.

<u>Sieve</u>	<u>Percent Passing</u>
3/8"	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10

Fine aggregate shall have not more than 45 percent retained between any consecutive screens.

2.3.2.2.2 Aggregates. Coarse aggregates shall consist of crushed stone or gravel, graded to meet the grading requirements of ASTM C33. The maximum limits for deleterious substances in coarse aggregate shall be as listed in ASTM C33. The maximum size of coarse aggregate shall be as specified elsewhere for the type of concrete work but in no case larger than 2". When not otherwise specified, aggregate shall be the largest size which is not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between individual reinforcing bars.

2.3.2.3 Water. Water shall be of drinkable quality; clean, fresh, and free of deleterious amounts of acids, alkalis or organic materials.

2.3.2.4 Admixtures.

2.3.2.4.1 Air-Entrainment. Air-entraining admixtures shall conform to ASTM C260.

2.3.2.4.2 Retarding Densifier. Retarding admixture shall be water-reducing and retarding type: Plastiment as manufactured by Sika Chemical Corporation or approved equal.

2.3.2.5 Curing Materials. Provide curing materials, when required, as follows:

2.3.2.5.1 Moisture Barrier. Moisture barrier shall be 8-mil polyethylene sheet, polyethylene-coated barrier paper, or 1/8-inch thick asphalt core membrane sheet.

2.3.2.5.2 Curing Compound. Curing compound shall be membrane-forming, conforming to ASTM C309, Type 1.

2.3.3 Mix design

2.3.3.1 Standard. Concrete mixes shall be designed using the absolute volume method as described in ACI 211.1. Concrete shall be 6.2 bag mix, with a maximum water cement ratio of 0.50, and shall be from an approved ready-mix plant.

2.3.3.2 Entrained Air. Use air-entraining admixture in all concrete, providing not less than 4 percent nor more than 6 percent entrained air for concrete exposed to freezing and thawing, and from 2 percent to 4 percent for other concrete.

2.3.3.3 Retarder. Add Plastiment, or approved equal, to the concrete mix when ambient temperatures exceed 85 degrees F. Retarder shall be added in amounts as recommended by the manufacturer.

2.3.3.4 Water Adjustment. The quantity of mixing water measured into the batch shall be reduced by the amount of free water contained in the fine and coarse aggregates. The weight of coarse and fine aggregates shall be increased by the weight of water contained in them.

2.3.3.5 Adjusted Mixes. Mix designs may be adjusted when material characteristics, job conditions, weather, test results or other circumstances warrant. The total water content per bag of cement shall not be exceeded. The cement content per cubic yard of concrete shall not be reduced. Do not use revised concrete mixes.

2.3.3.6 Grout. Provide cement grout mixture of 1 part Portland Cement to 3 parts fine aggregate (1/4-inch maximum), by volume, with minimum water required for placement and hydration. Adjust formulation as required for use of special admixtures. Admixtures used in grout shall be acceptable to the DISTRICT ENGINEER.

2.3.4 Reinforcement

2.3.4.1 Reinforcing Bars. Steel for reinforcing bars to be embedded in concrete shall be deformed bars of the size indicated on the drawings. Bars shall be free from defect and kinks, and from bends not shown on the drawings. The bars shall conform to the requirements of ASTM A615. Bars shall be Grade 60. All bars shall be new stock, free from rust scale, mill scale, or excessive rust when placed in the work. A thin coating of red rust resulting from short exposure will not be considered objectionable; any bars having rust scale, mill scale or a thick rust coat shall be thoroughly cleaned, or shall be rejected and removed from the premises upon the order of the Engineer.

2.3.4.2 Reinforcing Mesh. The wire mesh or fabric shall be of the size, number of wires and weight indicated on the drawings or directed by the Engineer. It shall conform to ASTM A185. All reinforcing mesh shall be of new stock, free from excessive rust when placed in the work.

2.3.4.3 Wire. Plain wire shall conform to ASTM A82-02.

2.4 SECONDARY WATER SYSTEMS

2.4.1 Pipe: This section covers water transmission pipe and fittings for the pressurized transmission and distribution of secondary water. All piping for SECONDARY WATER SYSTEMS shall be Polyvinyl Chloride, unless otherwise approved by the DISTRICT ENGINEER.

2.4.1.1 Polyvinyl Chloride (PVC) Pipe shall meet or exceed the requirements of AWWA C900 or AWWA C909. The pipe shall be homogeneous throughout; and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be uniform as commercially practicable in color, opacity, density and other physical properties. Pipe surfaces shall be free from nicks, scratches, gouges and other imperfection that might weaken the pipe wall or cause leakage at joints.

2.4.1.2 Pressure class rated pipe shall provide not less than the following allowable working pressures as determined by AWWA C900 or AWWA C909:

Allowable Working Pressure		Minimum
Pressure Class	psi	Dimension Ratio (DR)
150	150	18
200	200	14

2.4.1.3 The dimensions and tolerances of the pipe barrel and bell ends shall conform to the applicable requirements of AWWA C900 or AWWA C909 for the pressure-class specified for cast iron outside diameter pipe.

2.4.1.4 All fittings and accessories shall be as manufactured or recommended by the pipe manufacturer, or approved equal, and have bell and spigot configurations identical to that of the pipe. The pipe fittings may be manufactured from PVC, ductile iron or welded steel, and shall have strength equal to or greater than the pipe to which they attach. Fittings shall be installed as specified by the manufacturer.

2.4.1.5 The pipe and fittings shall be furnished with integrally thickened bell and spigot ends; for joining with a solid, uniform cross-sectional elastomeric gasket as the sealing element. Couplings are not permitted. The gasket shall be contained within the bell end. The gasket shall not be required to support the weight of the pipe when two sections are joined; but shall serve only as a seal, and shall conform to ASTM D3139. The critical sealing dimensions of the bell, spigot, and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to effect a positive seal under all combinations of the joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent welded joints are not permitted unless written approval is obtained from the DISTRICT ENGINEER prior to welding the joint.

2.4.2 Special Requirements.

2.4.2.1 Marking on the pipe shall include the nominal cast iron pipe size, AWWA C900 or AWWA C909 Class and dimension ratio (DR) and the manufacturer's name or trademark. Marking interval shall be not more than 5 feet.

2.4.2.2 Pipe shall be colored with a purple dye, pantone 512.

2.4.2.3 A tracer wire must be included to facilitate location of the pipe after burial.

2.4.3 Valve Boxes. All valves to be buried shall have cast iron valve boxes, firmly supported and maintained, centered and plumb over the wrench nut of the valve. The boxes shall be of the extension type with 39- to 60-inch extension. Boxes shall be equal to those manufactured by Tyler Pipe Industries #664-S, or approved equal. Lids shall be triangular in shape, and have the designation "Reuse Water" cast into them.

2.4.4 Valves.

2.4.4.1 Valves shall be bronze-mounted, double-disc, iron body gate valves, and, when so indicated or specified, shall have enclosed spur or bevel gearing. Valves shall have minimum working pressure rating of 150 psi. Valves shall be non-rising stem, unless rising stems are indicated on the drawings. Valves shall meet the requirements of AWWA Specification C-500, except as modified herein. Valves shall operate drip tight with full pressure on either side of the valve and no pressure on the other side. Packing and gearing shall be replaceable while the valve is in service. End connections shall be flanged, push-on joint, mechanical joint, or slip joint.

2.4.4.2 The flanges and drilling shall conform to dimensions of ANSI Standards for Class 125 or Class 250, for cold water. The joints shall be manufactured to conform with requirements of AWWA C110/A21.10.

2.4.4.3 Valves shall be so designed that the gates and stem are clear of the full specified diameter when open.

2.4.4.4 All valves shall turn clockwise to close.

2.4.4.5 When so indicated or specified, valves shall have cut steel spur gears or bevel gears in a factory-installed, enclosed gear case. The case shall be air, water, and oil tight with seals on all shafts. A worm gear position indicator shall be provided with geared valves.

2.4.4.6 The operating nut or wrench nut shall be cast iron, and shall be carefully fitted to the top of the valve stem, secured to the stem by a threaded nut; with threads' ½-inch minimum, National Coarse. The operating nut shall be 1-15/16-inch square at the top, 2-inch square at the base, and at least 1-3/4-inch high. There shall be a round flange at the base with a distinct arrow cast on the nut, and lettering to indicate direction to close or open.

2.4.4.7 The stems for all valves shall be of corrosion resistant material.

SECTION 3 CONSTRUCTION DETAILS

3.1 General

3.1.1 The CONTRACTOR and DEVELOPER shall employ suitable and competent mechanics for every kind of work. If any person employed by the CONTRACTOR is incompetent, disorderly or disobedient to the DISTRICT ENGINEER or the DISTRICT INSPECTOR, or rude or abusive to any of the general public he shall be removed from the WORK and not again be employed upon the WORK without the consent of the DISTRICT ENGINEER.

3.1.2 The CONTRACTOR shall, and will, in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by these SPECIFICATIONS and approved PLANS, and in accordance with the directions of the DISTRICT ENGINEER as given from time to time during the progress of this WORK. He shall furnish, erect, maintain, and remove such construction plant and such temporary works as may be required.

3.1.3 The CONTRACTOR shall observe, comply with and be subject to all terms, conditions, requirements, and limitations of the SPECIFICATIONS and approved PLANS, and shall do, carry on, and complete the entire work to the satisfaction of the DISTRICT ENGINEER.

3.1.2 Coordination of work. The CONTRACTOR shall review the DRAWINGS and SPECIFICATIONS and shall report any discrepancies to the DISTRICT ENGINEER and obtain from him written instructions for changes necessary to avoid interference. Before installation, the CONTRACTOR shall call Blue Stakes and make proper provision to avoid interferences in a manner approved by the DISTRICT ENGINEER. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his own expense.

3.1.3 Damage to utilities. If, during the execution of the WORK, any utility or private property is damaged, the CONTRACTOR shall immediately notify the utility company, department or person responsible for the utility or the property, and shall satisfactorily repair or replace any utility or property which is damaged or broken due to the execution of the WORK, or he shall arrange for the owner to perform the repair.

3.1.4 Safety standards and accident prevention. With respect to all work performed the Contractor shall:

(1) Comply with the safety standards provisions of applicable laws and building and construction codes, and

(2) Exercise every precaution at all times for the protection of persons (including employees) and property which shall include, as needed, the use of shoring, bracing, barricades, guards, night watchmen, red lighting and the elimination of hazardous conditions.

3.1.5 Emergencies. Emergencies may arise during the progress of the work which may require special effort or require extra shifts or persons to continue the work beyond normal working hours. The CONTRACTOR shall be prepared in case of such emergencies from whatever cause to do all

necessary work promptly. Such emergencies will be based on the DISTRICT'S ability to deliver water and sewer services to its customers, or to protect the life, health, safety and/or property of the general public.

3.1.6 Surface restoration.

3.1.6.1 Protection of Surfaces. In order to avoid unnecessary damage to existing paved surfaces, track equipment shall use rubber cleats when operating on or crossing paved surfaces, and shall follow all requirements of the jurisdiction having control over the surface. Damaged surfaces outside the PROJECT limits shall be repaired or replaced by and at the expense of the CONTRACTOR in a manner satisfactory to the jurisdiction having control over the surface.

3.1.6.2 Time. The Contractor shall provide temporary surfaces in good condition within one (1) day after trench backfill has been placed; and shall complete street repairs with seven (7) days from the date structural and trench backfill has been placed, unless more stringent requirements are imposed by the jurisdiction having control over the surface.

3.1.6.3 Cutting and Removal. Existing pavement to be removed shall be cut vertically in straight lines, and the portion to be removed shall be excavated in a manner that will not damage pavements which remain.

3.1.7. Tunneling or auguring. Casing pipe shall be used to protect the carrier pipe at railroad crossing, canal crossings, and highway crossings where shown on the drawings or where directed by the DISTRICT ENGINEER. Casing pipe and installation shall meet the requirements of the railroad, highway department, or other utility being crossed, as well as these SPECIFICATIONS. Alignment and grade of the casing pipe shall be maintained so that the carrier pipe can be installed to the line and grade as shown on the drawings.

3.1.7.1 Steel casing pipe shall be welded steel pipe meeting the requirements of ASTM A53. Casing driven in place by jacking, tunneling or auguring methods shall be provided with cathodic protection.

3.1.7.2 Size and Wall Thickness. Steel casing pipe shall be as shown on the drawings with no less than 0.375-inch wall thickness.

3.1.7.3 Installation. Casing shall be installed by jacking, tunneling, auguring, or other method that may be approved by the owner of the railroad, canal, or highway, and the DISTRICT ENGINEER. The hole for the casing shall be same size as the outside of the casing. Over-break shall be filled with sand or grout pumped into the opening after setting the casing. The casing shall be watertight. The carrier pipe shall be placed to line and grade on a bed of sand, and the void space between casing and carrier shall contain approved spacers.

3.1.7.4 Responsibility for Work. All of the operations of the CONTRACTOR in constructing the portions of the work under railroad tracks, canal, or highway shall be subject to the approval of the railroad, canal, or highway owner. The CONTRACTOR shall enter any agreements with and shall furnish any and all indemnity and other BONDS that may be required by them for the protection of the railroad, canal, or highway owner against injury and interference with traffic and service by operations of the CONTRACTOR. The CONTRACTOR shall provide services of guard, flag person, etc., as required by the authority having jurisdiction. The CONTRACTOR shall secure

permission from the affected utility before commencing on the portion of the work within the right-of-way and under the tracks, canal, highway or other improvements. The CONTRACTOR shall be solely responsible for the safety and adequacy of his construction plans and methods and for any damage which may result from their failure

3.1.8 Construction water

3.1.8.1 The Contractor shall make arrangements for and provide all necessary water at his own expense. If the Contractor purchases water from the DISTRICT at a fire hydrant on or near the project, all arrangements shall be made by him at his own expense and payment shall be made to the DISTRICT on basis of the actual quantity of water metered or by other approved methods. The DISTRICT must authorize the opening of any DISTRICT hydrants. Application for service shall be made to the DISTRICT office located at 5350 West 5400 South.

3.1.8.2 The Contractor shall use hydrants in strict accordance with District requirements for hydrant use and shall provide backflow or air gap protection.

3.1.9 Concrete. The methods, procedures, tools and equipment used by the CONTRACTOR shall be acceptable to the DISTRICT ENGINEER.

3.1.9.1 Formwork. Formwork, where required, shall be constructed so that concrete members and structures are of correct size, shape, alignment, elevation and position. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. Design and safe construction of formwork is the sole responsibility of the CONTRACTOR. Unless otherwise specified, or indicated on the drawings, or accepted by the DISTRICT ENGINEER; construction formwork shall be provided which will result in completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.

3.1.9.2 Joints. Provide construction, isolation, and control joints as indicated or required; and as specified on the DRAWINGS. Locate construction joints so as not to impair the strength and appearance of structures. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and to control random cracking.

3.1.9.3 Embedded Items. Set and build into the work anchorage devices and other embedded items required for other work attached to, or supported by cast-in-place concrete.

3.1.9.4 Placement.

3.1.9.4.1 Preparation. No concrete shall be placed until all form work, construction joints, reinforcing, and installation of embedded items have been completed and accepted by the Inspector.

3.1.9.4.2 Notification. The Inspector shall be notified at least one working day before the Contractor intends to place concrete.

3.1.9.4.3 Continuous Placement. Place concrete in a continuous operation within planned joints or sections, and with care to prevent segregation or splashing.

3.1.9.4.4 Consolidation. Consolidate placed concrete using mechanical vibrating equipment supplemented by hand rodding and tamping so that concrete is worked around reinforcement and into corners; and so that the concrete is free of honeycomb.

3.1.9.4.5 Weather Extremes. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing. In cold weather comply with ACI 306; in hot weather comply with ACI 305.

3.1.9.4.6 Finishes. Provide finishes as specified in other Sections; and, where not otherwise specified, as follows:

3.1.9.4.6.1 Formed Surfaces. For formed surfaces which will be exposed-to-view; remove fins and projections, patch defective areas with cement grout, and rub smooth. Formed surfaced not exposed-to-view require no finish treatment after form removal except filling of holes left by removal of form ties and patching defective areas.

3.1.9.4.6.2 Unformed Surfaces. Provide screeded screened finish for surfaces which will be covered by backfill or by concrete, and as a first step for float finish or exposed-to-view surfaces. Level and screed the concrete to produce a uniform surface, with no abrupt irregularities exceeding 3/8-inch. Apply float finish to unformed surfaces which will be exposed-to-view. Begin floating when surface water has disappeared, using hand-floats or power-driven equipment, and finish only as required to provide a uniform, smooth, granular texture. Joints and edges shall be tooled as shown on the drawings or as directed by the Engineer.

