LIMESTONE COUNTY WATER AND SEWER AUTHORITY

2015 POLICIES & PROCEDURES FOR DEVELOPMENT

STANDARD WATER & SEWER SPECIFICATIONS and DESIGN CRITERIA

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Adopted by

LCWSA Board of Directors: 3/4/15
Date

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POLICIES, STANDARD SPECIFICATIONS & DESIGN CRITERIA

1.01 PURPOSE

1.01.01 These Policies, Standard Specifications and Design Criteria are guidelines for Developers, their Engineers and Contractors for the planning, design and construction of water distribution lines, sanitary sewer, small wastewater pumping stations, and associated appurtenances within the Limestone County Water and Sewer Authority service areas.

1.01.02 These Standards shall govern the construction materials and installation of water distribution and wastewater collections systems that are, or will become, the responsibility of the Limestone County Water and Sewer Authority to operate and maintain as part of their system.

1.01.03 These Standards are intended to meet or exceed the requirements of the State of Alabama Department of Environmental Management (ADEM) and to aid the Engineer in his design of water distribution systems, wastewater collection systems, and wastewater lift stations. This design should incorporate the highest level of standards of practice and specify materials of highest quality identified in the technical specifications.

1.01.04 The Standards identify a single set of standards, criteria, submittal requirements and approval procedures to be used in the planning, design, and construction of projects within the Limestone County Water and Sewer Authority service areas.

1.01.05 These Standards are not intended to serve as a step-by-step design and construction method nor can this manual address every situation that may arise. The application of sound engineering/surveying principles combined with the information contained herein is necessary to complete the planning, design, and construction for water distribution and wastewater collection projects.

1.01.06 Nothing herein shall be construed to guarantee or assure any developer or subdivision of the availability of water or sewer service

to any particular development or subdivision of land. Nor shall anything in this resolution be deemed to abrogate, alter or amend any required fee, charge, or rate previously established for any service of the Authority.

1.02 DEFINITIONS

1.02.01 Whenever the words, forms, or phrases defined or pronouns used in their stead occur in this document, or any document or instrument herein contemplated or to which these specifications apply, the intent and meaning shall be construed and interpreted as follows:

1.02.02 ABBREVIATIONS: The following organizations are referred to in these Specifications by abbreviations of their titles:

(a)	AASHTO	American Association of State Highway and Transportation Officials.
(b)	ANSI	American National Standards Institute
(c)	ARAP	Aquatic Resource Alteration Permit
(d)	ASA	American Standards Association
(e)	ALDOT	State of Alabama Department of Transportation
(f)	ASTM	American Society for Testing and Materials
(g)	ADEM	Alabama Department of Environmental Management
(h)	AWWA	American Water Works Association
(i)	COE	Corps of Engineers
(j)	DIP	Ductile Iron Pipe
(k)	EPA	U.S. Environmental Protection Agency
(l)	NEMA	National Electrical Manufacturer's Association
(m)	NPDES	National Pollution Discharge Elimination System
(n)	OSHA	Occupational Safety and Health Administration
(o)	PVC	Polyvinyl Chloride
(p)	ROW	Right-of-Way
(q)	TVA	Tennessee Valley Authority
(r)	USGS	United States Geologic Survey
(s)	WEF	Water Environment Federation

1.02.03 AUTHORITY: Limestone County Water and Sewer Authority of Limestone County, Alabama.

1.02.04 AUTHORITY REPRESENTATIVE: An authorized representative of the Authority assigned to observe the construction of the work and advise the Authority of the Work's progression.

1.02.05 BOARD ENGINEER: The professional engineering firm duly authorized by the Board to act on behalf of the Authority.

1.02.06 CERTIFIED PLAT: A certified plat shall be defined as either:

a. The division of a tract of land or legal record into lots of not less than 10 acres (435,600 sq. feet) each, for the purpose of selling said lots but not for the development of same, provided such subdivision shall not require new street or road to meet road frontage requirements for all lots created, or the extension of water or sewer facilities or the creation of any public improvements; OR
b. A minor subdivision, or the division of a tract of land into lots, all fronting on an existing paved public road and not requiring the construction or extension of any new roads or streets, municipal facilities or public improvements; OR
c. The division of land owned by one or more individuals and/or corporations into homogeneous land use areas which constitute the General Plan of a Planned Unit Development district for the purpose of subsequent subdivision and development; OR
d. The sale or exchange of parcels of land between owners of adjoining property if additional lots are not thereby created and the lots or tracts resulting are not reduced below the current lot sizes, OR
e. Instruments correcting survey data or other details of a previously recorded subdivision plat.

1.02.07 COUNTY: The County of Limestone within the State of Alabama.

1.02.08 CUL-DE-SAC: A minor street with only one outlet and having an appropriate terminal for the safe and convenient reversal of traffic movement.

1.02.09 DEDICATION: The transfer of property from private to public ownership.

1.02.10 DESIGN ENGINEER: Shall mean the engineer or land surveyor registered and in good standing with the State Board of Registration of Alabama who is the agent in his professional capacity of the owner of land which is proposed to be subdivided or which is in the process of being subdivided.

1.02.11 DEVELOPER: The legal or beneficial owner or owners of all the land proposed to be included in a given development or the authorized agent thereof. In addition, the holder of an option or contract to purchase, a lessee having a remaining term of not less than thirty (30) years, or other persons having an enforceable proprietary interest in

such land shall be deemed to be a developer for the purpose of these Regulations.

1.02.12 DEVELOPMENT: The act of combining raw land, roads, utilities, buildings, financing and promotion into a completed operating property with "permanent" improvements.

1.02.13 DEVELOPMENT, SUBSTANTIAL COMPLETION OF: Completion and acceptance by LCWSA of all utilities (which shall be stubbed out to ownership tracts where appropriate); AND certification indicating that all required improvements have been installed or that sufficient bond exists to cover all costs of completion of the improvements; AND additional certificates and dedications necessary to insure adequate access for public protection and utilities as well as conformance to applicable plans and ordinance requirements.

1.02.14 EASEMENT: A grant by the property owner of use, by the public, a corporation, or person(s) of a strip of land for specified reasons, or as created by operation of law.

1.02.15 EMPLOYEE: Any person working on the project to which these Specification apply and who is under the direction or control of, and receives compensation from, the Authority.

1.02.16 ENGINEER: Professional Engineer duly authorized to act on behalf of the Authority.

1.02.17 EQUIPMENT: All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

1.02.18 FINAL PLAT: A plat of a tract of land which meets the requirements of these regulations and is in the proper form for recording in the Office of the Probate Judge.

1.02.19 FLOODPLAIN: Those land areas in and adjacent to streams and watercourses subject to continuous or periodic inundation from 100-year flood frequency events. Floodplains shall include all areas of the County, which are designated as floodplain by the Federal Insurance Administration, by the United State Geological Survey or by the State of Alabama. Areas designated, as floodplains by the Federal Insurance Administration shall not have their base flood

elevations altered without prior approval from Federal Insurance Administration.

1.02.20 FULL SERVICE FIRE HYDRANT: A fire hydrant defined as having 2-2.5 inch nozzles and 1-4 ½ inch steamer nozzle and capable of providing fire flows of a minimum of 500 gpm at 20 psi residual pressure.

1.02.21 GENERAL MANAGER: General Manager of the Authority.

1.02.22 GIS/CONSTRUCTION MANAGER: GIS/Construction Manager of the Authority.

1.02.23 HEALTH DEPARTMENT: Shall mean the County Health Department of the appropriate jurisdiction.

1.02.24 INSPECTOR: An authorized representative of the Authority assigned to make all necessary inspections and/or tests of the work performed, or of the materials furnished or being furnished by the Contractor.

1.02.25 LABORATORY: The official testing laboratories of the Authority or such other laboratories as may be designated by the Authority

1.02.26 LOT: A tract, plot, or portion of a subdivision or other parcel of land intended as a unit for the purpose, whether immediate or future, of transfer of ownership or for building development.

1.02.27 MATERIALS: Any substance specified for use in the work and its appurtenances.

1.02.28 NONRESIDENTIAL SUBDIVISION: A subdivision whose intended use is other than residential, such as commercial or industrial.