3.1.9.4.7 Curing. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces.

3.2 Water Systems The construction requirements for water systems will apply to SECONDARY WATER SYSTEMS as well, unless noted otherwise.

3.2.1. Excavation and backfill

3.2.1.1 Earthwork for pipe trenches shall include trench excavation, providing and placing bedding, borrow for backfill and bedding, backfill within the pipe zone, backfill above pipe zone, shoring, compaction of material, and consolidation of material.

3.2.1.2 Standards. All applicable standards and rules applying to pipe excavation and installation shall be strictly adhered to, including, but not limited to, the following:

1. AWWA C605.
2. AWWA C600.
3. Specifications for excavation on State Highways, latest revision.
4. General Safety Order Covering Utah Industries - Section 69, trenches.
5. United State Department of Labor OSHA Publication 2085 - "Employer - Employee, Safe Practice for Excavation and Trenching Operation".
6. Utah Occupational Safety and Health Rules and Regulations - General Standard (UOSHA).
7. AASHTO T-180

3.2.1.3 Excavation.

3.2.1.3.1 Excavation shall be accomplished to allow the pipe to be laid to the line and grade shown on the drawings or as directed by the DISTRICT ENGINEER.

3.2.1.3.2 The Contractor, at his option, may leave all or part of the trench unshored or unbraced. If this is the case, the sides of the trench shall be sloped to meet safety standards. Trenches less than four feet deep may be constructed with vertical walls. Trenches not meeting UOSHA standards will not be entered by the DISTRICT INSPECTOR, and pipes will not be inspected or accepted.

3.2.1.3.3 The DISTRICT INSPECTOR may require that unsuitable materials located beneath the pipe zone be overexcavated, backfilled and compacted to 95% maximum density as defined in AASHTO T-180.

3.2.2 Laying Pipe. Pipe shall be bedded in sand for a minimum of 6" below the pipe and 12" above the pipe. Gravel bedding or the use of other bedding materials is not permitted. Tees, elbows, crosses, and reducers shall be used for changes in direction and outlets. Where cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts. Anchors and thrust blocks shall be placed at valves, elbows, tees, etc. as shown on approved plans and standard details. All flanges shall be faced and drilled.

Valves which are not located in a dedicated right-of-way shall have a sign posted near the valve so that it may be easily located. The sign will be provided by the DISTRICT; the developer is responsible for providing a metal post, and placing it near the valve, so that the sign will be approximately 4 feet above grade.

All below grade bolted joints shall be coated with Poly FM (food grade) grease and wrapped in 8-mil black plastic. The plastic shall be held in place by 2-inch wide plastic backed adhesive tape, Polyken No. 900, Scotchrap No. 50, or approved equal.

A 12 gage tracer wire shall be laid with PVC pipe, terminating at accessible locations in the valve boxes. A warning tape, marked "Buried Water Line" shall be placed approximately 2 feet directly above the water line.

3.2.3 Compaction. Trenches over waterlines shall be backfilled and compacted in accordance with requirements of the City or County having jurisdiction.

3.2.4 Alignment. Waterlines shall be placed in accordance with the approved plans. Curved alignments are permitted within tolerances of the pipe manufacturer, and as shown on the plans. Deviations from the approved plans are permitted only with approval by the DISTRICT ENGINEER. Such deviations shall be shown on the AS-BUILT DRAWINGS. The CONTRACTOR is responsible for verifying the maximum degree of curvature allowed according to the AWWA standards and the manufacturer's recommendations for the type and size of pipe being installed. Where field conditions require deflection for curves not anticipated by the approved plans, methods to be used shall be presented to the DISTRICT ENGINEER for approval.

3.2.5 Tapping. The cast iron tapping sleeve and cast iron tapping valve shall be of the sizes indicated, and designed for 200 psi working pressure, intended to permit tapping the existing waterline with pressure in the line. Tapping sleeve and tapping valve shall be products of the same manufacturer and shall comply with MSS SP-11.

3.2.5.1 Tapping Sleeve. The tapping sleeve shall be a mechanical joint type with Class 125 cast iron outlet flange. End gaskets shall be duck-tipped type. Provide H615 tapping sleeve as manufactured by Mueller Co. or approved equal.

3.2.5.2 Tapping Valve. The tapping valve shall have mechanical joint inlet with Class 125 cast iron flange. Outlet shall be slip-on joint end. Tapping valve shall be Model H667 as manufactured by Mueller Co. or accepted equal.

3.2.5.3 Valve Box. Cast iron valve box shall be extension type, Tyler Pipe Industries #664-S with 39- to 60-inch extension or accepted equal. Install centered and plumb over the wrench nut of the valve.

3.2.6 Water Service Connections

3.2.6.1 Furnish and lay, or install by jetting, type "K" copper tubing as specified under "Copper Tubing" with a diameter equal to the size of the service connection. Where the service lateral is longer than 50 feet from main to meter, the diameter shall be one size larger than the meter. Fittings may be flair or compression type. Tubing shall extend from corporation stop to the meter yoke or meter valve and from meter yoke or meter valve to a point fifteen feet beyond the property line. Tubing shall be capped and marked with a 2x4. An expansion loop shall be formed in the soft copper tubing in a horizontal plane at the connection to the corporation stop. See detail on drawings.

3.2.6.2 The water service line shall be bedded in sand bedding the entire length of service line. No joints or connections are permitted between the corporation stop and the yoke or setter.

3.2.6.3 The meter box shall be installed in the park strip between back of curb and sidewalk and shall not be located in driveways or drive approaches. See also Section 1.2.1.2. Variances from these requirements shall be permitted only by approval of the DISTRICT ENGINEER. If relocation of a meter box to avoid interference with a driveway or drive approach is required, an application for a Sub-Standard Agreement shall be completed, and applicable fees paid.

3.2.6.4 Service connections shall be installed, as above described, as soon as possible after installation, testing and flushing of the water main. Service connections shall not be made closer than 2 feet to one another, or to a joint or valve.

3.2.6.5. Across State Highway rights-of-way, service lines shall be installed by auguring, open cut trench, or other method that may be approved by the Utah State Highway Department. In other than State Highway rights-of-way, service lines shall be laid in open cut trench; except that pipe 2-inch or smaller may be jetted under existing improved surfaces.

3.2.6.6. Inspection. Before backfilling contact the DISTRICT INSPECTOR for inspection of service connection.

3.2.7 Frost protection. Water lines shall be placed at a depth that will provide at least 48 inches to the finished ground surface. Excavations, while open, shall be protected from frost to assure that pipes are not placed in or on frozen ground. For secondary water lines, see section 1.2.3.

3.2.8 Flushing and testing. See Section 4.3.

3.2.9 Waterline loops. Where it is necessary to provide a loop for a waterline to prevent interference with an existing storm drain or other utility, such loop shall be of shop welded steel pipe, with mechanical joints or flanged fittings at each end. No non-welded joints are permitted in the loop.

3.2.10 Hydrants. Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting. Hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb.

3.2.10.1 Hydrants shall be set to final finish grade, with nozzles at least 18-inches above the ground. A concrete pad shall be provided at all fire hydrants as shown on standard details. Bolts at breakaway flanges shall be fully accessible.

3.2.10.2 Concrete thrust blocks shall be provided for the hydrant bowl, auxiliary gate valve, and elsewhere as indicated on the drawings.

3.2.10.3 Below grade bolted joints shall be coated with food grade grease and wrapped in 8-mil black plastic. The plastic shall be held in place by 2-inch wide plastic backed adhesive tape, Polyken No. 900, Scotchrap No. 50, or approved equal. To provide for drainage of the hydrant, a short pipe nipple shall be extended through the plastic to drain the water to the gravel outside the film wrap.

3.2.10.4 The hydrant, valve and connecting piping shall be flushed, tested and disinfected. The hydrant shall be flushed with all outlet valves open.

3.2.10.5 The CONTRACTOR shall use only hydrant wrenches to open hydrants. He shall also make certain that the hydrant valve is open "full", since "cracking" the valve causes damage to the valve, and promotes washout under the hydrant due to leakage at the drain port. An approved auxiliary valve shall be provided on the outlet line for control purposes. Fire hydrant valves must be closed slowly and completely to avoid a surge on the system which creates undue pressure on the water lines. The CONTRACTOR shall carefully note the importance of following these directions.

If one of the CONTRACTOR'S employees shall knowingly or unknowingly damage any hydrant valve system, the CONTRACTOR shall be responsible for all resulting costs and damages. He shall immediately notify the DISTRICT so that the damage can be repaired as quickly as possible.

Upon completing the use of the hydrants, the CONTRACTOR shall notify the DISTRICT, so that the hydrants may be then inspected for possible damage. Any damage resulting from the use of the hydrants by the CONTRACTOR will be repaired if necessary by the DISTRICT and the cost thereof shall be borne by the CONTRACTOR.

The CONTRACTOR shall furnish all connectors, wrenches, valves, and small tools that may be necessary to meet the requirements of the DISTRICT pertaining to hydrant use.

Violation of these requirements may result in fines and will leave the CONTRACTOR liable for damage suits because of malfunctioning of damaged fire hydrants, in the event of fire.

3.2.11 Where secondary water lines cross potable water lines, joints of the secondary line should be located at least 5 feet away from the potable water line.

3.3 Sewer Systems

3.3.1 Excavation and backfill

3.3.1.1 Earthwork for pipe trenches shall include trench excavation, providing and placing bedding, borrow for backfill and bedding, backfill within the pipe zone, backfill above pipe zone, shoring, compaction of material, and consolidation of material.

3.3.1.2 Standards. All applicable standards and rules applying to pipe excavation and installation shall be strictly adhered to, including, but not limited to, the following:

1. Specifications for excavation on State Highways, latest revision.
2. General Safety Order Covering Utah Industries - Section 69, trenches.
3. United State Department of Labor OSHA Publication 2085 - "Employer - Employee, Safe Practice for Excavation and Trenching Operation".
4. Utah Occupational Safety and Health Rules and Regulations - General Standard (UOSHA).
5. AASHTO T-180.

3.3.1.3 Excavation.

3.3.1.3.1 Excavation shall be accomplished to allow the pipe to be laid to the line and grade shown on the drawings or as directed by the DISTRICT ENGINEER.

3.3.1.3.2 The Contractor, at his option, may leave all or part of the trench unshored or unbraced. If this is the case, the sides of the trench shall be sloped to meet safety standards. Trenches less than four feet deep may be constructed with vertical walls.

3.3.1.3.3 The DISTRICT INSPECTOR may require that unsuitable materials located beneath the pipe zone be overexcavated, backfilled and compacted to 95% maximum density as defined in AASHTO T-180.

3.3.2 Compaction. Compaction of materials located above the pipe zone shall be in accordance with requirements of the authority having jurisdiction over the road.

3.3.3 Alignment & Grade. Sewer lines shall be constructed in a straight line between manholes, in accordance with the approved plans. Lines shall be constructed to slope uniformly between manholes without bellies or sags. Grades shall be consistent with the approved plans.

3.3.4 Bedding. All sewer pipe shall be bedded in ¾" minus gravel for a minimum of 6" below the pipe and 12" above the pipe. Sand bedding or the use of other bedding materials is not permitted. . All gravel bedding shall pass the ¾" screen, and none shall pass the 3/8" screen.

3.3.5 Manholes.

3.3.5.1 Precast Base. Flexible sleeves of synthetic rubber with stainless steel clamps shall be provided in all pipe openings in pre-cast bases. After pipe is clamped in place, openings around the sleeves shall be filled with cement grout.

3.3.5.2 Base Gravel. Pre-cast bases shall be founded on gravel or other material satisfactory to the DISTRICT ENGINEER, of minimum thickness indicated on the drawings.

3.3.5.3 Cast Base. Cast-in-place bases shall not be permitted without approval of the DISTRICT ENGINEER, and shall be as indicated on the drawings. Surfaces of the water channel and interior shall be float finished. Concrete shall conform to Section 2.3.

3.3.5.4 Pipe Openings. A plastic seal or water stop shall be installed to make watertight connections in manhole pipe openings.

3.3.5.5 Grade Rings. Precast grade rings shall be provided as required to adjust the height of the manhole. A maximum of 2 grade rings, not to exceed 12" total height, is permitted in new construction. Brick shall not be used in lieu of, or in addition to grade rings. Cast-iron grade rings are not permitted. The manhole shall be provided with a concrete collar, and the finished product shall be parallel to and one-half inch below the asphalt road grade. (See standard drawings).

Manholes which are located in unimproved areas (not in a finished, paved road) shall have the rim raised above surrounding grade to minimize surface water infiltration.

Manholes placed in roadway shoulders, within 10 feet of the edge of pavement shall be set horizontal and extend two to four inches above finished grade, allowing for access, maintenance and drainage, and to minimize adverse effects of snow plows.

3.3.5.6 Debris in Manholes. Manholes are to be kept clean during construction. Plywood or prefabricated false bottoms are to be used through all construction phases, until the manhole has been raised to grade and grouted.

3.3.5.7 Cure time. Precast concrete products shall not be installed until seven days has passed since the product has been manufactured. The date stamped on the concrete product will be used as the starting date in determining this time period. Any concrete product installed without this seven-day period will not be accepted by the DISTRICT ENGINEER and will be required to be removed and replaced.

3.3.5.8 Signs. Manholes which are not located in a dedicated Right-of-Way shall have a sign posted near the manhole so that it may be easily located. The sign will be provided by the DISTRICT; the developer is responsible for providing a metal post, and placing it near the manhole, so that the sign will be approximately 4 feet above grade.

3.3.6 Drop Manholes. Drop manholes shall be as indicated on the drawings. Pipe and fittings shall be of the same type and class as pipe in the sewer line. Refer to drop manhole detail drawing.

3.3.7 Connections to main (laterals). All pipe and fittings shall be PVC plastic meeting requirements in Section 2.2.1.1. Fittings shall be shop-fabricated. Joints shall be rubber gasket. Welded joints may not be used. A flexible connection shall be provided for manhole connections. Connections shall be a minimum of 30 degrees above the horizontal centerline. Provide cleanouts as required by the Plumbing Code. Laterals shall be extended to 15 feet past the property line, and identified with a 2x4 location board.

3.3.8 Proximity to Water lines. Separation between sewer and water lines shall conform in every way to requirements of the State of Utah Division of Drinking Water requirements. Sewer lines shall be located at least 10 feet horizontally from culinary water lines. Where such separation is not

possible, the water line shall be located above the sewer line on an excavated shelf or separate trench, maintaining at least 18" vertical separation.

Where sewer and water mains must cross and the vertical separation required above is not possible, water mains shall be constructed of mechanical-joint ductile iron pipe, or equivalent, for a distance of 10 feet on either side of the point of crossing.

3.3.9 Flushing and testing. Sewer lines shall be kept clean and free from debris during construction. Flushing and testing shall be in accordance with Section 4.4.

3.3.10 Grease Traps. Grease traps (grease separators) shall be a minimum of 1000 gallon capacity, shall be precast concrete, and shall be consistent with the standard drawings. Grease traps shall be provided for all commercial or industrial properties where the discharge of fats, oils, or grease may occur in excessive quantities as determined by the DISTRICT ENGINEER. An approved sampling station shall be located immediately downstream of the grease trap.

SECTION 4 INSPECTION AND TESTING

4.1 District Inspections

4.1.1 The INSPECTOR shall at all times have access to the WORK. The CONTRACTOR shall provide proper facilities for such access and observation of the WORK and also for any inspection, or testing thereof.

4.1.2 If any WORK is covered contrary to the instructions in these SPECIFICATIONS, it must, if requested by the INSPECTOR, be uncovered for his observation and replaced at the CONTRACTOR'S expense.

4.1.3 If the DISTRICT ENGINEER considers it necessary or advisable that covered WORK be inspected or tested the CONTRACTOR, at the DISTRICT ENGINEER'S request, shall uncover, expose or otherwise make available for observation, inspection or testing as the DISTRICT ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective the CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction.

4.1.4 No work shall proceed unless the CONTRACTOR has informed the INSPECTOR of such work. While continuous inspection by the INSPECTOR is not required, daily inspection may be expected. If daily inspection does not occur, the CONTRACTOR should contact the DISTRICT ENGINEER.

4.2 Testing agencies

All required tests of compaction, concrete, or other materials or processes shall be performed by agencies qualified to perform such work. Evidence of such qualification may be required by the INSPECTOR. The results of their tests shall be provided to the INSPECTOR at no expense to the DISTRICT.

4.3 Water Systems

4.3.1 Water quality tests

4.3.1.1 The CONTRACTOR shall be responsible for maintaining the disinfected condition of existing water lines when connecting to, cutting into, repairing or tapping existing water lines. Disinfection procedures for these operations shall be in accordance with the AWWA Standard C651-99. Mains shall be flushed unless approved by the DISTRICT ENGINEER. Taps required by the CONTRACTOR for chlorination or flushing purposes shall be provided by him as part of the construction of water mains.