1.02.29 OR EQUAL: Wherever a particular process, material, device, detail, or part is specified herein, followed by these words or by similar or equivalent expressions, such words or expressions shall be understood to mean and permit the use of another process, material, device, detail or part that the Authority shall determine is fully equal in suitability, equality, durability, performance, and in all other respects, to the process, material, device, detail, or part herein specified for such use, and shall approve for such use in the work.

1.02.30 OWNER: The term "Owner" shall mean any person, group of persons, firm or firms, corporation or corporations, or any other legal entity having legal title to or sufficient proprietary interest in the land sought to be subdivided under these regulations.

1.02.31 OMITTED

1.02.32 PLANNED UNIT DEVEOPMENT: Shall mean the use of land and density of buildings and structures different from those which are allowed as of right within the zoning district in which the land is situated.

1.02.33 PLANS: The official construction drawings or exact reproduction thereof which show and describe the water or sewer improvements to be done.

1.02.34 POLICIES: Policies which have been adopted by the Authority.

1.02.35 PRELIMINARY PLAT: Shall mean a tentative plan of the complete proposed subdivision submitted to the Authority for its consideration.

1.02.36 PROBATE JUDGE: Shall mean the County Judge of Probate for the appropriate competent jurisdiction.

1.02.37 REGISTERED ENGINEER: An engineer properly licensed and registered in the State of Alabama.

1.02.38 OMITTED

1.02.39 RESUBDIVISION: A change in a map of an approved or recorded subdivision plat if such change affects any street layout on such map or area reserved thereon for public use, or any lot line; or if it affects any map or plan legally recorded prior to the adoption or any regulations controlling subdivisions.

1.02.40 SANITATY SEWER: A sewer which carries wastewater.

1.02.41 SKETCH PLAT: A sketch preparatory to the preparation of the Final Plat to enable the applicant to save time and expense in reaching general agreement with the Authority as to the form of the plat and the objectives of these regulations.

1.02.42 SPECIAL CONDITIONS: Additions and revisions to the Standard Specifications applicable to an individual project. The special conditions are intended to supplement, modify, or delete items covered in the Standard Specifications. Special conditions shall prevail over General Conditions.

1.02.43 SPECIFICATIONS: A part of the document containing the written directions, provisions, and requirements for completing the work. Standards for specifying material or testing which are cited in the contract Specifications by reference shall have the same force and effect as if included in the contract physically.

1.02.44 STATE: The State of Alabama

1.02.45 STATION: A specific point on the centerline of a sewer or water main or on the survey baseline designating some specific distance from the point of origin. Stations are numbered in terms of one hundred linear feet measured horizontally.

1.02.46 STORM SEWER: A sewer which carries surface runoff and subsurface waters.

1.02.47 STRUCTURES: Facilities such as bridges, culverts, catch basins, inlets, retaining walls, curbing, storm and sanitary sewer lines, water lines, underdrains, electrical ducts, manholes, lighting fixtures and poles, transformers, flexible and rigid pavements, buildings, vaults, and other manmade features that may be encountered in the work and not otherwise classified herein.

1.02.48 SUBDIVIDER: Any person who (1) having an interest in land, causes it, directly or indirectly, to be divided into a subdivision or who (2), directly or indirectly, sells, leases, or develops, or offers to sell, lease, or develop, or advertises for sale, lease, or development, any interest, lot, parcel, site, unit, or plat in a subdivision, and who (3) is directly or indirectly controlled by, or under direct, or indirect common control with any of the foregoing.

1.02.49 SUBDIVISION: Shall mean the division of a lot, tract, or parcel of land into two (2) or more lots, plats, sites, or other division of land for the purpose, whether immediate or future, of sale or of building development. It includes re-subdivision and, when appropriate to the context, relates to the process of subdividing or to the land or territory being subdivided. It shall also include all divisions of land involving the dedication of new street(s) or change in existing streets.

It shall also include the division of a tract of land into lots all fronting on an existing paved public road and not requiring the construction or extension of new roads or streets, municipal facilities or public improvements.

1.02.50 WORK: The furnishing of all labor, materials, tools, equipment and incidental necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, Plans and Specifications.

1.02.51 WRITTEN NOTICE: Any notice to any party of the contract relative to any part of the contract in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the work.

1.03 STANDARD REFERENCE SPECIFICATIONS

1.03.01 All Standard Specifications referenced throughout these Specifications are to be taken as the latest version available.

1.03.02 The following is a nonexclusive list of national standard Specifications referenced in these Specifications:

ANSI

A21.10	Standard for Gray-Iron Ductile-Iron Fittings, 2-inch Through 48-inch for Water and other Liquids
A21.11	Standard for Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure pipe and Fittings
A21.15	Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
A21.40	Standard for Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
A21.50	Standard for Thickness Design of Ductile-Iron Pipe
A21.51	Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined for Water or Other Liquids

ASTM

A27	Mild to Medium Strength Carbon Steel Castings for General Application
A44	Gray Iron Castings
A53	Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
A82	Cold-Drawn Steel Wire for Concrete Reinforcement

A123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A184	Fabricated Deformed Steel Bars Mats for Concrete Reinforcement
A185	Welded Steel Wire Fabric for Concrete Reinforcement
A227	Steel Wire, Hard-Drawn for Mechanical Springs
A283	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars
A307	Carbon Steel Externally Threaded Standard Fasteners
A449	Quenched and Tempered Steel Bolts and Studs
A496	Deformed Steel Wire for Concrete Reinforcement
A497	Welded Deformed Steel Wire Fabric for Concrete Reinforcement
A563	Carbon and Alloy Steel Nuts
A570	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A616	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
A617	Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
A648	Steel Wire, Hard Drawn for Prestressing Concrete Pipe, Spec
A746	Ductile Iron Gravity Sewer Pipe
B47	Copper trolley Wire
B108	Aluminum-Alloy Permanent Mold Castings
B209	Aluminum-Alloy Sheet and Plate
B211	Aluminum-Alloy Bar, Rod, and Wire
B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
B241	Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
B308	Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded
C31	Making and Curing Concrete Test Specimens in the Field
C32	Sewer and Manhole Brick (Made from Clay or Shale)
C33	Concrete Aggregates
C39	Comprehensive Strength of Cylindrical Concrete

Specimens,

C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C62 Building Brick (Solid Masonry Units Made From Clay or Shale)

C76 Reinforced Concrete, Culvert, Storm Drain and Sewer Pipe

C90 Hollow Load-Bearing Concrete Masonry Units

C94 Ready Mix Concrete

C109 Compressive Strengths of Hydraulic Cement Mortars (Using 2 in. or 5MM Cube Specimens), Test Method for Portland Cement

C150 Portland Cement

C171 Sheet Materials for Curing Concrete

C172 Sampling Free Concrete

C173 Air Content of Freshly Mixed Concrete By the Volumetric Method

C216 Facing Brick (Solid Masonry Units Made from Clay or Shale)

C260 Air-Entraining Admixtures for Concrete

C309 Liquid Membrane-Forming Compounds for Curing Concrete

C425 Compression Joints for Vitrified Clay Pipe and Fittings

C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

C478 Precast Reinforced Concrete Manhole Sections

C494 Chemical Admixtures for Concrete

C497 Determining Physical Properties of Concrete Pipe (D-Load Test)

C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C828 Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12 in.)