The CONTRACTOR shall be responsible for disposal of heavily chlorinated treated water flushed from mains and shall neutralize the waste water for protection of the environment before disposal into any natural drainage channel, sanitary sewer, storm drain, curb and gutter or onto the ground. The Contractor shall be responsible to confirm the acceptable point of discharge with the DISTRICT ENGINEER prior to chlorination of the waterline.

4.3.1.2 Bacteriological Samples. Twenty four (24) hours after the line is flushed the INSPECTOR will take samples from the installed pipe line. The locations of the samples shall be at intervals along the pipe line as selected by the INSPECTOR. The sampling bottles and methods used will be in accordance with the Utah State Board of Health, "Public Drinking Water Regulations", or other similar applicable regulating agencies.

4.3.1.3 Records and Documentation. All disinfection operations shall be observed by, and will be recorded by the INSPECTOR. The CONTRACTOR shall provide to the INSPECTOR information regarding the length of pipe disinfected, size of pipe, type of pipe, location of pipe, date, time and duration of disinfecting operations, complete list of equipment used and personnel performing the disinfection, and any comments about the disinfection operations.

4.3.1.4 Repetition of Flushing and Testing. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained.

4.3.1.5 The requirements of this section shall not apply to SECONDARY WATER SYSTEMS.

4.3.2 Pressure tests

4.3.2.1 All pipe and fittings or other items to hold or convey liquids shall be tested for leakage in the presence of the INSPECTOR. Testing for leakage shall be done after the pipe has been cleaned and tested for alignment when applicable, before disinfection when applicable, and before painting or embedding in concrete when applicable. Prior to testing for leakage, underground pipelines shall be backfilled to a level acceptable to the INSPECTOR, and the backfill in place shall have been compacted or consolidated to PROJECT density requirements.

All valves, joints, seams, couplings, fittings, flanges, welds, etc., in pipelines shall be watertight.

Leakage is defined as the release of any water, air or smoke passing through the pipes, including joints, fittings, outlets, etc. Measurement shall be made by direct measurement of the amount of water, air or pressure lost or by the amount required to be added to maintain the original level of pressure. Drops of water or evidence of smoke or bubbles will be considered as evidence of leakage.

4.3.2.2 Valves, hydrants, gates, fittings, and special fittings shall be tested for water tightness. Each valve and hydrant shall be closed so that reaches of pipe between valves can be tested. Reaches being tested shall have approved taps placed in high points, to release trapped air and to be used as access points for filling and testing. Lines shall be filled with water of similar quality to the water the line will carry. Pressure shall be raised to not less than 200 psig (except 150 psig maximum against butterfly valves) and continuously maintained for two (2) hours. During this test period, no loss of pressure shall occur. If make-up water is required to maintain pressure, the cause for the leak shall be identified and corrected and the line retested until there is no leakage or loss of pressure.

4.3.2.3 Records and Documentation. The pressure tests shall be recorded by the CONTRACTOR with the INSPECTOR present. Records shall contain the length of pipe tested, size of pipe, type of pipe, rated working pressure of pipe, time and duration of test(s), pressure(s) used, complete list of

test equipment used, list of personnel performing the test(s), and any comments about the test. Test records shall be submitted to the INSPECTOR before the water line will be accepted. A "Contractor's Materials and Test Certificate for Underground Piping" shall be completed and submitted to the INSPECTOR.

4.3.3 Compaction tests. Compaction tests shall be performed by qualified, independent soils testing firms in accordance with standards established by the prevailing authority for roads. Where compaction of soil under or around pipes is required due to overexcavation, testing shall be not less than 95% in accordance with AASHTO T-180.

4.4 Sewer Systems

4.4.1 Pressure tests

4.4.1.1 The CONTRACTOR shall retain an approved testing agency to perform the following leakage tests on all pipe installed including laterals and/or service stubs. The methods and equipment used to make the test shall be mutually determined by the DISTRICT INSPECTOR and the CONTRACTOR before any testing is started. The CONTRACTOR shall, at his own expense, locate and correct any excess leakage and repair any damage to the pipe or its appurtenances indicated by, or resulting from, the test. For the purpose of testing, a section of the sewer shall be considered as the length of sewer between successive manholes. Any section that fails a test shall be repaired and retested at the CONTRACTOR'S expense. Any excavation or surface restoration required in fixing leaks shall be in conformance applicable standards.

An infiltration test will be required when the pipeline is below the groundwater level. The amount of water leaking into the pipe shall be measured and it shall not be more than 10 gallons per inch diameter per mile of pipe.

In areas where the groundwater is below the pipe, a low pressure air test shall be performed. The section of pipe between successive manholes shall be sealed with suitable plugs. One of the plugs shall have an orifice through which to pass air into the section of pipe being tested. The air supply line shall have a positive on-off valve and suitable means for readily disconnecting it at the control panel. A second orifice in the plug shall be used for constantly reading the internal pressure of the pipe. This orifice shall be continuously connected to a pressure gauge having a range of from 0 to 10 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of +/- 0.04 psi.

The line under test shall be pressurized to approximately 4 psi. The air supply shall then be shut off, and the pressure allowed to stabilize for a minimum of 2 minutes. If during this period the pressure drops below 3.5 psi, more air shall be introduced to raise the pressure to a minimum of 3.5 psi. After this stabilization period, the air supply line shall be disconnected and timing shall begin. The time of the test, in minutes, shall be equal to the pipe diameter, in inches. The maximum allowable pressure drop during the specified time period shall be 1.0 psi. A copy of the successful air test report shall be provided to the DISTRICT.

4.4.2 Compaction tests. Compaction tests shall be performed by qualified, independent soils testing firms in accordance with standards established by the prevailing authority for roads. Where compaction of soil under or around pipes is required due to overexcavation, testing shall be not less than 95% in accordance with AASHTO T-180.

4.4.3 Mandrel testing. Sewer pipe shall at the request of the INSPECTOR be deflection tested by pulling a solid, pointed mandrel through the completed pipeline. The diameter of the completed mandrel shall be 95% of the pipe diameter. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely flushed with water. The CONTRACTOR shall be required, at his expense, to locate and repair any and all sections of pipeline which fail this test, and retest each such section.

4.4.4 Video Inspection.

4.4.4.1 As a prerequisite for final acceptance of all new sewer trunk lines (all sewer lines except service connections), the CONTRACTOR shall perform an internal television inspection and furnish to the DISTRICT video tape recordings which pictorially demonstrate that satisfactory watertight conditions exist at all joints in the lines, and that the pipe is free from deleterious cracks, leaks, deflections or other damaged conditions.

Television inspection shall be performed only after the sewer lines have been flushed and checked and accepted for grade and alignment, and have been satisfactorily tested for infiltration and ex-filtration. Standing or low-flow running water shall be present to facilitate the detection of bellies.

4.4.4.2 Television inspection equipment and methods to be used by the CONTRACTOR in performing the internal television inspection and video recording shall be suitable to provide the video tape recordings specified next hereinafter and shall be acceptable to the DISTRICT.

4.4.4.3 Video Tapes: Video tape recordings of sewer line inspections shall be made on Maxell Plus, T-120, or accepted equal, and shall be enclosed in vinyl plastic boxes. The audio portion of the composite signal shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio reports shall be recorded by the operating technician on the video tapes as they are being produced and shall include the location of the sewer, the names or numbers of the manholes involved, a manhole-to-manhole direction of travel, and a description of the conditions in the sewer line as they are encountered. The purpose of the video tape recording shall be to supply a permanent visual and audio record of the sewer pipe section, and the video tapes shall become the property of the DISTRICT upon completion of the PROJECT.

4.4.4.4 A schematic drawing of the sewer system, showing all manholes and connecting lines, shall be provided. The schematic shall indicate the direction of the camera, and shall include a sequential numbering system beginning with the first manhole in the survey to the last. A north arrow shall also be provided. Any other documentation that is necessary to understand the video survey should be included on or with the schematic.

4.4.5 Lateral Inspections.

4.4.5.1 The lateral connecting the structure's DWV system to the stub installed by the DEVELOPER (see Section 3.3.7) shall be inspected by the INSPECTOR for conformance to the Plumbing Code and these specifications.

4.4.5.2 Requests for inspection shall be made to the DISTRICT offices at least one working day in advance.

SECTION 5
STANDARD DRAWINGS

APPENDIX

New Project Development Procedures	p. 39
Check List for Inspections	p. 40
Preconstruction Meeting	p. 41
Bonding Procedures	p. 42

NEW PROJECT DEVELOPMENT PROCEDURES

Name of Project _____ Location _____		Date
ق	Request for letter on availability of service	_____
ق	Submittal of preliminary design	_____
ق	Design review: returned to engineer with red lines	_____
ق	Resubmittal of corrected drawings	_____
ق	Review drawings and stamp 4 sets approved: 1 to file, 1 to Engineering, 1 to Inspector, 1 to engineer	_____
ق	Calculate the bond amounts, review fees and all connection and impact fees. Provide copy to engineer and developer.	_____
ق	Upon posting of bonds and payment of review fees, set a preconstruction meeting; notify all who are to attend: Developer, District Engineer, Inspector, Engineer.	_____
ق	Hold preconstruction meeting in Board Room; Contractor sign preconstruction meeting form	_____
ق	Construction Inspections (see inspection checklist)	
	a. Approved plans to be used by inspector for all inspections	
	b. Inspection log to be kept	
	c. Inspection reports to be completed	
	d. Inspections to be conducted at least daily while work is in progress	_____
ق	Upon project completion, Contractor requests punch list	_____
ق	Contractor provides videos of sewer lines and proof of successful bacteria testing of water lines	_____
ق	Inspector creates a punch list which is provided to Contractor	_____
ق	A set of as-built construction drawings, both paper and electronic, are provided for review	_____
ق	Contractor requests a review of corrected punch list items. Inspector signs off on punch list when all item are corrected	_____
ق	Inspector provides a copy of all field notes and field marked construction drawings to Engineering. Engineering compares as-builts to original approval and field marked plans. A list of discrepancies or problems are provided to the engineer.	_____
ق	Final corrected as-builts are provided to Engineering, who signs off on the project	_____
ق	With approvals from Inspector and Engineering, District Engineer prepares a request for bond reduction for Board action, and schedules it for the next Board meeting. A copy of the request goes to the Contractor	_____
ق	As-built drawings are provided to GIS in electronic format for addition to the GIS system	_____
ق	Upon completion of the warranty period, Inspector conducts an inspection of the system to identify any deficiencies which have occurred as a result of poor materials or workmanship.	_____
ق	Upon approval by Inspector, District Engineer prepares a request for bond release for Board action and schedules it for the next Board meeting. A copy of the request goes to the Contractor	_____

PROJECT COMPLETE

CHECK LIST FOR INSPECTIONS

The following is a list of items that will be inspected or must be completed prior to requesting a bond reduction. The list is not intended to cover every item or issue, but is to be used as a guideline together with good workmanship.

Waterline

- Proper depth and size
- Properly bedded and backfilled
- Disinfected
- Flushed
- Chlorinated
- BT Sample taken
- Thrust blocks as required

Fire Hydrants

- Plumb and at proper elevation
- Proper orientation
- Concrete pad
- Bolt accessible
- Thrust block
- Auxiliary valve in street

Meter Boxes

- Located in park strip (not driveway)
- Level with curb
- Meter set at 18" - 20" below lid
- Box supported by 12x6x1 pavers

Water Valves

- Set level with lids
- Clean
- Workable
- Concrete collar at grade

Sewer Manholes

- Set to grade
- Manhole grouted and clean
- Lifting holes grouted
- Steps in manhole
- Debris and boards removed
- Grade rings grouted
- Concrete collars around manholes

Sewer Line

- Proper elevation and alignment
- Properly bedded and backfilled
- No bellies
- Laterals connected in 10:00 o'clock or 2:00 o'clock position
- Video tape provided
- Air tested
- Flushed and rocks and debris removed

PRECONSTRUCTION MEETING

Kearns Improvement District

5350 West 5400 South Kearns, Utah 84118 Phone 968-1011 Fax 968-1023

Name of Project _____ Location _____

Developer _____ Phone _____

Engineer _____ Phone _____

Contractor _____ Phone _____

Public Works Inspector _____ Phone _____

Kearns Engineering Inspector: _____ Phone _____

Attending:

Kearns:	Developer:	Jurisdiction:
ف District Engineer	_____	فCounty فW Jordan فWVC
ف District Inspector		
ف Engineering Tech	_____	_____

1. The District inspector will provide an Inspection Report to contractor for each visit. If a KID inspector is not present at least once each day that work is performed, contractor is to call for an inspection. Call the District Inspector; if he is unavailable, call the office at 968-1011.
2. The approved plans and District Standard Drawings and Specifications are to be available on site.
3. It is critically important that pipe bedding and backfill is done correctly. Compaction test results and copies of field section reports may be required by the District Engineer.
4. Deviations from the approved plan will require KID approval before covering.
5. Contractor is to video tape the sewer line, conduct pressure tests, and request bacteria tests as outlined in the Specifications and in the inspection checklist. This must be done prior to requesting a bond reduction.
6. Engineer is to provide as built drawings in both hard copy and electronic format upon completion of work. Bond reduction will not take place without this submittal.

Other: _____

Developer acknowledges receipt of a copy of this document by signing here ↓

BONDING PROCEDURES
Kearns Improvement District

In order to assure proper receipt and release of bonds, the following procedures are to be followed:

1. The plans are to be reviewed by Engineering to determine compliance with District standards and specifications. The applicant is provided with standard drawings and specifications with which he is required to comply.
2. Based on the approved plans, Engineering will calculate the fees and bond amounts associated with the project. These bond amounts will use approved values that reflect the costs that the District might incur in hiring an outside contractor to construct this project two years hence.
3. The applicant is notified as to the fees and bond amounts and is provided with appropriate bond agreement forms and extension agreement form. Finance is notified that Engineering is awaiting a bond in the amount of \$xxx from the named applicant.
4. The applicant posts the bond. For cash bonds, Finance notifies Engineering that the bond has been received. Upon receipt of bonds, a record is kept by Engineering of the bond status.
5. A preconstruction meeting is held. Engineering conducts the meeting, and reviews the project scope, and the standards expected to be met. Inspection procedures are outlined to the applicant. Any changes to the approved plans must be reviewed and approved by engineering before implementing.
6. Engineering will perform inspections on a regular basis. Inspections may be on request by the contractor, or randomly as determined by the inspector. A log will be kept of all inspections performed. For serious violations, the inspector may order the work stopped until the correction is implemented.
7. Partial releases of a bond may be requested before the project is complete; however, such partial releases will be limited to a maximum of two draws, and generally will not be considered for bond amounts under \$50,000. To reduce the bond to 50% would require the project to be at least 65% complete. Partial releases are subject to review and approval by the District Engineer.
8. When the applicant has determined that the bonded work is complete, he may call for a bond reduction inspection. This request should be in writing to the District Engineer. Staff will actually perform an inspection, and a single punch list provided to the contractor. The contractor will be required to video the sewer line, and provide a copy of the videotape to Engineering, who will review it. The contractor shall also provide a set of as-built drawings, which will be reviewed by engineering prior to approval.
9. The contractor will correct any deficiencies, and provide as-built drawings in paper copy and electronic format to the District. The air test, hydrostatic tests, and bacterial tests will have been passed and copies placed on file with the District. Engineering will confirm that these corrections and submittals are complete, and then prepare a request for bond reduction for submittal to the board of trustees.

In order to be considered at the monthly meeting of the board of trustees, the request for bond reduction must be placed, and the inspection video, as-built drawings and appropriate test results provided, at least two weeks before the meeting which is normally held on the second Wednesday of each month. This assumes also that no corrections are needed. Engineering must turn in the formal bond reduction request to the District Engineer at least one week before the meeting in order to be considered on the agenda.