D698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12-inch. Drop

D968 Abrasion Resistance of Organic Coatings by the Falling Abrasive Tester

D1238 Flow Rates of Thermoplastics by Extrusion Plastometer

D1248 Polyethylene Plastics Molding and Extrusion Materials

D1505 Density of Plastics by the Density-Gradient Technique

D1693 Environmental Stress-Cracking of Ethylene Plastics

D2122 Dimensions of Thermoplastic Pipe and Fittings

D2657 Heat Joining of Polyolefin Pipe and Fittings

D2751 Acrylolnitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings,

D2794 Resistance of Organic Coatings to the Effects of Rapid

Deformation (Impact)
D2837 Hydrostatic Design Basis for Thermoplastic Pipe Materials

AWWA

C105 Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids
C115 Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
C301 Standard for Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and other Liquids
C302 Standard for Reinforced Concrete Pressure Pipe, Non-Cylinder Type, for Water and Other Liquids
C500 Standard for Gate Valves 3 in. Through 48 in. NPS for Water and Sewage Systems.
C502 Dry-Barrel Fire Hydrants
C504 Rubber-Seated Butterfly Valves
C509 Resilient-Seated Gate Valves, 3 in. through 12 in. NPS, for Water and Sewer Systems
C515 Reduced Wall, Resilient Seated Gate Valves
C550 Protective Interior Coatings for Valves and Hydrants
C600 Installation of Ductile-Iron Water Mains and their Appurtenances.
C651 Disinfecting Water Mains

1.03.03 The following is a list of other publications referenced in the Specifications:

1. Limestone County Subdivision Regulations.
2. Alabama Department of Transportation
   (a) Standard Specifications for Highway Construction
3. Occupational Safety and Health Administration Publications.
   (a) Safety and Health Regulations for Construction.
4. Manual on Uniform Traffic Control Devices for Streets, and Highways.

1.04 PLAT SUBMISSIONS AND APPROVALS

1.04.01 SPECIAL NOTE – Classification of Plat – Whenever any subdivision of land is proposed, before any contract is made for the sale of any part thereof, and before any permit for erection of a structure in such proposed subdivision shall be granted, the subdividing owner or his authorized agent shall apply for and secure approval of water and sewer service for such proposed subdivision in accordance with the following procedure, which includes the following:

(1) Subdivision
    (a) Sketch Plat (optional)
    (b) Final Subdivision Plat

1.04.02 Submission of Construction Plans Required. **All plans** for residential, commercial, institutional and industrial developments within the service area of the Authority, for which water or sewer services shall be required, must be submitted for the approval of the Authority in accordance with the procedures adopted herein.

1.04.03 Plat Approval Without Construction Plans or Water/Sewer Improvements Where new subdivisions consisting of two (2) or more lots are developed along existing roads where water/sewer lines are already in place and no new water and/or sewer improvements are required, are still subject to the requirements of these documents. Prior to construction of water or sewer taps being completed for the lots, the developer shall pay the appropriate impact fees and tap fees. No construction shall occur until developer has notified the Authority.

1.04.04 Sketch Plat Review. Any developer who proposes subdividing land and requiring water or sewer service within the Authority service area has the option of submitting a sketch plat (in advance of submitting the preliminary plat) for the purpose of determining service availability. The Service Request Review Fee will apply to any review of such sketch plat or to other inquiries with respect to service availability for a proposed subdivision.

A sketch plat if submitted, shall be drawn at an approximate scale of 200 feet to one inch and shall show the tentative street layout, approximate right-of-way width, lot arrangements, the location of the nearest water and sewer lines, water courses, existing structures, total acres, approximate number of lots, adjoining streets, north point, tract boundary, and proposed use of land.

1.04.05 Plat Submission for Review. The Sanitary Sewer Plan, Water Distribution Plan and Construction Plans for water and sewer improvements included as required with the subdivision's Plat must be submitted to the Authority for review prior to Plat approval by the Limestone County Probate Judge. Construction Plans must meet the minimum standards for design and other general requirements established by the Authority's Standard Specifications unless specifically waived by written agreement of the Authority.

Construction Plans must also meet all other requirements of ADEM, Limestone County and the State of Alabama. Plats must be submitted to the Authority's Planning and GIS Coordinator at least fifteen (15) days prior to the date review is requested, and must be accompanied by the Construction Plans Review Fee.

The Plat shall be prepared by a registered land surveyor and shall be clearly and legibly drawn at a convenient scale of not less than on (1) inch equals one hundred (100) feet and the sheets shall be numbered in sequence if more than one (1) sheet is used. The sheet size shall be acceptable for filing in the Office of the Probate Judge but shall not exceed twenty -four by thirty -six (24" X 36") inches. The Plat shall fulfill the following requirements:

1. Plats shall be so designated and will contain the name of the proposed subdivision OR the words "Re-subdivision of" if the proposed subdivision or any portion thereof, is a part of any previously approved subdivision of legal record.

2. The name, address and Deed Book and Page of record of the legal owner AND the name and address of the agent or agents acting for the legal owner.

3. North point referenced to a line established in the U.S. Public land survey, date and scale.

4. A caption giving the location of the subdivision by government lot, quarter section, township, range, city, county and state including sufficient description to clearly define the lands; AND lot and block and subdivision name and parcel number(s) and legal Deed Book and Page of all portions which are a part of previously approved subdivision(s) of legal record.

5. The name, address and seal of the registered surveyor or engineer preparing the plat or map.

6. A vicinity map at a maximum scale of 1" = 1000' which shall show the location of the proposed subdivision and all existing and approved roads within twelve hundreds (1,200) feet of the exterior boundaries of the proposed subdivision.

7. The exact length and bearing of the exterior boundaries of the tract of land being subdivided. Distances will be provided to the nearest hundredth of a foot and bearings to the nearest tenth of a

second of arc to achieve a positional accuracy of 1:5000, corresponding to third order accuracy.

8. Dimensions and area in acres of all proposed lots and other land areas and the bearings of the respective sides. All lots and blocks shall be numbered.

9. The name, address, and legal Deed Book and Page of the ownership for all adjacent parcels as they appear in the current records of the County Tax Assessor's Office.

10. Wooded areas, wetlands, unstable soils or slopes and any other adverse condition affecting the site.

11. The location, widths and names of all existing or platted streets, alleys, pedestrian way or other public ways and easements, jurisdiction lines, railroad and utility rights-of-way, parks cemeteries, drainage ditches, water courses, culverts and drain pipes, water mains, sewer lines, bridges, and other permanent or temporary buildings or structures, and other public places on or adjacent to the tract of land being subdivided.

12. The location, widths and names of all proposed streets, alleys, pedestrian ways or other public ways and easements.

13. The location, widths, purposes and names of all existing or proposed public rights-of-ways and easements.

14. Land intended to be dedicated to parks, school sites, open space, or other public use, or to be reserved by deed covenant for use of all property owners in the subdivision with conditions, if any, of such dedication or reservations. Private property to be held in common and NOT dedicated for public use shall be so indicated.

15. Flood plain district limits including the contour line of the floodway, the flood profile elevation (100 year flood) and the contour line two (2) feet above the vertical distance of the flood profile elevation.

16. Site information including:
    a) Acreage in total tract
    b) Total number of lots

1.04.06 Water and Sewer Improvement Approval. No water or sewer improvement, including on-site and off-site, shall be extended to any development until the Authority has approved water and sewer improvements based on Construction Plans provided with the plat of the development. Authority approval shall be voided if the development fails to obtain final plat approval from the Probate Judge after Authority approval. Final approval of water and sewer improvements presented with the final plat shall not be granted by the Authority unless the water and sewer improvements have been satisfactorily constructed, inspected and tested in accordance with Standard Specifications of the Authority and properly bonded and dedicated to the Authority by the developer or, unless the developer of the development posts with the Authority an acceptable Performance Bond for Water and Sewer Improvements to guarantee construction of the improvements as approved with sufficient security to secure the Authority in the event of default by the developer.

1.04.07 Plat Endorsement. Plats submitted for Authority approval, in addition to all other endorsements required by Local or State Agencies shall include the following endorsement:

Approval of Limestone County Water and Sewer Authority

The undersigned, a duly authorized representative of the Limestone County Water and Sewer Authority of Limestone County, Alabama, hereby approves the within plat for the recording of same in the Probate Office of the county in which the property is situated, this the _____ day of _____, _____.