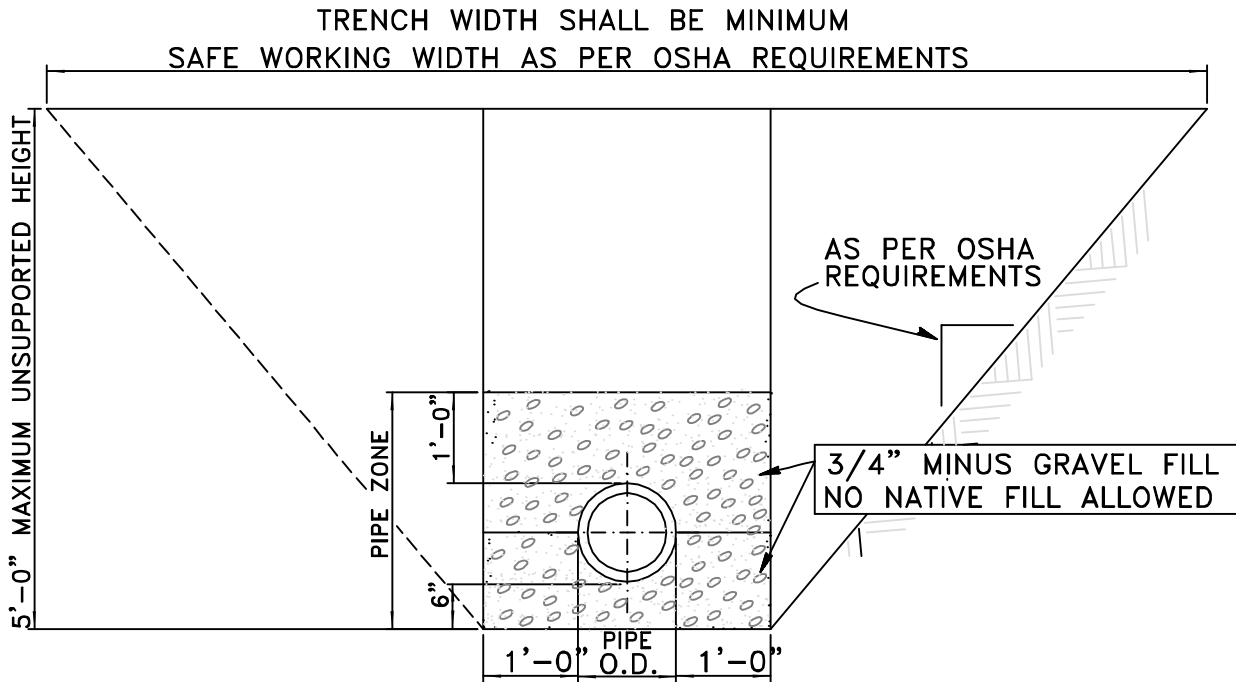
Occasionally certain items cannot be completed because of winter weather constraints. If this is the case, the contractor should post a bond for the remaining work, which will be fully released after completion of that work. The bond reduction process can proceed as soon as the replacement bond is in place.

10. Once the board of trustees has approved the bond reduction, the bonded improvements become the property and responsibility of the District. Finance will be notified to process the release of funds as necessary. Eighty percent of the bond will be released. The remaining 20% will be held as a guarantee of the workmanship and materials of the bonded installation. This amount will be held for a period of 18 months.

11. If deficiencies in materials or workmanship are found during the 18 month period, the contractor will be required to correct them at their expense. If the District makes the correction, either because it was an emergency situation, and water or sewer service to the residents is interrupted, or because the contractor has failed to respond to reasonable requests to correct the deficiency, the District will retain a portion of the guarantee to cover the expenses incurred. The District will maintain records of its expenses related to such repairs.

12. Approximately 16 months after the bond reduction, engineering will initiate a process to allow for full release of the bond. The District Inspector will inspect the installation. Any corrections required will be provided to the contractor, who is required to correct such deficiencies. Upon correction of the deficiencies, Engineering will provide a full bond release request to the board of trustees, who will consider that request at the next regularly scheduled meeting.

13. Upon approval by the board of trustees of the bond release, Engineering and Finance will be notified and appropriate steps will be taken to release the remaining funds. At this point in time, the contractor is released from responsibility for the installation, and the District assumes full responsibility.



SEWER MAIN

1. RANDOM DAILY INSPECTIONS WILL BE PERFORMED BY K.I.D. INSPECTOR PRIOR TO BACKFILLING PIPE TRENCH.
2. SEWER PIPE BEDDING: PIPE SHALL BE LAID ON 6" OF 3/4" MINUS GRAVEL. GRAVEL WILL BE RANDOMLY INSPECTED AS TO ACCEPTABILITY BY THE DISTRICT INSPECTOR BEFORE BACKFILLING THE PIPE ZONE.
3. SEWER LINE PIPE ZONE BACKFILL IN THE PIPE ZONE SHALL BE 3/4" MINUS GRAVEL. VISUAL INSPECTIONS OF BEDDING AND BACKFILL WILL BE CONDUCTED BY THE INSPECTOR BEFORE BACKFILLING THE TRENCH.
4. BACKFILL ABOVE PIPE ZONE AS PER PREVAILING AUTHORITY.
5. PIPE LOCATION: INSTALL PIPE IN CENTER OF TRENCH.

DATE
6-10-05

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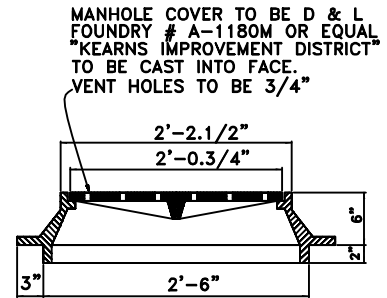
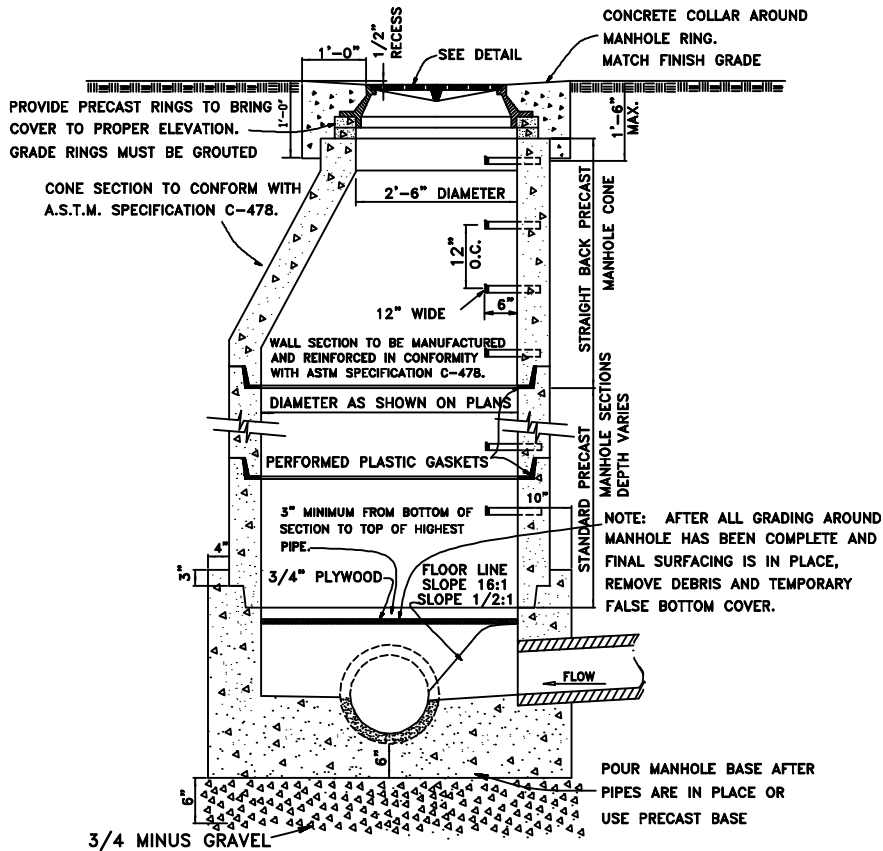


TYPICAL SEWER LINE TRENCH DETAIL

OF _____

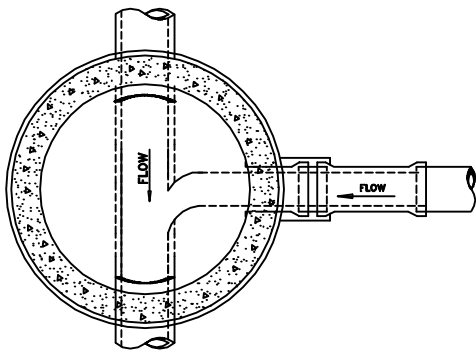
DRWG. NO.

1



STANDARD MANHOLE
FRAME AND COVER

STANDARD MANHOLE
PROFILE



STANDARD MANHOLE
PLAN VIEW

MANHOLE NOTES

1. PROVIDE STUBS WHERE SHOWN ON THE PLAN DRAWINGS.
2. FURNISH & INSTALL 3/4" PLYWOOD FALSE BOTTOM COVERS IN ALL NEW OR EXISTING MANHOLES AROUND WHICH GRADING OR SURFACING IS BEING PERFORMED. PLYWOOD BOTTOMS TO BE REMOVED AFTER PAVING.
3. MANHOLES MAY BE 4'-0", 5'-0", OR 6'-0" AS SHOWN ON THE PLAN DRAWINGS.
4. PROVIDE STEPS ON WALLS OF MANHOLE SECTIONS @ 12" O.C. AND POSITIONED UNDER OPENING. STEPS SHALL BE CAST-IN PLACE, VIBRATED INTO GREEN CONCRETE, OR PRESS-FIT INTO PREFORMED HOLES IN WALLS.
5. STEPS SHALL BE CO-POLYMER POLYPROPYLENE COATED STEEL STEPS, MODEL PST-PF, AS MANUFACTURED BY M.A. INDUSTRIES, INC., OR ACCEPTABLE EQUAL.

DATE
6-10-05

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RH

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RM

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CE

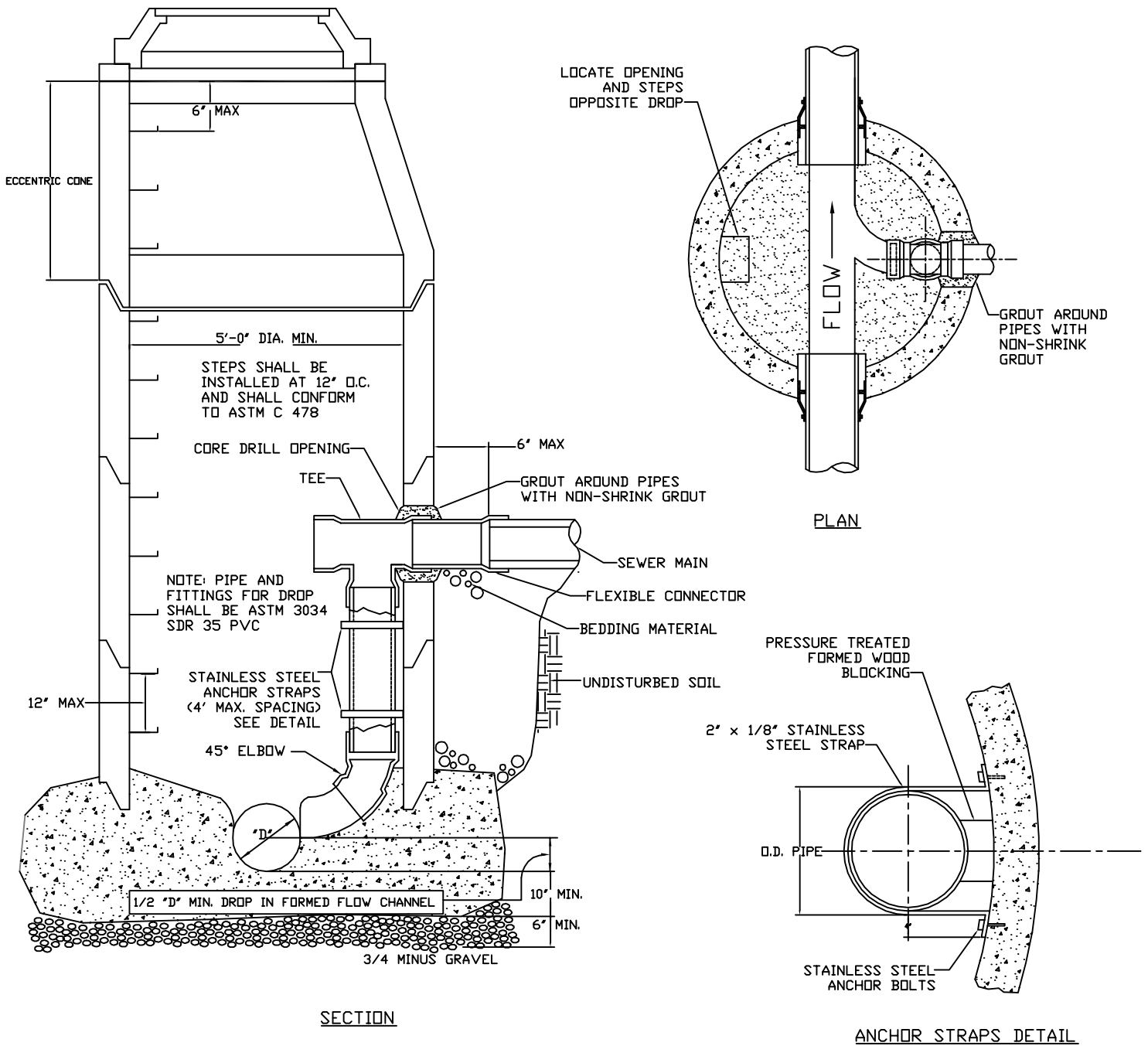


STANDARD MANHOLE

OF _____

DRWG. NO.

2



NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND INSIDE DROP MANHOLE SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
2. BACKFILLING: INSTALL ALL BACKFILL MATERIAL PER SPECIFICATION REQUIREMENTS.
3. CONCRETE: CLASS 4000 AS PER SPECIFICATIONS.
4. FINISH: PROVIDE SMOOTH AND NEAT FINISH ON INTERIOR OF GRADE RINGS.
5. FURNISH AND INSTALL 3/4" PLYWOOD FALSE BOTTOM COVER IN ALL NEW OR EXISTING MANHOLES AROUND WHICH GRADING OR SURFACING IS BEING PERFORMED.

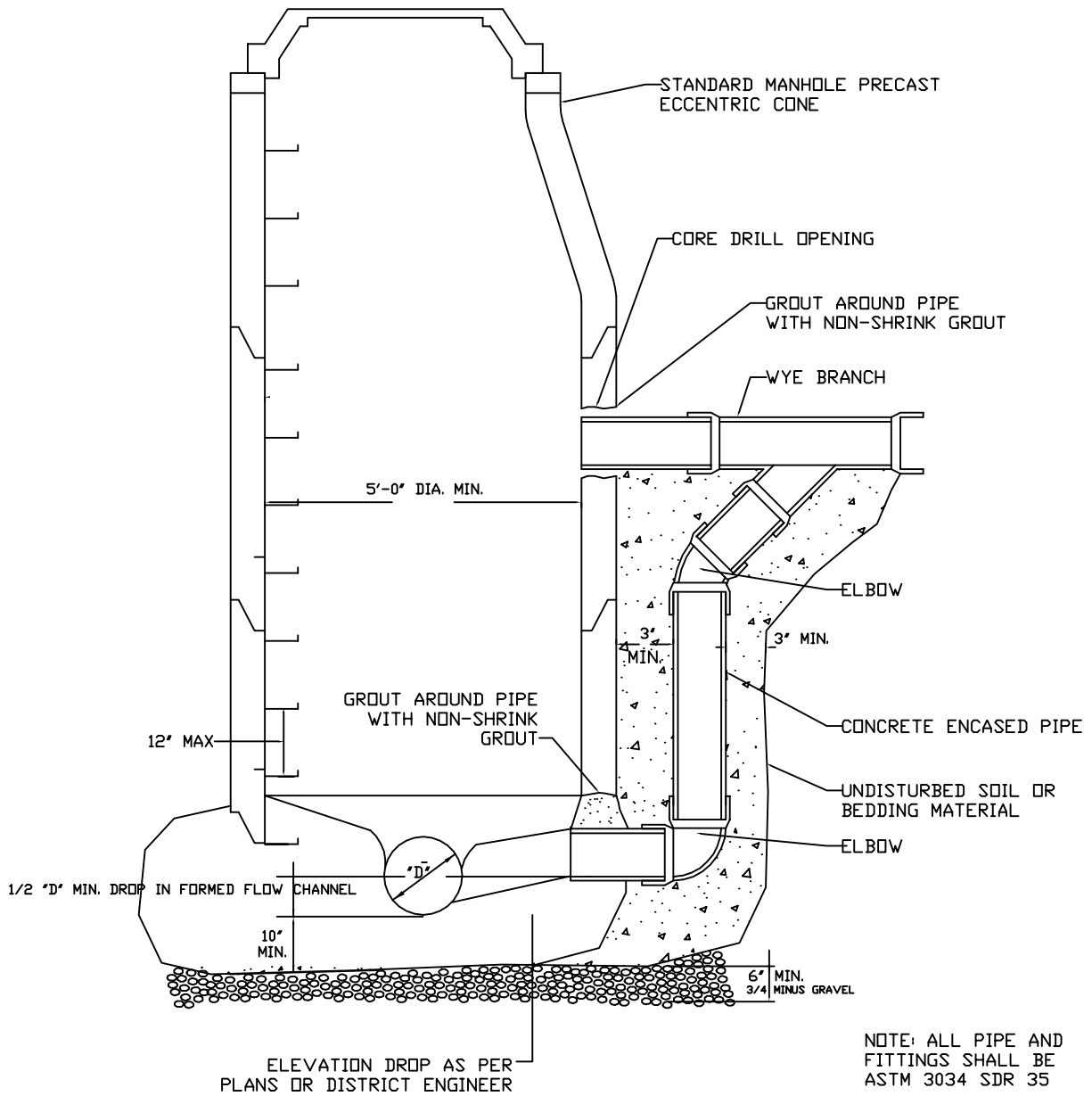
DATE
6-10-05

DRAWN
RH
CHECKED
RM
CHECKED
CE



TYPICAL INSIDE DROP MANHOLE DETAIL

OF _____
DRWG. NO.
3



SECTION

NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND OUTSIDE DROP MANHOLE SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
2. BACKFILLING: INSTALL ALL BACKFILL MATERIAL PER SPECIFICATION REQUIREMENTS.
3. CONCRETE: CLASS 4000 AS PER SPECIFICATIONS.
4. FINISH: PROVIDE SMOOTH AND NEAT FINISH ON INTERIOR OF GRADE RINGS.
5. FURNISH AND INSTALL 3/4" PLYWOOD FALSE BOTTOM COVER IN ALL NEW OR EXISTING MANHOLES AROUND WHICH GRADING OR SURFACING IS BEING PERFORMED.

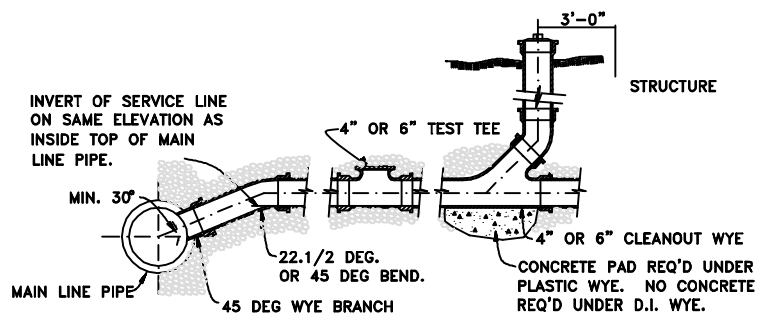
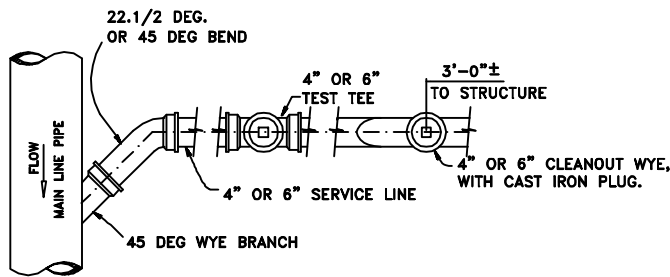
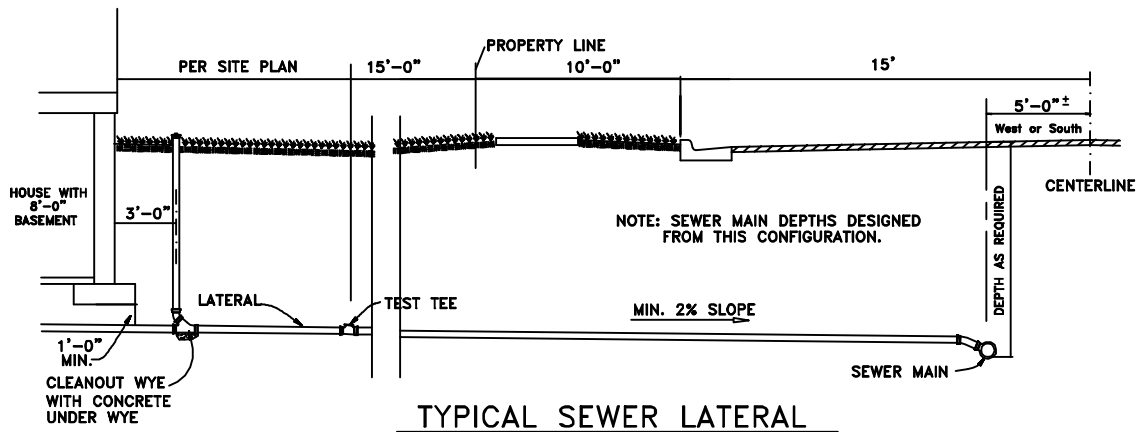
DATE
6-10-05

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TYPICAL OUTSIDE DROP MANHOLE DETAIL

OF _____
DRWG. NO.
4



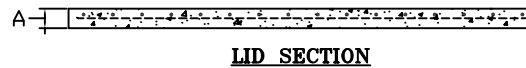
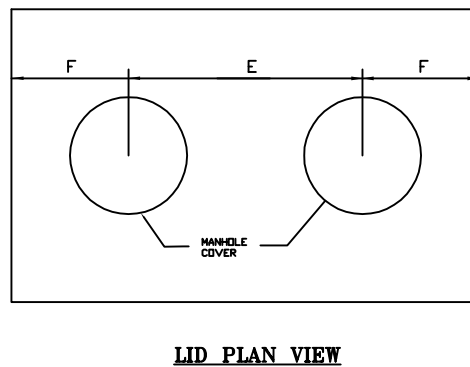
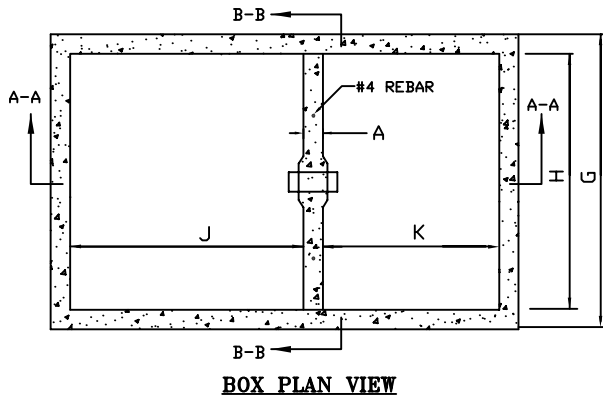
DATE 6-10-05

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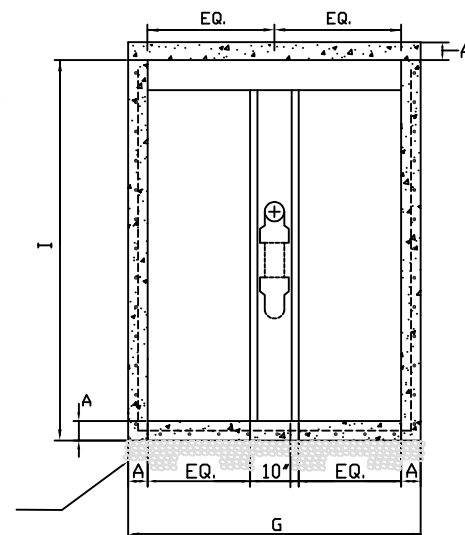
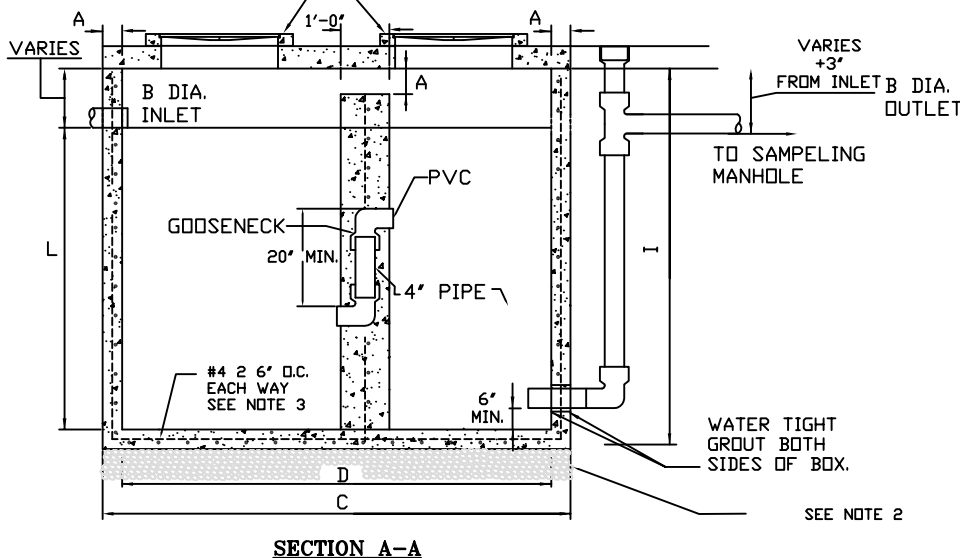


SEWER SERVICE CONNECTION

OF _____
 DRWG. NO. 5



RING AND COVER (A1180) OR EQUAL, IF APPROVED BY KID TYPICAL OF 2.
 NO MORE THAN ONE GRADE RING (1" max.) PER RING AND COVER.



GREASE TRAP DIMENSIONS			
	1000 Gal	1500 Gal	2100 Gal
A	6"	6"	8"
B	4"	4"	6"
C	9'-6"	9'-6"	13'-0"
D	8'-6"	8'-6"	12'-0"
E	5'-6"	5'-6"	8'-0"
F	1'-6"	1'-6"	2'-0"
G	5'-6"	5'-6"	7'-0"
H	4'-6"	4'-6"	6'-0"
I	4'-6"	6'-0"	5'-0"
J	5'-6"	5'-0"	8'-0"
K	3'-0"	3'-0"	4'-0"
L*	3'-6"	3'-0"	4'-0"

L* minimum

NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND CONCRETE BOX, SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
2. BASE: PROVIDE 6" OF 3/4 MINUS GRAVEL UNDER GREASE TRAP.
3. IF PREFABRICATED GREASE TRAP IS USED, SUBMIT DESIGN DETAILS TO DISTRICT ENGINEER FOR APPROVAL.
4. SEE SHEET 8 FOR SAMPLING MANHOLE DETAIL.
5. GREASE TRAP INTERCEPTOR SHALL BE 1,000 GAL. MINIMUM CAPACITY
6. SANITARY SEWER (S.S.) SHALL NOT RUN THROUGH THE SAMPLING MANHOLE AND/OR GREASE INTERCEPTOR. S.S. SHALL BE CONNECTED TO THE SEWER LATERAL DOWNSTREAM FROM THE SAMPLING MANHOLE.
7. WHEN JOINING TWO PIPES OF DIFFERENT COMPOSITION USE FERNCO COUPLERS (NOTE: "NO HUB" BANDS ARE NOT ALLOWED).
8. BENDS TOTALING 90° MUST BE PROVIDED WITH A CLEANOUT.
9. DISTANCE BETWEEN CLEANOUTS NOT TO EXCEED 60'.
10. AT INSPECTION, FILL INTERCEPTOR WITH WATER ABOVE INLET AND OUTLET OF WATER TIGHT JOINTS.
11. GREASE INTERCEPTOR SHALL BE SUITABLE FOR H-20 LOADINGS.

DATE 6-10-05

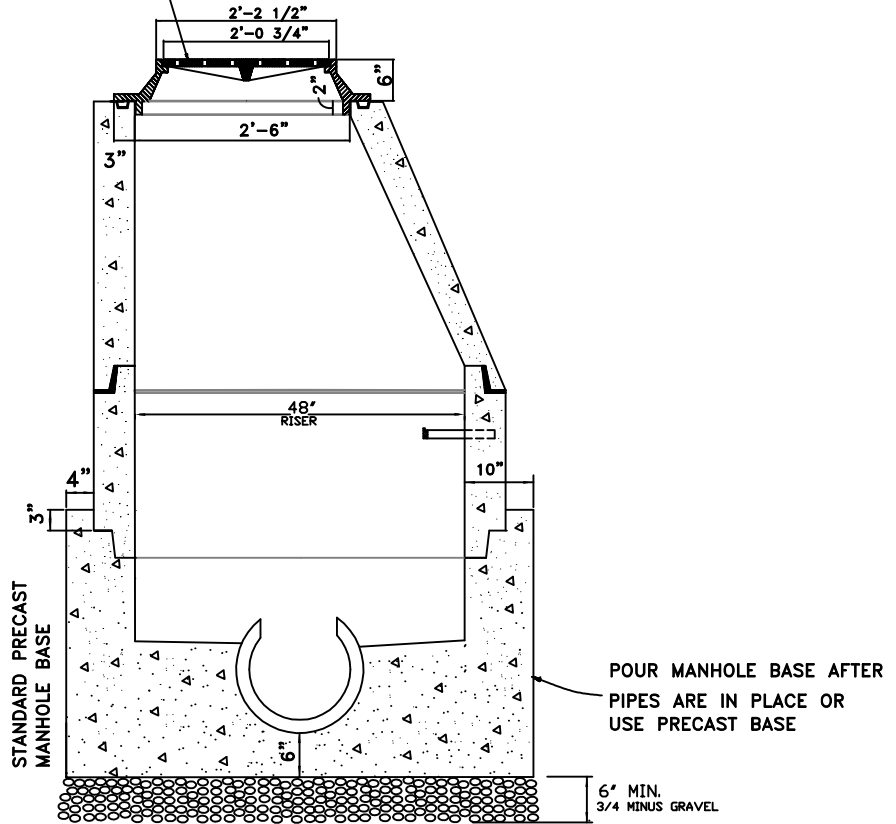
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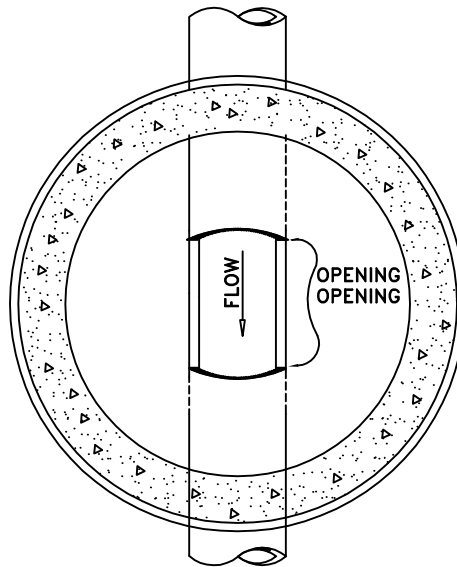
TYPICAL GREASE TRAP DETAIL

OF _____
 DRWG. NO. **6**

MANHOLE COVER TO BE D & L FOUNDRY
 # A-1180 WITH OR EQUAL WITH
 "KEARNS IMPROVEMENT DISTRICT"
 CAST INTO FACE. VENT HOLES TO BE
 NO LARGER THAN 3/4"



SAMPLING MANHOLE
 PROFILE



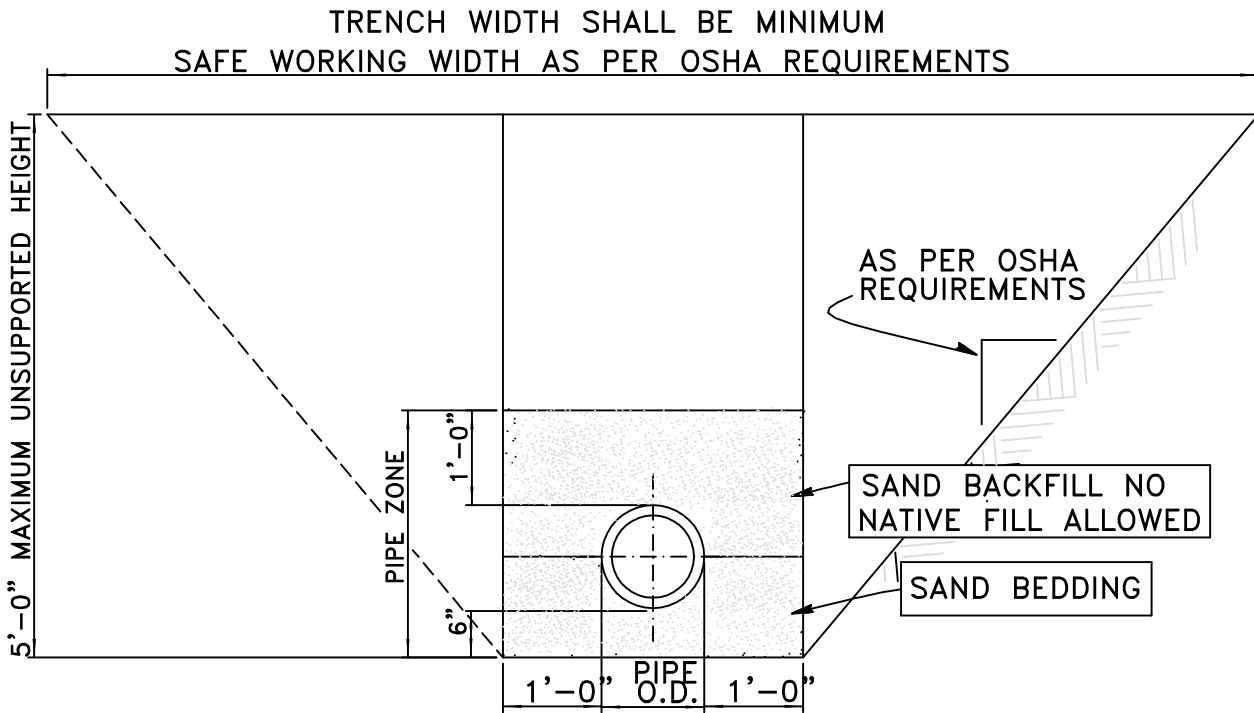
SAMPLING MANHOLE
 PLAN VIEW

DATE	6-10-05
DRAWN	RH
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SAMPLING MANHOLE DETAIL

OF	7
DRWG. NO.	7



WATER MAIN

1. RANDOM DAILY INSPECTIONS WILL BE PERFORMED BY K.I.D. INSPECTOR PRIOR TO BACKFILLING PIPE TRENCH.
2. WATER PIPE BEDDING: PIPE SHALL BE LAID ON 6" OF SAND. SAND AND GRAVEL WILL BE RANDOMLY INSPECTED AS TO ACCEPTABILITY BY THE DISTRICT INSPECTOR BEFORE BACKFILLING THE PIPE ZONE.
3. SEWER LINE PIPE ZONE BACKFILL IN THE PIPE ZONE SHALL BE 3/4" MINUS GRAVEL. VISUAL INSPECTIONS OF BEDDING AND BACKFILL WILL BE CONDUCTED BY THE INSPECTOR BEFORE BACKFILLING THE TRENCH.
4. BACKFILL ABOVE PIPE ZONE AS PER PREVAILING AUTHORITY.
5. PIPE LOCATION: INSTALL PIPE IN CENTER OF TRENCH.