Limestone County Water and Sewer Authority

By: _____

Title: _____

1.05 SERVICE AVAILABILITY (DEMAND) FEE

1.05.01 Any person (s) or entities desiring water or sanitary sewer service for any development of two (2) lots or greater within the service areas of the Authority, which development requires a review process in

accordance with existing policies, shall submit to the Authority's Planning and GIS Coordinator such request in writing, said request shall contain at a minimum, the following information:

1. Sketch map drawn at a scale not to exceed 1"=400' indicating the location of and approximate size of the proposed development. Map shall indicate the location of the proposed development. Provide details on the number of residential services anticipated, or potential water and sewage capacities required if a non-residential development, including anticipated flow requirements of same. All information shall be based on the ultimate build-out of development for which service is requested.
2. State the earliest expected date on which service is desired, and any anticipated phasing of development with corresponding phasing of water and/or sewer requirements.
3. Request the Authority's review of its ability to provide requested services(s), which indication of contact person, and a response so stating
4. Peak and average domestic flows and fire flow demands for water and peak and average day demands for sewage.
5. Each request for service(s) shall be accompanied by a Service Availability Review Fee of $100 for a review of the availability of water and sewer. The $100 will be credited to the Construction Plan Review Fee if the fees are paid separately. Refer to Section 1.08 for details regarding Construction Drawing Review and Approval and applicable fees. Checks should be made payable to the Limestone County Water and Sewer Authority, <u>which fee shall not be refundable in any case</u>. The Authority shall not undertake any such review unless and until said fee is submitted.
6. The Service Availability Fee is optional for residential subdivisions. It is a requirement for commercial and industrial developments.

1.06.00 STANDARDS FOR CONSTRUCTION PLANS

1.06.01 All Construction Plan sheets must have certain required signatures, including an Alabama Professional Engineer's seal. The signatures indicate the following:

"Developer": Indicates approval by the developer of the property.

"Design Engineer": Indicates approval by the engineer whose stamp appears on the plans.

"GIS & Construction Manager" : Indicates review of Construction Plans for conformance with the Standard Specifications, a review of the Construction Plans for acceptable hydraulic, flow-carrying capacity and compatibility with long-term growth plans of the proposed water and sewer facilities.

"Approved for Construction": Indicates approval to proceed with construction of water and sewer facilities by the Limestone County Water and Sewer Authority.

The following signature block shall be provided on the cover sheet of the utility plans.

Reviewed for Submittal

_____ _____
Developer *Date*

Submitted for Review

_____ _____
Design Engineer *Date*

Reviewed for Compliance with LCWSA Standard Specifications, Policies & Procedures

_____ _____
Limestone County Water and Sewer Authority *Date*
Board Engineer

Approved for Construction

_____ _____
Limestone County Water and Sewer Authority *Date*

1.06.02 The Title Sheet must contain a location map at a scale not smaller than 1"=1,000', the name of the project, and the name(s), addresses, and telephone numbers of the Developer(s). The Title sheet must also contain an index to all sheets, and the following statement in the lower right-hand corner:

"Standard Specifications for Water and Sanitary Sewer, latest edition as adopted by the Limestone County Water and Sewer Authority is, hereby made a part of these Plans."

1.06.03 Street Plan containing the following:

a) Location of all proposed and existing streets or rights-of-way in or adjacent to the subdivision.
b) Width of existing and proposed rights-of-way
c) Street names
d) Plan of all streets, showing natural and finished grades drawn to a scale of not less than 1″=100′
e) Location of all required sidewalks and crosswalks.

1.06.04 Storm Drainage Plan containing the following information:

a) Location of proposed drainage ways, streams, storm inlets, storm drains, inverts, top of castings, detention ponds, ditches, etc. in the subdivision which might have an impact on water and/or sewer improvements.
b) Location of easements and right-or-way for drainage ways and maintenance access thereof
c) Street and storm drainage plans may be combined by the Design Engineer

1.06.05 Sanitary Sewer Construction Plans shall contain the following information:

1. Plan and profile of proposed sewer system, drawn at 1″=50′ horizontal and 1″=5′ vertical scales, with grades (%) indicated and invert elevations shown at every manhole. (Calculations are to be done from center of manhole to center of manhole.) Profiles shall include location of each storm drain and/or storm drain structure.
2. All pertinent planimetric features.
3. Planimetric location of proposed sewers as related to existing or proposed: streets, alleys, highways, buildings, sidewalk, curb and gutter, structures, other utilities, easements and right-of-ways.
4. Location, size and material of all existing and proposed sewers, with locations of connections to other sewers and locations of service laterals.
5. Direction of flow in each sewer line.
6. Horizontal location of all manholes and other system features, and deflection angles at manholes.
7. North arrow on each Plan sheet.
8. Alabama Professional Engineer's seal, signature and signing date on each Plan sheet.
9. Bench Mark elevation based on USGS datum.
10. All topographic features, both existing and proposed.
11. All property lines including rights-of-way.
12. Indications of any modifications or revisions from previous drawings.

13. References to applicable Standard Specifications of the Authority with respect to those required for the construction of utility improvements proposed.
14. All pertinent water and sewer utility easements.
15. Show all existing and proposed utilities including water, wastewater, gas, electricity, telephone, cable TV, and storm sewers with measurements and/or details of same.
16. Special details related to stream, railroad, highway or other type crossings.

1.06.06 Water Distribution Construction Plans shall contain the following information:

1. Plan of proposed water system, drawn at 1"=50', with all critical elevations.
2. Location, size, and material of all existing and proposed water mains in the subdivision, (or outside the subdivision if off-site connections are required), with locations of connections to other mains, service connections, valves, fire hydrants, blow-offs and all other appurtenance indicated
3. North arrow on each Plan sheet.
4. Alabama Professional Engineer's seal, signature and date of signing on each Plan sheet.
5. All topographic features, both existing and proposed.
6. All Property lines including subdivision block and lot numbers and right-of-way.
7. Indications of any modifications or revisions from previous drawings.
8. References to applicable Standard Specifications of the Authority with respect to those required for the construction of utility improvements proposed.
9. All pertinent water and sewer utility easements.
10. Show all existing and proposed utilities including water, wastewater, gas, electricity, telephone, cable TV, and storm sewers with measurements and/or details of same.
11. Special details related to stream, railroad, highway or other type crossings.

1.06.07 Where proposed water and sewer improvements are located within or cross easements of another utility, it shall be the responsibility of the developer to provide the Authority with the letter of approval of the affected utility(ies) permitting the new Authority improvements.

1.07 DESIGN CRITERIA (ON-SITE AND OFF-SITE IMPROVEMENTS)

1.07.01 Sanitary Sewers and Appurtenances

1.07.02 All sanitary sewers shall be designed in accordance with these criteria, specifications contained in sections 3.01 through 3.03, and the standards of the Alabama Department of Environmental Management (ADEM).

1.07.03 Sanitary sewers, both gravity and force main, to be dedicated to the Authority shall be constructed within dedicated road rights-of-way or utility easements.

1.07.04 Sewers shall be designed for self-cleansing velocity of 2.0 ft./second at design flow, a maximum velocity of 5.0 ft./second unless an exception is requested and granted by the Authority due to unusual slope conditions, and shall accommodate design flow at one-half full. Minimum gravity sewer size for sewers shall be 8-inches. Sewers shall meet the following minimum slope requirements.

Nominal Sewer Size	Minimum Slope in Feet Per 100 Feet
4 inch (service only)	1.00
6 inch (service only)	0.80
8 inch	0.40
10 inch	0.28
12 inch	0.22
15 inch	0.15

1.07.05 Sanitary sewer lines shall be located as follows:

a. Trunk sewers shall be routed along natural drainage features, where practical, to provide a conduit at elevations low enough to serve the entire drainage basin within which the trunk is located, and to minimize impact on existing or proposed development.

b. Collector sewers shall be routed along existing or proposed street centerlines or center of existing or proposed utility easements. In curved roadways, sewers shall be routed as close to center line as possible while maintaining a clearance of 5.0 feet, minimum, from faces of curbs, edges of pavement, or other drainage features.

c. Deviations from the above, such as the routing of collector sewers

along rear lot lines or in easements, shall be only done where necessary to access existing sanitary line. The Authority reserves the right to reject any particular layout or design of any sanitary sewers within its service areas.

1.07.06 Design flow shall be based on a contribution of 100 gallon/capita/day multiplied by a peak factor as outlined below:

Population Equivalent	Peak Factor
0 – 2,000	4
2,001 – 10,000	3.25
10,001 – 50,000	2.5
≥ 50,001	2

1.07.07 Sanitary sewers shall meet all requirements of Section 3.01.

1.07.08 All manholes shall be designed in accordance with the following guidelines:

(a) Distance between manholes shall not exceed 350 feet unless otherwise approved by the Authority. Maximum distance on collector sewers will never exceed 400 feet. On sewers 18 inch and larger, where approved by the Authority, the length may exceed 400 feet.
(b) Maximum deflection angle at manholes shall be 90 degrees.
(c) For in/out invert elevations greater than 2.0 feet., a drop manhole shall be used. Drop manholes shall be avoided where practical.
(d) Watertight frames and covers shall be required where the proposed manholes are subject to inundation. All manhole frame and covers shall be flush with the ground surface unless otherwise noted and approved by the Authority.
(e) A vent assembly shall be required on trunk sewers at approximately 1,500 ft. intervals and at the end manhole where practical. Trunk sewers are defined as gravity sewer lines with diameters equal to or greater than 15-inches.
(f) Manholes receiving direct discharge from force mains shall be lined with cementitious waterproofing to assist in protection of concrete from sulfide deterioration.
(g) Meet the requirements of Section 3.03 through 3.04 of this document.
(h) Minimum fall between the inlet and outlet inverts of the manhole shall be a minimum of 0.2′.

1.07.09 All wet wells shall be designed in accordance with the following guidelines:

(a) No wet well shall be less than six (6) feet in diameter.
(b) The wet well shall be sized to allow for no more than 5 starts/hour at peak flow.
(c) The wet well capacity shall be measured from the low pump cutoff level to the bottom of the lowest inlet pipe.
(d) All wet well penetrations shall be mechanically sealed with resilient pipe connectors to eliminate inflow and infiltration.
(e) Inlet design must be positioned to minimize flow turbulence which accelerates release of trapped gases in the flow stream.
(f) Wet well bottoms shall be designed with a minimum of a 4-inch, 45^{o} fillet at wall joints to prevent solids accumulation.
(g) All fabricated joints on precast concrete shall be sealed with a butyl mastic sealant.
(h) All concrete external wet well joints shall be sealed using a wrap seal such as CANUSA Wrapidseal® or equivalent to prevent infiltration or inflow at the joint(s).
(i) Access steps for wet wells will not be allowed.
(j) Access hatch shall be lockable, double-leaf, aluminum diamond pattern able to support a minimum live load of 150 psf. The entire hatch and all hardware components shall be highly corrosion resistant. The size of the access hatch will be reviewed on a case by case basis by the Authority.
(k) Concrete wet well shall conform to the requirements of AASHTO M-199 SR and ASTM C478.
(l) Concrete wet wells shall be lined as follows:
    1. Interior walls, floor and ceiling of wet wells shall be lined with a cementitious manhole liner such as Strong- Seal®. Refer to Section 3.04 of this document for details.

(m) For all wet wells, base slabs shall be designed to provide support and restraint against floatation. Calculations shall be submitted to the Authority for review.
(n) Coated steel, pre-fabricated below ground wet wells and pumping stations will not be permitted.
(o) Wet wells shall meet the requirements of Section 3.03.

1.07.10 All sanitary gravity sewers shall be constructed of the following types of pipe:

(a) Sanitary gravity sewers 15 inches in diameter and smaller shall be constructed of ductile iron, epoxy-lined (or other Authority

approved lining system) sewer pipe or PVC (SDR 26) sewer pipe unless specific needs demand otherwise, and only then pending the review and approval of the Authority. PVC sewer pipe shall be allowed where the pipe slope is less than or equal to 12.00% and the cut is less than or equal to 14 ft. If the slope is greater than 12.00% or the cut is greater than 14ft., ductile iron sewer pipe shall be used. "Cut" is defined as the vertical distance from the finished ground, or surface, to the invert of the pipe.

(b) Pipe between manholes shall be of the same type of material from manhole to manhole. No couplings will be allowed. For instance, if a portion of the profile depth is in excess of 14 feet and requires ductile iron pipe and a portion is at a depth of less than 14 feet which would allow PVC, the entire segment shall be ductile iron regardless of lesser depth.

(c) Sanitary sewers with slopes in excess of 18% shall be constructed with concrete restraining collars designed at intervals to insure pipe stabilization.

(d) Sanitary sewers 18 inches in diameter and larger shall be constructed of epoxy-lined (or other Authority approved lining system) ductile iron sewer pipe.

(e) Sanitary sewers crossing storm drains, creeks, or ditches shall be ductile iron pipe and will be provided with concrete encasement.

(f) Sanitary sewers with less than 4ft. of cover shall be ductile iron pipe.

(g) If areas which have been filled and the proposed sewer will be within the fill, ductile iron pipe must be specified.

(h) All ductile iron pipe shall be interior coated with Protecto 401 epoxy lining (or other Authority approved lining system).

1.07.11 All sanitary sewers shall have a minimum of 36 inches of cover in non-traffic areas and 48 inches in paved areas subject to vehicular traffic. Pipe with less than 48-inches of cover shall be constructed of ductile iron pipe.

1.07.12 Sanitary sewers which cross beneath storm drains shall maintain a minimum of 18 inches vertical clearance. Pipe beneath storm drains crossings shall be ductile iron or be provided with concrete encasement 2 feet beyond outside edge of storm drain.

1.07.13 Separation between sanitary sewers and water mains shall be 5 ft. horizontal, and 24 inches vertical between the bottom of the water main and the top of the sanitary sewer. Sewer pipes shall pass beneath water lines. If separation cannot be maintained, the sewer pipe shall be encased a distance of 5 feet either side of the point of crossing.

1.07.14 Separation between sanitary sewer and primary electrical lines shall be a minimum of 10 feet (edge to edge).

1.07.15 Permanent easements for sanitary sewers shall be a minimum width of 20 feet. Permanent easements for sanitary sewers with depths in excess of 14 ft. shall be a minimum width of 30 feet.

1.07.16 Sewers shall be designed to serve every lot or parcel adjacent to the sewer. Manufactured, 90-degree "PVC sanitary sweep tees" shall be used for connecting private service lines to the collector sewer. Straight branch ductile iron tees are acceptable on ductile iron service lines. Minimum sewer service size for residential subdivisions shall be 4-inch diameter. Service size for commercial and industrial developments shall be 6-inch diameter unless demand dictates a larger diameter.

1.07.17 All sanitary sewers or force main systems which discharge into the Authority's system shall be designed according to these criteria.

1.07.18 Sanitary sewer pumping stations shall be reviewed on a case by case basis. Preliminary discussion with Planning and GIS Coordinator concerning pump station designs are encouraged before preparation of preliminary plans so specific design requirements can be established. Minimum design criteria for pumping stations are as follows:

a) Stations shall be submersible. No suction lift stations will be permitted.
b) Pumps shall be Flygt. Pumps shall normally operate in the 1170-1800 rpm speed range. 3450 rpm operating pumps shall only be used where approved in advance by the Authority. Consideration may be given to the use of KSB® or Fairbanks-Morse® pumps in the event that Flygt pumps does not meet the required pump conditions for the specific application. Variation from Flygt pumps must be approved prior to use by the Engineer and the General Manager.
c) A minimum of two (2) pumps are required. Pumps to be equally rated for one at duty load and one standby. Automatic alternation of pumps shall be provided in the control panel. The ability to change the lead-lag pump arrangement shall also be provided in the control panel.
d) Power to station shall be three phase, 60 Hz. Cost of power and electrical improvements to serve the pump station will be borne by Developer. The electric service shall be sized for both pumps to operate simultaneously plus any other miscellaneous loads.