DATE 6-10-05

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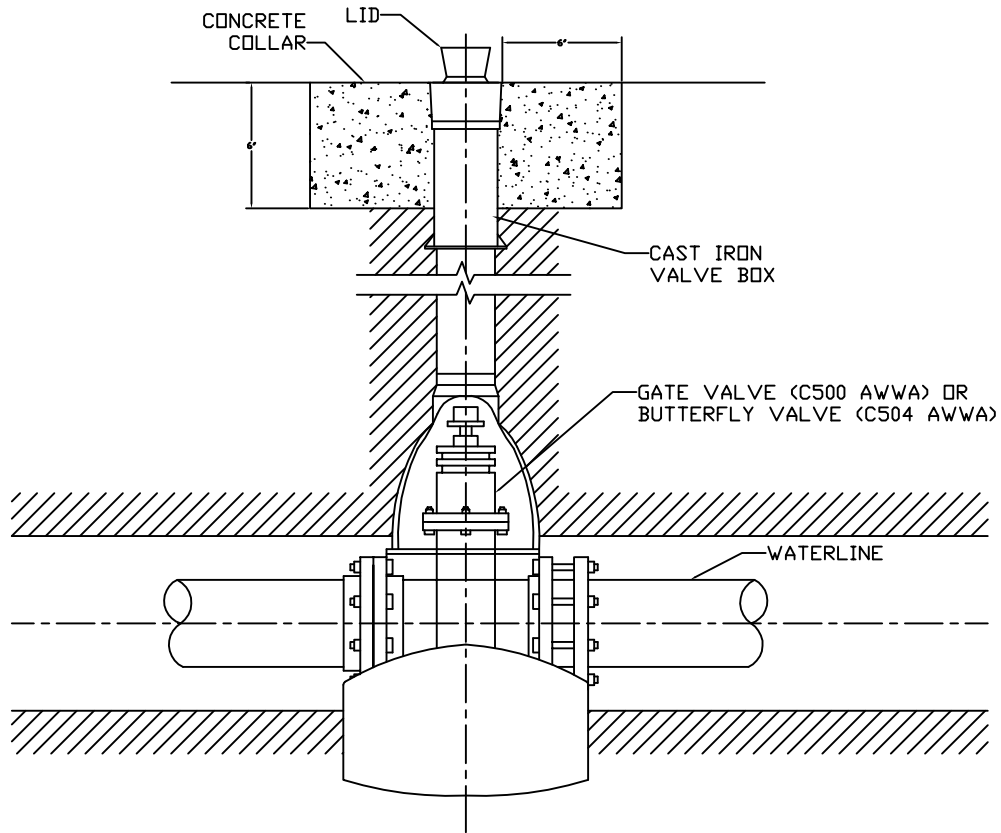


TYPICAL WATER LINE TRENCH DETAIL

OF _____

DRWG. NO.

8



NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND VALVE, SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
2. BACKFILLING: INSTALL ALL BACKFILL MATERIAL PER SPECIFICATION REQUIREMENTS.
3. GREASE: APPLY POLY-FM GREASE TO ALL BOLTS. WRAP WITH 8 MIL THICK POLYETHYLENE SHEET AND TAPE WRAP.
4. CONCRETE COLLAR: CONCRETE PER CITY OR COUNTY SPECIFICATIONS.
5. VALVE BOX MUST BE VERTICAL TO ALLOW FOR VALVE KEY ACCESS.
6. PROVIDE VALVE STEM EXTENSIONS FOR VALVES DEEPER THAN 4' FEET.

DATE 6-10-05

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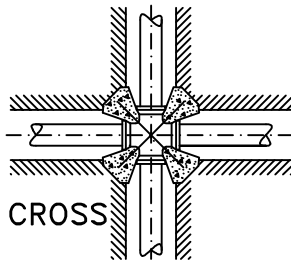
TYPICAL GATE VALVE DETAIL

OF _____
DRWG. NO.
9

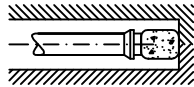
$$\text{BEARING AREA} = (\text{TEST PRESSURE}/250) \times (2000/\text{SOIL BEARING STRESS}) \times (\text{TABLE VALUE})$$

MINIMUM BEARING AREA IN SQUARE FEET

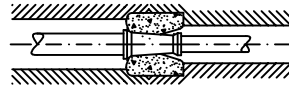
FITTING SIZE	TEE, WYE PLUG OR CAP	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22 1/2° BEND	11 1/4° BEND	45° VERT BEND * (CU YDS.)	22 1/2° VERT BEND (CU YDS.)	11 1/4° VERT BEND (CU YDS.)
			A1	A2						
4"	2.4	3.3	3.3	1.5	1.8	0.9	0.5	1.2	0.5	0.2
6"	5.3	7.5	7.5	5.6	4.1	2.1	1.0	1.9	1.0	0.5
8"	9.4	13.3	13.3	10.0	7.2	3.7	1.8	3.4	1.8	0.9
10"	14.7	20.8	20.8	17.5	11.3	5.7	2.9	5.3	2.9	1.5
12"	21.2	30.0	30.0	26.7	16.2	8.3	4.2	7.7	4.1	2.1
14"	28.9	40.8	40.8	33.3	22.1	11.3	5.7	10.4	5.6	2.9
16"	37.7	53.3	53.3	45.8	28.9	14.7	7.4	13.6	7.4	3.8
18"	47.7	67.5	67.5	60.0	36.5	18.6	9.4	17.2	9.3	4.8



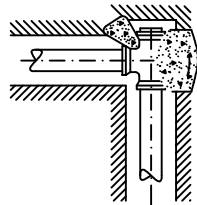
CROSS



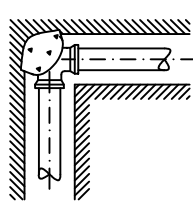
CAP / PLUG



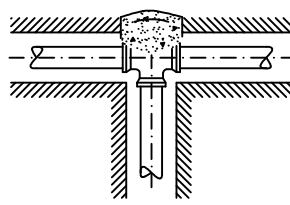
REDUCER



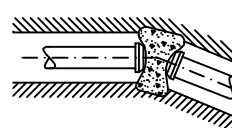
TEE W/CAP



90° BEND



TEE



HORIZONTAL ELL

THRUST BLOCK DETAILS

NOTES:

1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH OR STRUCTURAL BACKFILL APPROVED BY ENGINEER.
2. KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES.
3. REQUIRED BEARING AREAS AT FITTINGS SHALL BE AS REQUIRED TO CONFORM TO TEST PRESSURE(S) AND ALLOWABLE SOIL BEARING STRESS(ES) STATED IN NOTE 7.
4. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS TYPICAL DETAIL.
5. ALL BURIED PIPING EXCEPT FLANGED, SCREWED, SOCKET WELD PVC OR WELDED STEEL PIPE SPECIFIED TO BE PRESSURE TESTED SHALL BE PROVIDED WITH CONCRETE THRUST BLOCKS AT ALL DIRECTION CHANGES UNLESS OTHERWISE NOTED.
6. THRUST BLOCKS SHALL NOT BE LOCATED OR SIZED TO ENCASE ADJACENT PIPES OR FITTINGS.
7. BEARING AREAS ARE BASED ON TEST PRESSURE OF 250 P.S.I. AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 POUNDS PER SQUARE FOOT.
8. MEGA LUGS MAY BE USED IN PLACE OF THRUST BLOCKS IN CERTAIN APPLICATIONS WHEN APPROVED BY THE DISTRICT ENGINEER.

DATE 6-10-05

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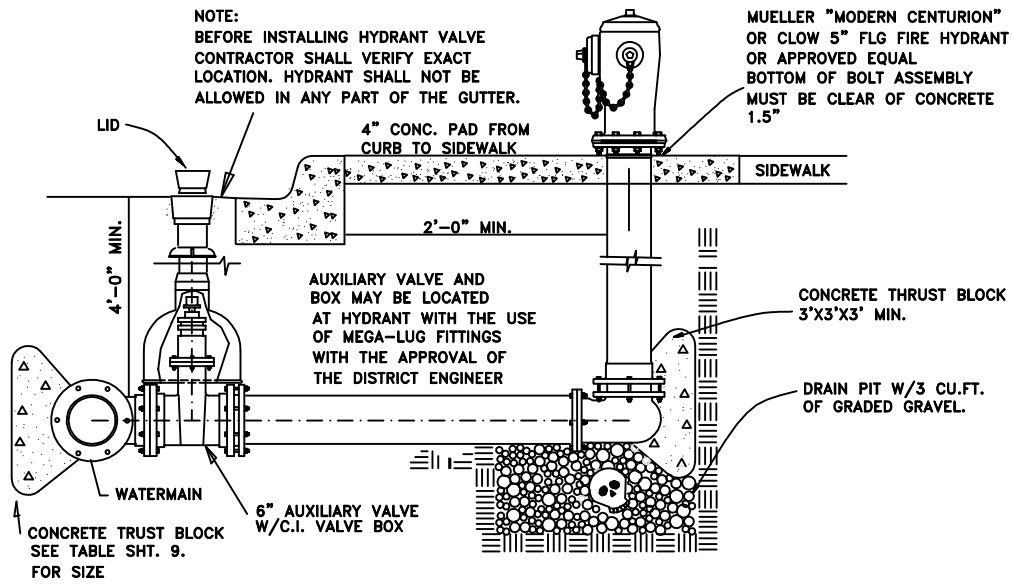


THRUST BLOCK DETAILS

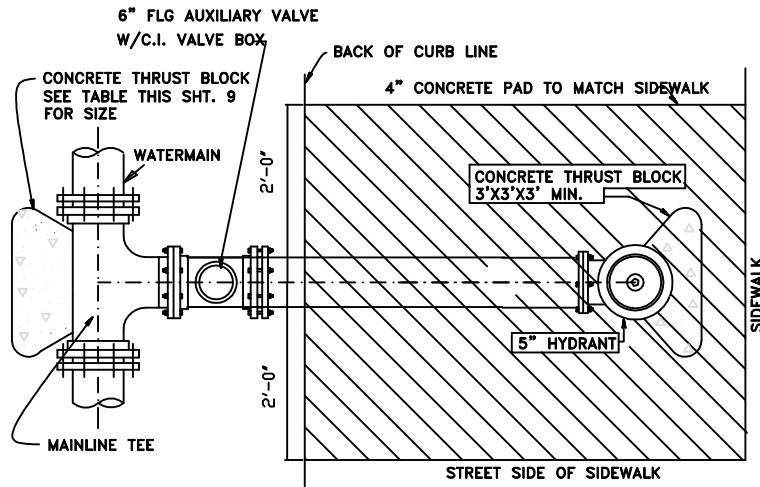
OF _____

DRWG. NO.

10



TYPICAL HYDRANT INSTALLATION
PROFILE VIEW



TYPICAL HYDRANT AND PAD DETAIL
PLAN VIEW

DATE
6-10-05

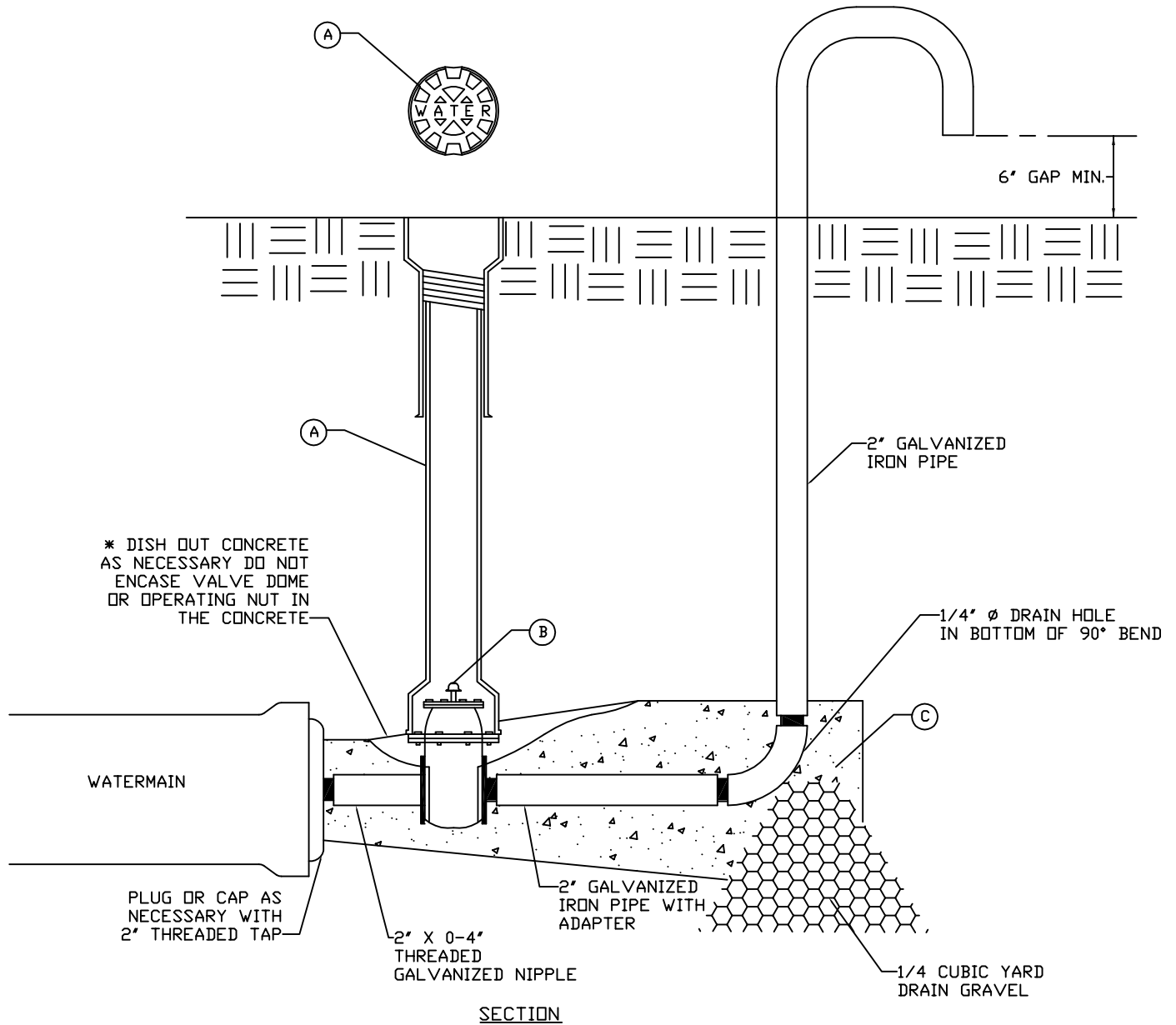
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CE



HYDRANT INSTALLATION

OF _____
DRWG. NO.