e) Access and fenced enclosure shall be provided to the station. Fence fabric shall be 6-foot, black epoxy coated, chain link. Poles shall also be black epoxy coated. A minimum 12-foot (2 @ 6 feet) double swing gate shall be provided. Minimum site dimensions shall be 50′ by 50′. All access roads and station sites shall be provided with permanent utility easements so noted on the Final Plat. Access roads to pump stations shall at a minimum be 6-inches of compacted gravel at 10 feet width.
f) An electronic magnetic in-line flow meter shall be provided. Meter shall be installed in a precast 5-foot diameter manhole with minimum 30-inch square aluminum access hatch centered over the flow meter.
g) A pump-around bypass shall be provided.
h) Provision for emergency generator connection shall be provided with manual transfer switch and a NEMA 3R, angled, 4-wire, 4-pole 2.5" hub generator receptacle assembly.
i) Levels shall be sensed by stainless steel submersible liquid level transmitter with each pump being controlled by the level control system. Three (3) back-up float switches shall also be provided.
j) Minimum wet well diameter shall be 6 feet.
k) Removal rails and slip-connect pump discharge flanges shall be provided for each pump. Rails shall be stainless steel.
l) A separate precast or poured-in-place valve vault shall be provided for check valves and plug valves. No check valves shall be installed in the wet well. All valves shall be mounted in the horizontal position. Vaults shall be provided for provision to gravity drain. If terrain does not allow for gravity drain, a sump pump with float shall be provided to dewater the valve vault. Pump shall be 120 volt with minimum 1.5-inch discharge. Discharge shall be piped to the top of the vault and be directed away from the vault.
m) Control/isolation valves shall be flanged, full (100%)port plug valves and include operating handles..
n) Check valves shall be flanged, external, lever/weight, or rubber-flapper type with external position indicator and horizontally mounted.
o) Lockable, aluminum hatches with stainless steel hardware and lock-open devices shall be provided for wet well, valve vaults and flow meter vaults.
p) Wet well shall be vented to atmosphere. Minimum vent size shall be 4-inch diameter and include stainless steel bird screen at the opening.
q) Controls shall be mounted in a stainless steel, NEMA 4 enclosure.

r) An external pump alarm light shall be provided mounted on control panel.
s) A one-inch water service with meter and reduced pressure backflow preventer in insulated enclosure shall be provided for the station. Enclosure shall include heater or heat tape for freeze protection. A one-inch frost proof yard hydrant with locking hasp shall be provided.
t) Designer shall provide design calculations to Authority including TDH (total dynamic head), buoyancy calculations, wet well sizing calculations, system curve and selected pump curve.
u) No overhead power lines shall cross over the valve vault or wet well.
v) Pump station sites shall be graded to provide positive drainage away from wet well and vaults. Top of wet well shall be set a minimum of 1-foot above the 100-year flood elevation. At a minimum, top of wet well and valve vaults shall be set 6-inches higher than the surrounding finished grade. All pump station sites shall be finished with graded, compacted crushed stone covering the site to eliminate the need for yard maintenance.
w) Surge/lightning suppression shall be provided.
x) Electrical shall be designed to meet the requirements of the latest National Electrical Code. Design shall be performed by an electrical engineer licensed to practice in the State of Alabama.
y) Include telemetry at each pump station to meet level of standard required by the Authority.
z) Pump station appurtenances shall meet the requirements as set forth in Section 3.07 and 3.08.
aa) Pump station wet wells shall be provided with single grate fall protection device as manufactured by USF Fabrication, or equal. Grate shall open to same side as station hatch.

1.07.19 No downspouts, storm drains or French drains shall be connected to the sanitary sewer system.

1.07.20 Minimum design criteria for force mains are as follows:

a) All force mains without a grinder pump shall be a minimum of 4-inch. Force mains with a grinder/chopper type of pump shall have a minimum size of 3-inch where approved by the Authority. Force main smaller than 3-inch will not be allowed without prior approval of the Authority.
b) Force main shall be sized to maintain a minimum velocity of 2 ft/sec. Force main design shall be based on a design c-factor of 130.

c) Force mains shall be routed in existing or proposed R.O.W. or in existing or proposed utility easements. If placed within roadways, ductile iron pipe is required for force main material.
d) Force mains shall be PVC SDR 21, Class 200 for working pressures up to 110 psi; HDPE DR 17 DIPS for working pressures up to 100 psi and open-cut installation; HDPE DR 11 DIPS for directionally bored force main; or Ductile iron class 350 with Protecto 401 lining for all working pressures.
e) Minimum cover shall be 36"; maximum cover shall be 60". Where force mains cross beneath sidewalks, storm drains, paved areas or roadways, the force main shall be ductile iron pipe.
f) Automatic combination air/vacuum release valves in precast manholes are required at each high point.
g) Plan view of force main routing shall be at 1"=50' horizontal.
h) No 90° bends are allowed – use two 45° bends.
i) Force mains shall meet the requirements of Section 3.02.

1.07.21 Water Mains and Appurtenances

1.07.22 All water mains shall be designed in accordance with these criteria, Specifications contained in Sections 4.01 through 4.03, and the standards of the Alabama Department of Environmental Management.

1.07.23 Water mains to be dedicated to the Authority shall be constructed within dedicated rights-of-way, or utility easements, at least 10 ft. in width.

1.07.24 All developments regardless of size shall be provided with a minimum residual service pressure of 20 psi at the individual lot service meter at the calculated peak domestic service demand for the development. LCWSA will review the proposed development for domestic service capability using the current LCWSA hydraulic model. Data for peak domestic calculations will be based upon the equation $Q=20(c)^{½}$ where c = total persons served based on 2.5 persons/residence. Data for average day demand for residential development is 200 gallons/day/residence. For other applications such as commercial establishments, schools, etc., industry standard uses or historical water billing records for similar facilities may be applied with the approval of the Authority.

1.07.25 In areas where the existing system does not support the minimum residual service pressure of 20 psi and peak service demand for domestic service, or at a minimum flow of 500 gpm for fire service, whichever is greater, offsite improvements will be required to provide

this level of service flow and pressure. All costs of the offsite improvements to provide the minimum residual service pressure of 20 psi at the calculated domestic service demand or fire service demand will be borne by the developer or property owner less any costs for increased level of service required to benefit the LCWSA system and shall be paid in accordance with Section 1.10, Offsite Water & Sewer Policy.

1.07.26 All residential, commercial and retail developments shall be provided with a minimum of 500 gpm fire flow at 20 psi residual pressure (unless a higher fire flow rate is required by developer or city service area). LCWSA will review the proposed development for fire flow capability using the current LCWSA hydraulic model. Data for calculations will be based upon the Request for Service Availability letter provided by the developer or his Engineer and subject to the review of the Authority Engineer. If it is determined that offsite improvements of up to one (1) mile can achieve the desired fire flow for the development, then all cost of offsite improvements to provide the fire service will be borne by the developer or property owner. If offsite improvement of greater than 1 mile is required to achieve the design fire flow for the development, then all cost of offsite improvements shall be borne by the property owner for the first mile and the Authority shall determine whether to implement at its cost, the additional capital improvements required to provide fire protection immediately, or incorporate these improvements into its long-term capital improvement plan.

1.07.27 Commercial or industrial developments that require large volume flows (greater than 500 gpm) for either fire service or normal service or higher service pressures shall be reviewed by LCWSA on a case-by-case basis. LCWSA will review the proposed development for the proposed level of service (fire and pressure) using the current LCWSA hydraulic model. If it is determined that offsite improvements are required, the developer will be required to bear the burden of cost of all improvements for increased level of service less any costs for increased level of service required to benefit the LCWSA system.

1.07.28 Maximum designed velocity shall be 5.0 ft./second unless otherwise approved by the Authority Engineer.

1.07.29 All water mains in new developments shall be ductile iron, Pressure Class 350. All water mains 12" and greater in diameter shall be ductile iron pipe, Pressure Class 350.

1.07.30 With the exception of those circumstances allowed in Paragraph 1.07.31, water mains shall be 8-inch minimum diameter line. Every effort shall be made to provide looped feed with multiple point(s) of connection to the existing water system. Dead-ends shall be avoided whenever practical. Smaller diameter lines may be permitted where directed by the Engineer or the Authority.

1.07.31 Water lines in cul-de-sacs less than 500-feet in length may be 6-inch diameter.

1.07.32 Water lines in commercial/retail/industrial developments shall be a minimum of 8-inch diameter.

1.07.33 Water mains shall be designed for installation behind curbs or slope of ditches where practical. Water lines shall be installed beneath proposed sidewalks. Water line shall be installed on the opposite side of road from primary electrical lines. Where water and electrical lines occur on the same side of the road, a minimum of five (5) feet of separation (edge to edge) shall be maintained. No water line shall be installed in the center of roadside ditches. Water line plans shall clearly define the location of all water lines on the drawings. Dead-end mains shall extend to the last lot or parcel being served so that no service lines are installed in front of adjacent lots or parcels. Water lines on cul-de-sacs shall extend around the cul-de-sac and not through the paved area. Water line shall be extended across the length of entire property being developed so service can be extended in future without disturbing other property. No shrubbery or trees shall be planted atop or within 5′ of the water line. No permanent structures shall be erected atop of or within 5′ of the water line.

1.07.34 Water lines crossing beneath existing County/State roads shall be installed by means of bore and jacking. Casing shall be steel and sized as set forth in the technical specifications. Casing spacers and casing end seals shall be required for all pipes in casings. Crossings of State Highways shall be submitted by the Developer to ALDOT for approval. Authority shall be provided with a copy of ALDOT permit prior to signing of final plat or approval of construction plans.

1.07.35 All mains shall have a minimum of 36 inches of cover in non-traffic area, and a minimum of 36 inches of cover in paved areas subject to vehicular traffic.

1.07.36 Water mains shall have 5 ft. horizontal and 24″ vertical clearance from sanitary sewers, and shall have 3 ft. horizontal and 12″ vertical

clearance from other underground structures. Where water lines pass beneath storm drains, the pipe shall be ductile iron for a distance of 20 feet (10′ either side). Water lines shall pass over sanitary sewers.

1.07.37 All service lines which cross under streets, highways, or any other paved roads must be placed individually inside Schedule 40 PVC casing pipe, 2" minimum size for 1" service line, to 2 ft. behind the sidewalks on each side of the new roadway. All service lines shall be a minimum of 1-inch. Each unit or lot shall be provided with a service line unless otherwise approved by the Authority Engineer. No single service line arrangements providing service to two lots will be permitted. Unless approved by the Authority Engineer, no single service line arrangements providing service to more than one structure on the same lot; or to two or more lots will be permitted. No residential or commercial developments will be allowed to utilize a master meter installation unless recommended by the Authority's Engineer and approved by the LCWSA Board of Directors. Service meters shall be located adjacent to property lines, and grouped in pairs where practical. On zero lot line lots or lots with less than 60 feet of frontage, the water meter shall be located in the center of the lot. On lots with frontage in excess of 60 feet, the meter shall be located within 5 feet of the side property line. Minimum service size is 1 inch.

1.07.38 A water valve shall be required at every water main intersection. (See Standard Details for valve installation.) For connection to live mains, check with the Authority for details on the use of cut-in tees or tapping sleeves and tapping valves will be permitted. Where valves are installed, the pipe connection between the valve and the adjoining fitting shall be ductile iron. No PVC water pipe will be permitted between fittings and valves at points of intersection or at fire hydrants. Water valves shall be located outside the paved area where practical. Where connection to existing water line requires reverse connection due to proximity of water line to road, the pipe through the 90^0 bends shall be ductile and the fittings shall be restrained using "Mega-Lug" style restraint devices.

1.07.39 Adequate thrust blocking shall be designed for the expected pressures, including the required test pressure. If location prohibits thrust blocking, all fittings, valves, and hydrants shall use restraint devices (Mega-Lug).

1.07.40 Fire hydrants shall be required at 1,000 feet maximum spacing so that any lot is no further than 500 feet from the nearest hydrant on water lines inside subdivisions. On hydrants outside subdivisions, fire

hydrant spacing shall be at the spacing as designated by the Engineer. Fire hydrants shall not be permitted on lines smaller than 6" diameter. A 6-inch isolation valve is required for each fire hydrant. Valve and hydrant shall utilize restraint devices (Mega-Lug) to the tee or hydrant locking tees. No PVC water line will be allowed in the make-up between the tee and the hydrant shoe. This pipe shall be either anchor couplings or ductile iron pipe using restraint devices. Minimum bury on fire hydrants shall be 48-inches and the fire hydrant flange shall sit a minimum of 4-inches above finished grade.

1.07.41 A fire hydrant or hydrant, may be required at the dead end of any water main to allow for flushing the main at 2.5 ft./sec., minimum. Spacing requirements of fire hydrants may dictate the need for a fire hydrant at the end of the line. Otherwise a blow-off assembly shall be installed at the end of line for flushing needs or future extension.

1.07.42 Pressure regulators for individual services are not required by the Authority except in areas of pressure exceeding 75 psi; however, they are recommended. They are not part of the Authority's system for operation and maintenance. Pressure regulators shall be installed in a separate meter box from that of the water meter and shall be located on the customer's side of the water meter.

1.07.43 All water mains and appurtenances which connect to the Authority's system shall be designed according to these criteria.

1.07.50 Exterior Grease Traps

1.07.51 Grease traps shall be required and installed in accordance with the Authority's F.O.G. (Fats, Oils and Grease) Ordinance.

1.07.52 Grease trap shall be shown on the Construction Plans and approved by the Authority.

1.07.60 Miscellaneous

1.07.61 Sanitary sewer and water facilities which connect to, or will be dedicated to, the Authority's existing infrastructure shall be designed in accordance with all criteria established herein. Also, all materials, construction, and testing of such facilities shall be in accordance with all Sections of this manual, and therefore, shall be subject to inspection by the Authority as it deems necessary to insure the requirements contained herein are met.

1.07.62 All car washes shall incorporate a wash water recovery feature which uses recycled water in the washing cycle(s), in order to limit the quantity of potable water needed to replenish the system due to losses. Proposed facilities shall be submitted to the Authority for review and approval.

1.07.63 Any facilities not specifically covered herein shall be presented to the Authority for its approval. It is recommended the Authority be contacted prior to detailed design to discuss specific requirements.

1.08 CONSTRUCTION DRAWINGS REVIEW AND APPROVAL

1.08.01 The Design Engineer will make the initial submittal of three (3) hardcopy sets of Construction Plans to the GIS/Construction Manager for review, with the required Construction Plans Review Fee. **Electronic plan submittals are not allowed.** Construction Review Fees are as follows:

Water	$ 500.00
Sewer	$ 500.00

Above fees are cumulative and some or all may apply to a development or subdivision.

1.08.02 The GIS/Construction Manager will forward all three copies to the Board Engineer for review and approval.

1.08.03 The Board Engineer will return one (1) set each of mark-up drawings and appropriate comments to both the Authority and the Design Engineer within fourteen (14) days upon receipt of plans from the Authority.

1.08.04 Telephone and email communications regarding corrections/revisions, flow data, etc., will take place between the GIS/Construction Manager, Board Engineer and the Design Engineer directly, as necessary.

1.08.05 The Design Engineer will return mark-up Plans, three (3) corrected set of Plans and a letter addressing the corrections/changes made to the Board Engineer for second review.

1.08.06 The Board Engineer will review the Plans a second time; items 1.08.03, 1.08.04 and 1.08.05 will be repeated as necessary.

1.08.07 The Board Engineer will notify the Design Engineer of the following by memorandum.

1. Deficiencies as they apply to plans.
2. Acceptance of Construction Plans when all deficiencies are corrected.

1.08.08 The GIS & Construction Manager will advise design engineer/developer for the amount of appropriate fees that are due to the Authority.

1.08.09 The Design Engineer will provide to the GIS/Construction Manager , the FINAL, original Plan Sheets with the required signature blocks. The sheets must bear the Design Engineer's and Developer's signatures, with dates.

1.08.10 The GIS/Construction Manager will obtain the signature on the plan sheets of the Board Engineer and return them to the Design Engineer.

1.08.11 When construction plans are approved, the Design Engineer will submit two (2) additional paper sets of final construction drawings and one (1) electronic set in PDF format to the GIS/Construction Manager. A total of three (3) sets of paper plans is required for each to contain the signatures of Board Engineer and approval by the Authority. One set will be returned to the Design Engineer/Developer (providing that all fees have been paid). The Design Engineer may submit more sets if desired.