11



LEGEND		
NO.	ITEM	DESCRIPTION
(A)	VALVE BOX WITH LID	2 PIECE CAST IRON
(B)	2" GATE VALVE WITH SCREW ENDS	2" X 2" OPERATING NUT
(C)	CONCRETE THRUST BLOCK	

NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND THRUST BLOCK, SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
2. BACKFILL: INSTALL AND COMPACT ALL BACKFILL MATERIAL PER SPECIFICATIONS.
3. CONCRETE: TO BE PER SPECIFICATIONS. POUR CONCRETE AGAINST UNDISTURBED SOIL.
4. SPECIAL DESIGN: WATERMAINS 12" AND LARGER REQUIRE SPECIAL WASHOUT ASSEMBLY DESIGN.
5. VALVE BOX MUST BE VERTICAL TO ALLOW FOR VALVE KEY ACCESS.

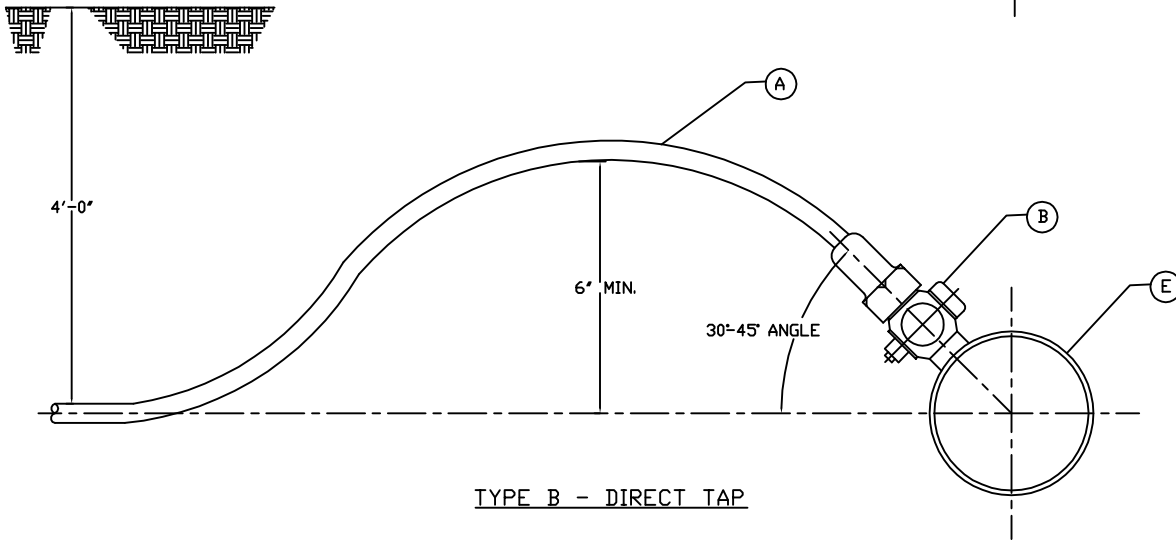
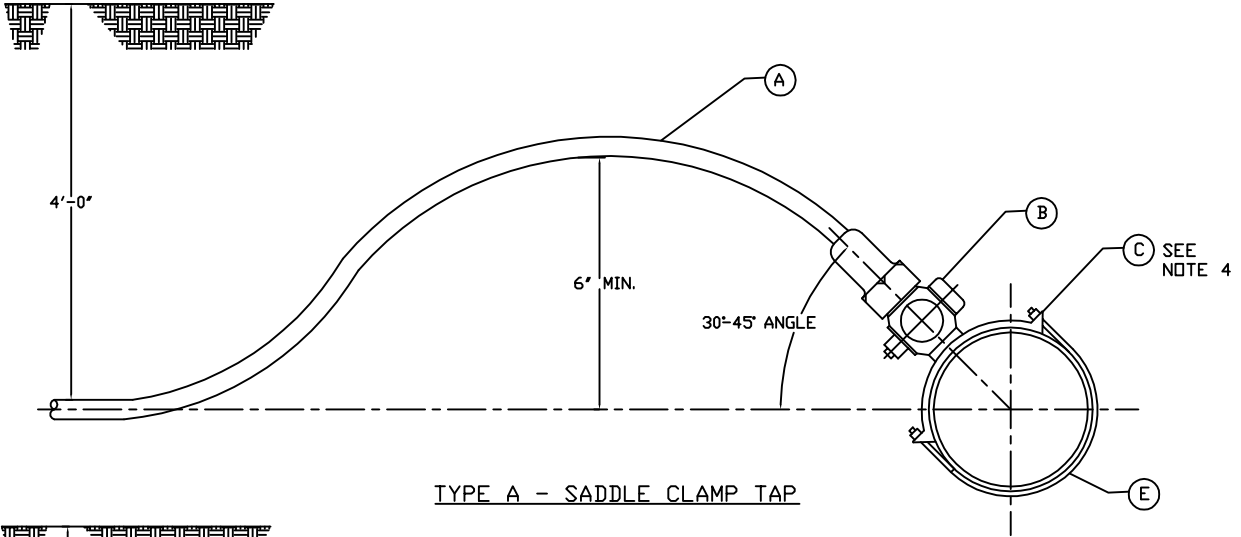
DATE 6-10-05

DRAWN RH
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 CHECKED CE



TYPICAL WASH OUT VALVE DETAIL

OF _____
 DRWG. NO. 12



LEGEND		
NO.	ITEM	DESCRIPTION
(A)	COPPER PIPE	TYPE K - SOFT (NOTE 5)
(B)	CORPORATION STOP	BRASS (NOTE 4)
(C)	SERVICE SADDLE CLAMP	<D.I., P.V.C.> ** (NOTE 3)
(E)	WATER MAIN PIPE	<D.I., P.V.C.>

** DI PIPE MAY BE DIRECT TAPPED

NOTES:

1. INSPECTION: PRIOR TO BACKFILLING AROUND TAPS SECURE INSPECTION OF INSTALLATION BY KID INSPECTOR.
2. BACKFILL: AS PER SPECIFICATIONS.
3. PROVIDE BRASS DOUBLE STRAP TAPPING SADDLE FOR TAPPING DUCTILE IRON OR PVC PLASTIC PIPE, MUELLER H-16000 SERIES OR EQUAL.
4. 3/4" FORD FB600 BALL CORP AWWA TAPER THREAD INLET, FLARE OR COMPRESSION FITTINGS ACCEPTED.
5. PROVIDE HORIZONTAL EXPANSION LOOP IN COPPER PIPE.
6. TAPPING: PLACE TAPS A MINIMUM OF 24 INCHES APART. USE A TAPPING TOOL WHICH IS SIZED CORRESPONDING TO THE SIZE OF THE SERVICE LINE TO BE INSTALLED. NO TAPS WITHIN 24 INCHES OF END OF PIPE.
7. TAPE: TEFLON TAPE IS REQUIRED ON ALL TAPS.
8. CONTRACTOR TO RETAIN ALL TAPPED PLUGS AND PROVIDE THE PLUGS TO DISTRICT INSPECTOR.
9. ALL DIRECT TAP TO UTILIZE "CC" THREADS.

DATE
6-10-05

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RH

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RM

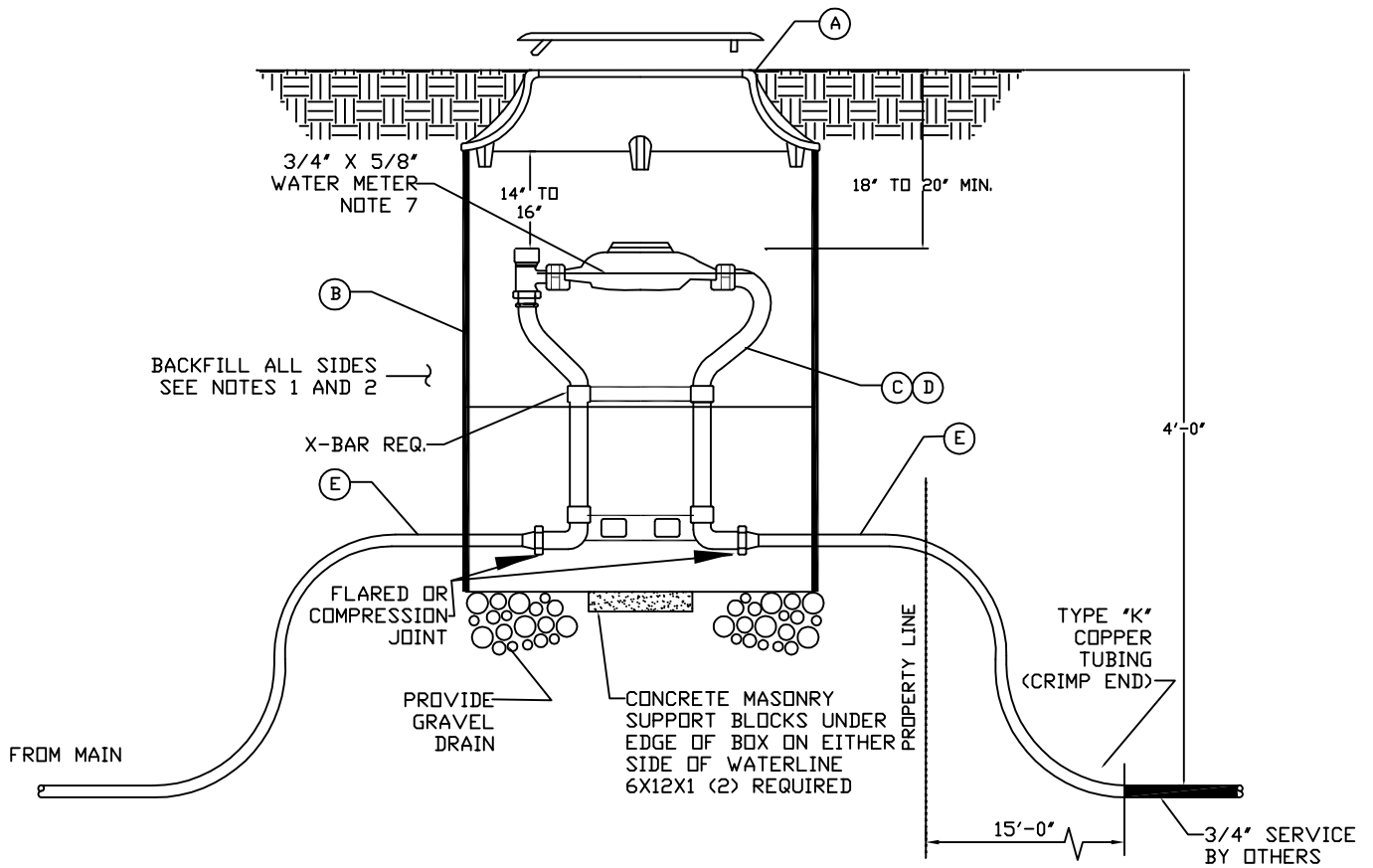
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TYPICAL SERVICE TAP DETAIL

OF _____

DRWG. NO.
13



LEGEND		
NO.	ITEM	DESCRIPTION
(A)	FRAME AND COVER	NOTE 3
(B)	METER BOX (18" TO 21" DIAMETER) (30" DEEP)	NOTE 4
(C)	3/4" METER YOKE	NOTE 5
(D)	1" METER YOKE	NOTE 6
(E)	COPPER PIPE	TYPE K (SOFT)

NOTES:

- INSPECTION: PRIOR TO BACKFILLING AROUND METER BOX, SECURE INSPECTION OF INSTALLATION BY DISTRICT INSPECTOR.
- BACKFILLING: INSTALL ALL BACKFILL MATERIAL PER SPECIFICATION REQUIREMENTS IN LIFTS NOT EXCEEDING 6 INCHES AFTER COMPACTION. COMPACT EACH LIFT TO A MINIMUM RELATIVE DENSITY OF 95 PERCENT.
- D&L FOUNDRY AND SUPPLY MODEL L-2240 METER BOX LID AND RIM WITH 2" HOLE FOR RADIO READ. BRANDED "WATER METER" CAST IN TOP.
- METER BOX MAY BE ADS FURNISH SAMPLE BOX AND REVIEW WITH DISTRICT ENGINEER.
- 3/4" COPPER WATER METER VOILE FORD 70 SERIES FULL 3/4" METER SETTER VBHC 72 21W-11-33 WITH RESIDENTIAL CHECK VALVE OR WATTS # J02A-UNUM BVDC WITH 21' TUBING.
- 1" SETTER VBHC 74-21W-44-44 OR EQUAL.
- WATER METER FURNISHED AND INSTALLED BY KEARNS IMPROVEMENT DISTRICT.
- PLACEMENT:
 - DO NOT INSTALL METER BOXES UNDER DRIVEWAY APPROACHES, SIDEWALKS, OR CURB AND GUTTER.
 - ALL METER BOXES TO BE INSTALLED IN PARK STRIP.
 - SEE SPECIFICATIONS SEC. 1.2.1.2

DATE
6-10-05

DRAWN
RH

CHECKED
RM

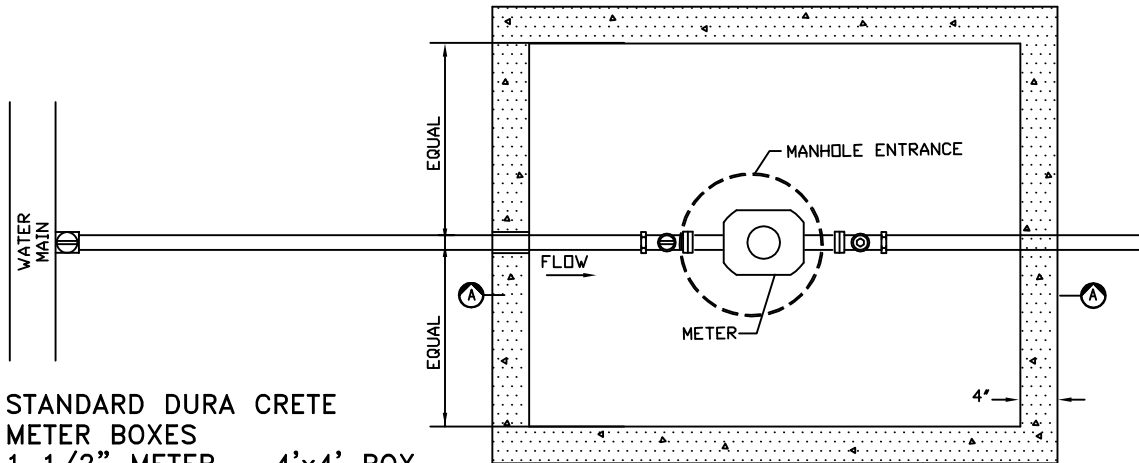
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CE



TYPICAL METER BOX DETAIL

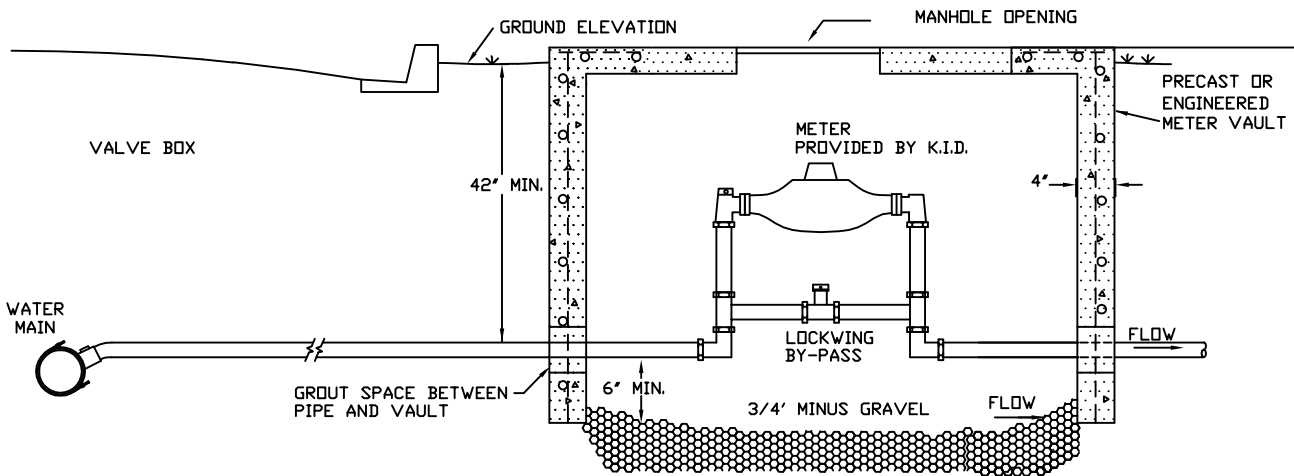
OF _____

DRWG. NO.
14



STANDARD DURA CRETE
METER BOXES
1 1/2" METER - 4'x4' BOX
2" METER - 5'x5' BOX

PLAN VIEW



STANDARD DURA CRETE
METER BOXES
1 1/2" METER - 4'x4' BOX
2" METER - 5'x5' BOX

SECTION A-A

1. LOCATE MANHOLE OPENINGS DOWN CENTER LINE OF METER VAULT.
2. METER BOX SHALL BE MIN. 4' DEEP WITH GRAVEL BOTTOM.
3. IF THE BACKFLOW ASSEMBLY IS LOCATED OUTSIDE OF THE METER BOX, METER BOX SIZE MAY BE REVISED AS REQUIRED.
4. METER SETTER FOR 1 1/2" AND 2" METERS ARE AS FOLLOWS:
FORD SERIES COPPERSETTERS FOR FLANGED METERS
1 1/2" VH76-21B-11-66
2" VH77-21B-11-77

DATE 6-10-05

DRAWN RH
CHECKED RM
CHECKED CE

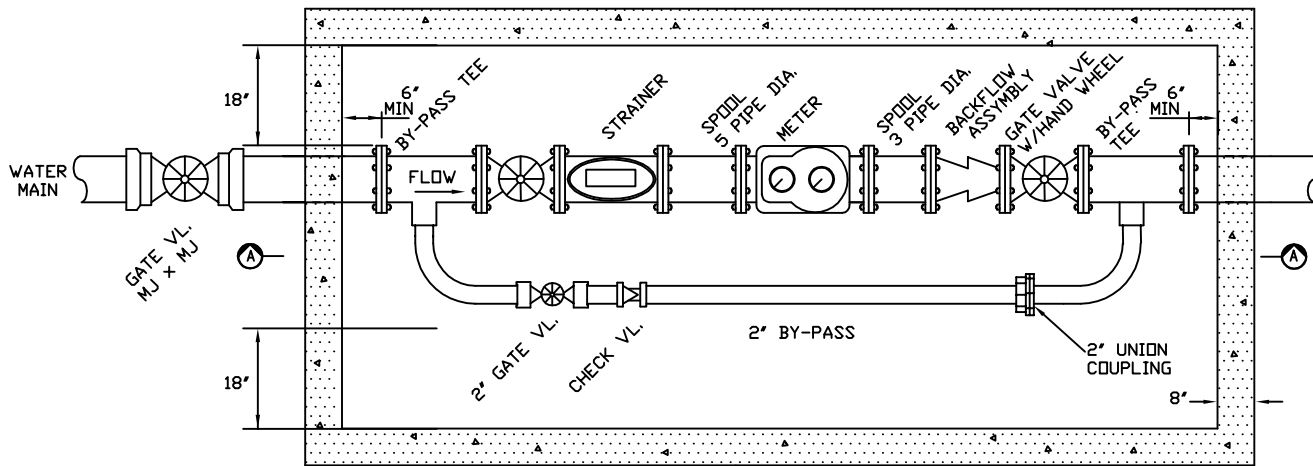


1 1/2" - 2"
WATER METER VAULT

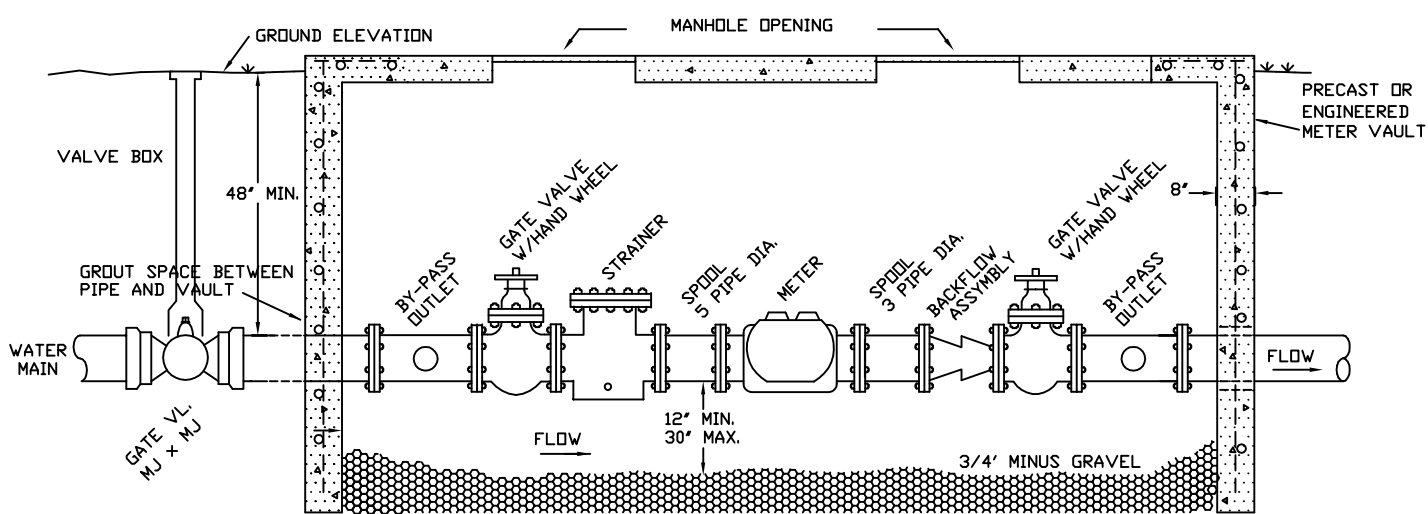
OF .

DRWG. NO.

15



PLAN



SECTION A-A

1. LOCATE MANHOLE OPENINGS DOWN CENTER LINE OF METER VAULT.
2. METER BOX SHALL BE MIN. 5' DEEP WITH GRAVEL BOTTOM.
3. IF THE BACKFLOW ASSEMBLY IS LOCATED OUTSIDE OF THE METER BOX, METER BOX SIZE MAY BE REVISED AS REQUIRED.
4. INSTALL GATE VALVE & VALVE BOX OUTSIDE OF BUT ADJACENT TO METER VAULT.
5. FOR 6" AND LARGER METERS CONTACT K.I.D. ENGINEERING DEPARTMENT.

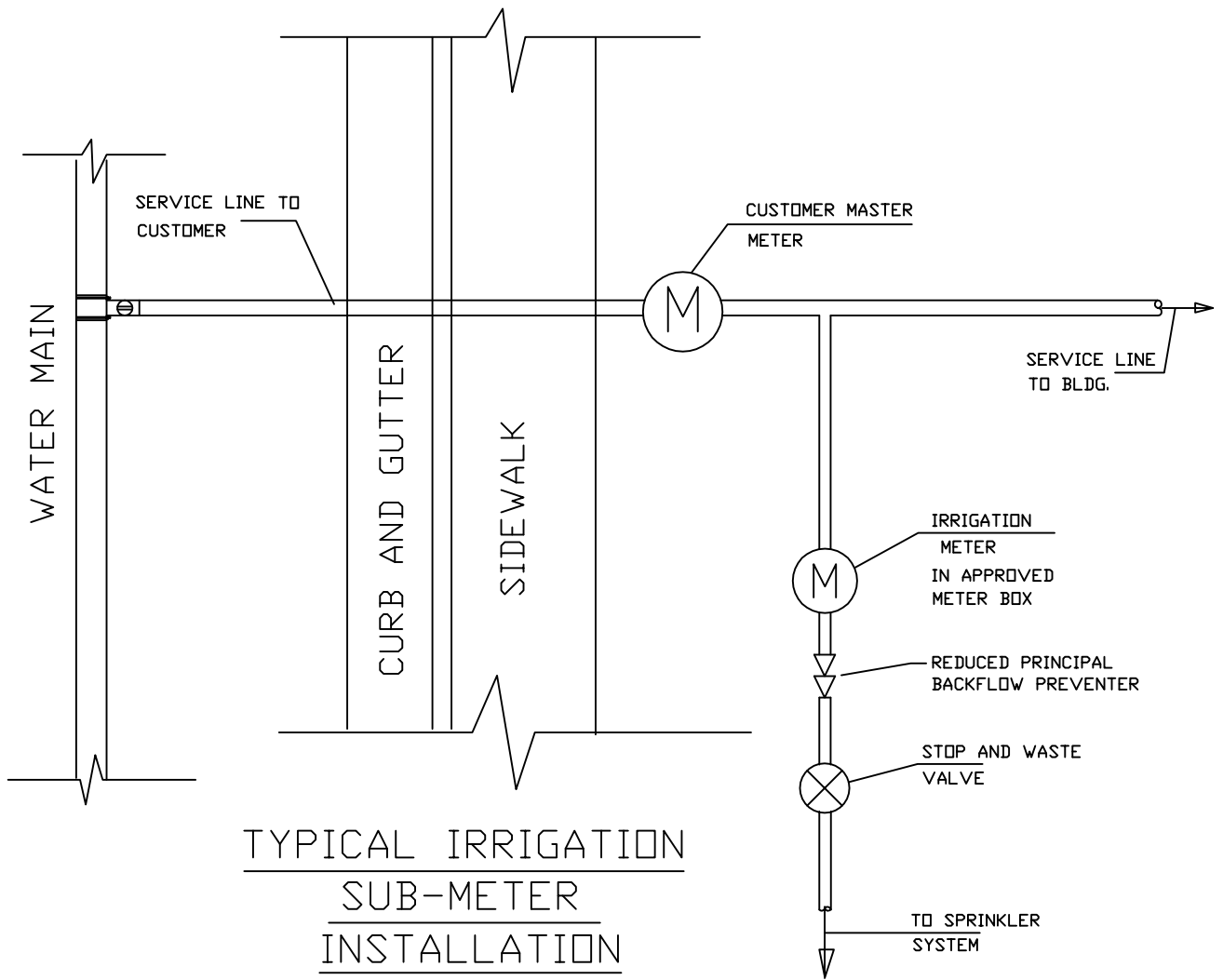
DATE 6-10-05

DRAWN RH
 CHECKED RM
 CHECKED CE



3" - 4" WATER METER VAULT

OF _____
 DRWG. NO. 16



TYPICAL IRRIGATION
SUB-METER
INSTALLATION

SCHEMATIC DETAIL NO SCALE

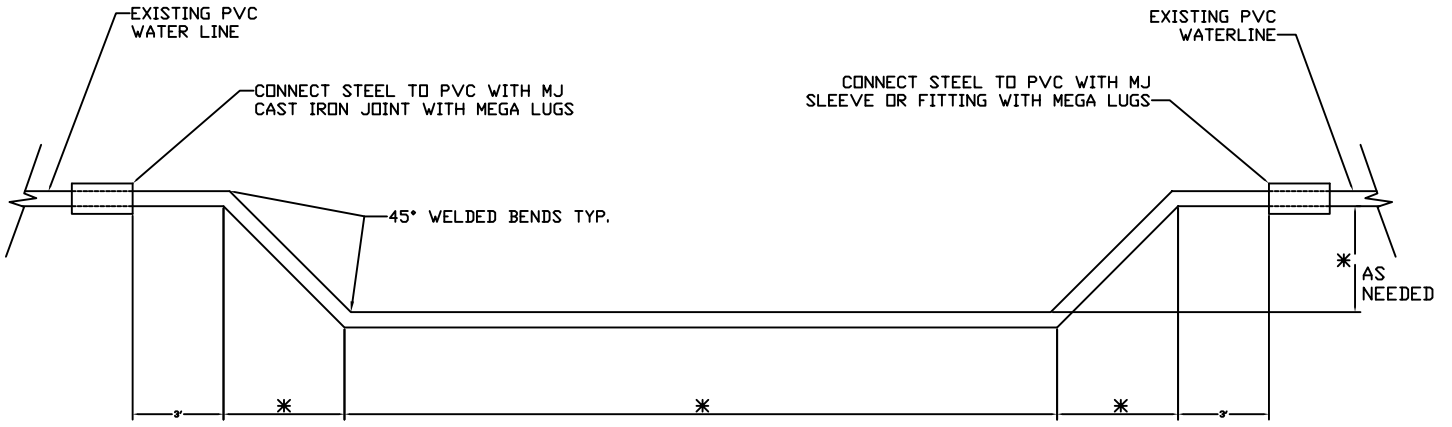
DATE 6-10-05

DRAWN RH
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TYPICAL IRRIGATION
SUB-METER INSTALLATION

OF .
DRWG. NO. 17



* DISTANCE AS REQUIRED TO RELOCATE LINE

WATER MAIN LOWERING

NOTES:

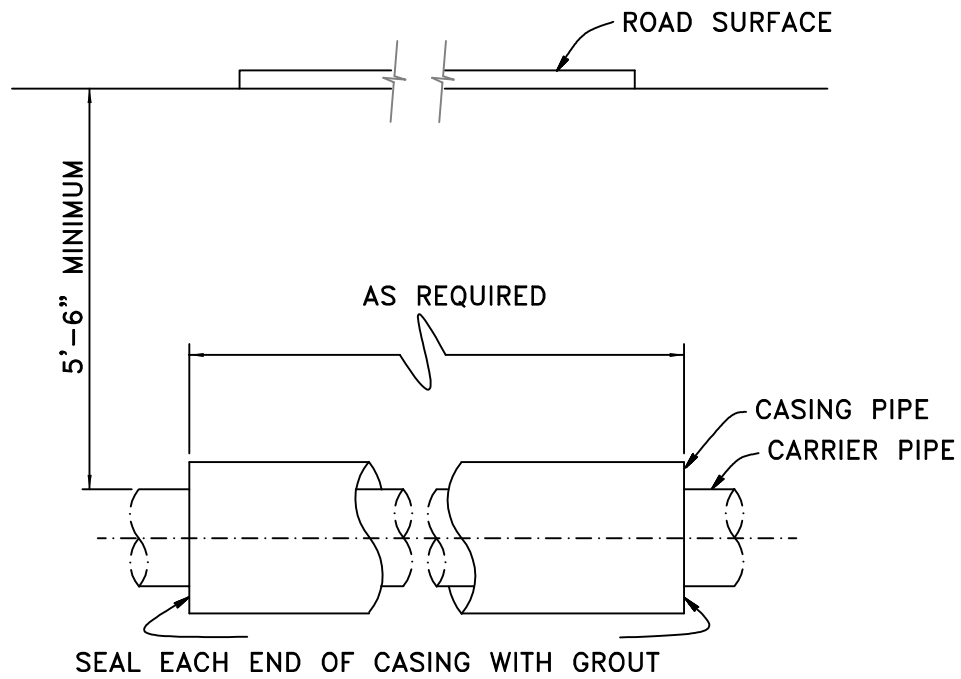
1. THE LOOP SHALL BE FABRICATED OUT OF SCHEDULE 40 STEEL PIPE.
2. PIPE SHALL BE EPOXY LINED AND COATED PER AWWA C210 STANDARDS.
3. PIPE SHALL BE DOUBLE TAPED WRAP PER AWWA C209 STANDARDS.
4. SUBMITTAL: CONTRACTOR SHALL SUBMIT DETAIL DRAWING OF WATERLINE LOOP TO DISTRICT ENGINEER FOR APPROVAL BEFORE FABRICATION.
5. PRIOR TO BACKFILLING PIPE TRENCH SECURE INSPECTION OF INSTALLATION BY KID INSPECTOR.
6. PIPE BEDDING AS PER SPECIFICATIONS.

DATE	6-10-05
DRAWN	RH
CHECKED	RM
CHECKED	CE

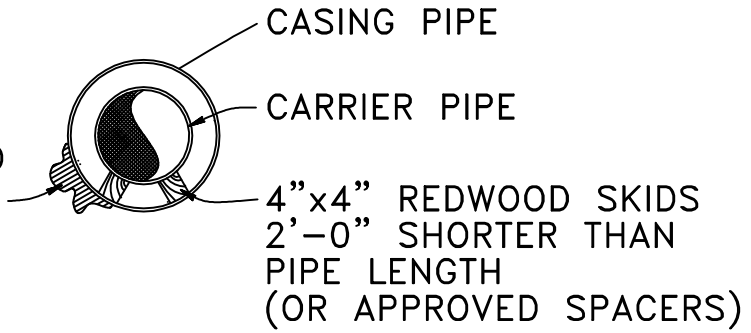


TYPICAL WATER MAIN LOOP DETAIL

OF	18
DRWG. NO.	18



ANY VOIDS CREATED BY BORING SHALL BE FILLED BY PRESSURE GROUTING



UNDERCROSSING DETAIL

PIPE SIZE	MIN. ID/OD CASING SIZE	MIN. WALL THICKNESS
4"	12" I.D.	1/4"
6"	16" I.D.	1/4"
8"	18" I.D.	1/4"
12"	24" I.D.	5/16"
16"	30" I.D.	3/8"

DATE 6-10-05

DRAWN
RH
CHECKED
RM
CHECKED
CE



UNDERCROSSING DETAIL

OF _____
DRWG. NO.
19