1.08.12 The Developer will provide payment (check) for all fees and charges.

1.08.13 The GIS/Construction Manager will forward approved construction drawings to the Inspector.

1.08.14 A copy of the approved construction plans showing the LCWSA approval stamp with signatures shall remain on site at all times during construction activities.

1.08.14 Construction Plans Signature Block

The following signature block shall be provided on the cover sheet of the plans.

Reviewed for Submittal

_____ _____
Developer *Date*

Submitted for Review

_____ _____
Design Engineer *Date*

Reviewed for Compliance with LCWSA Standard Specifications, Policies & Procedures

_____ _____
Limestone County Water and Sewer Authority Board Engineer *Date*

Approved for Construction

_____ _____
Limestone County Water and Sewer Authority *Date*

1.09 IMPACT FEES

1.09.01 Due to the projected capital costs necessary to keep pace with future development in the service area of the Authority, an Impact Fee is hereby assessed by the Authority to be charged to any new development submitted for approval to the Authority, regardless of the size of the development. The Impact Fee will be assessed to Developer's pursuant to the Authority's authority to charge for its services (see Alabama Code Section 11-50-314(a)(8)). The purpose of the Impact Fee is to identify and to assess the Developers for the Authority's equity costs for providing the existing infrastructure utilized to serve the proposed development and to provide access to the system's available capacity.

1.09.02 In order to establish a fair and equitable methodology for assessing Impact Fees, the Authority has established an average residential equivalent flow (the average volume of water by a conventional residential customer within the Authority's service area) for the Limestone County Water and Sewer Authority customer base to be 200 gallons per day. The Impact Fees will be assessed at a rate of $1,000 per residential equivalent each, for both water and wastewater (where available) based on the number and type of development units proposed. The Authority reserves the right to consider the economic

impact of any development; as well as other considerations, when establishing Impact Fees.

1.09.03 As new development is presented to the Authority, this methodology will be applied in accordance with the formula set out below to assess to each such development, its prorated share of the cost of the infrastructure the development will access.

1.09.04 The Impact Fees to be assessed to any particular development other than residential will be calculated by dividing the anticipated peak flow (in gallons per day) required by the development by 200 gallons per residential equivalent, then multiplying the total by $1,000.

Stated mathematically, the formula for establishing the Impact Fee is as follows:

Impact Fee = (peak flow ÷ 200) X $1,000

1.09.05 For the purposes of the above formula, the following terms shall have the meanings assigned to them below:

(a) Peak Flow shall mean the anticipated peak flow of sewage and/or water necessary to accommodate a proposed development at full build-out, measured in gallons per day. The peak flow of any proposed development shall be included by the Developer with plans submitted to the Authority for approval. The Authority shall review and verify the peak flow calculations for each development prior to approval. In case of any discrepancy between the peak flow submitted by the Developer and the opinion of the Authority as to the peak flow, the opinion of the Authority shall be used for purposes of calculating the Impact Fee. Peaking factors to be used are as shown below:

Population Equivalent	Peak Factor
0 – 2,000	4
2,001 – 10,000	3.25
10,001 – 50,000	2.5
≥ 50,001	2

1.09.06 Any person, firm, or corporation desiring to use or access capacity of the Authority shall be required to comply with the following:

1. All appropriate authorities of the Limestone County Water and Sewer Authority and the State of Alabama must approve a plat of the development, including a layout containing all utility easements and other improvements. The area to be served must be platted and said plat must be recorded.

2. Payment of the Impact Fees shall be made by posting with the Authority cash or check in the amount of the assessed charge prior to any construction. **Payment shall be made to the Authority at time of Final approval of the Construction Plans. Final approved construction plans will not be released by the Authority until all fees are paid. In the event no construction plans are required, in accordance with Paragraph 1.04.02, impact fees and tap fees must be paid before plat will be signed by the Authority.**

3. The Developer shall be required to provide, at no cost to the Authority, all easements necessary for extension, enlargement, or construction of any water or sewer line over, along, or across the Developer's property.

4. If changes in the amount of Impact Fees are necessary, the Developer must pay the Impact Fees, as adjusted in full, prior to approval of the final construction plans by the Authority.

1.10 DENIAL OF SERVICE

1.10.01 The Authority, in adopting this policy, expressly reserves the right to deny approval to a proposed development or access to or use of its water or sewer capacity by any proposed development, when in the sole judgment of the Authority the development, even where it otherwise meets all required design specifications, would overburden existing system capacity in the area where it is proposed to be located or when, in the sole judgment of the Authority, the expansion or extension of capacity required by the development is not deemed to be in the financial or other interest of the Authority for any reason. Nothing herein shall be construed as requiring the Authority to undertake any water or sewer extension or enlargement or to require the Authority to provide access to or use of its system to any new development.

1.11 DEVIATIONS FROM POLICY

1.11.01 Whenever the Authority is of the opinion that it is in the best interest of the Authority to construct water or sewer line without requiring strict compliance with this policy, such line may be constructed and deviations from this policy authorized upon such terms and conditions as shall be approved by a majority of the Authority's Board.

1.12 OFF-SITE WATER AND SEWER POLICY

1.12.01 Any person, firm or corporation ("developer") or homeowner desiring to have water and/or sewer service extended for a development/lot/subdivision shall meet all requirements previously outlined in these Standard Specifications.

1.12.02 All off-site costs for any off-site improvements shall be the responsibility of the developer.

1.12.03 The Authority reserves the right to utilize the Authority's Engineer of Record to design off-site water and sewer improvements. The Developer will be responsible for all engineering costs related to the design of these off-site improvements. Design fees for the improvements will be estimated by the Authority's Engineer of Record and approved by the Authority and Developer prior to commencement of design. Developer shall be required to pay cost of off-site design improvements to the Authority prior to Engineer of Record beginning design. Engineer of Record will provide completed design back to the Authority who will in turn release it to the Developer for construction.

1.12.04 Easements – LCWSA will acquire off-site easements, rights-of-way or permits but the developer shall reimburse the Authority for all costs associated with acquiring any easements, rights-of-ways or permits necessary for the installation of said off-site water mains and/or sewer lines including legal and engineering fees and acquisitions costs.

1.12.05 Performance of Work

The Authority or a properly licensed general contractor approved by the Authority shall perform the work in extending the on-site and off-site Authority's water mains and/or sewer lines. General contractor must be licensed in the State of Alabama. This license must also declare a major classification of Municipal and Utility (MU) and/or Municipal and Utility Specialty (MU-S). If the work is to be performed by a general contractor, a pre-construction meeting shall be held prior to the

start of construction. All work will be required to meet all specifications adopted by the Authority.

1.12.06 Acceptance of Work

Any and all work to be performed under this policy shall be inspected and tested pursuant to policies and Standard Specifications adopted by the Authority.

1.12.07 Applicability

This policy shall apply to water main and sewer line extensions from existing facilities. This policy shall not be applicable to requests for water and sewer services in areas where, because of elevation and remoteness, service cannot be extended from existing facilities of the Authority. Request for service to such areas should be presented to the Authority for its consideration, and the Authority will evaluate these requests on a case-by-case basis .

1.12.08 Limitations

(a) Elevations - Due to the various elevations within the service area of the Authority, water and sewer extensions to new developments may be provided only when property elevations are within those elevations served by the Authority's existing facilities. Developers, prior to submission of any proposed development, should obtain necessary information regarding service elevations from the Authority.
(b) Service – Due to availability to treat and/or availability of capacity within the service area of the Authority, water and/or sewer extensions to new developments may be provided only when the Authority deems suitable capacity and/or treatment options are available with existing facilities. Developers, prior to submission of any proposed development, should obtain necessary information regarding capacity and/or treatment options from the Authority.

1.12.09 Ownership

Upon completion of such extensions and their acceptance by the Authority, such water and/or sewer improvements shall become the property of the Authority. The persons paying the cost of constructing such utilities shall execute any written instrument requested by the Authority to provide evidence of the Authority's title to such utilities. In consideration of such utilities being transferred to the Authority, the

Authority shall incorporate said utilities as an integral part of the Authority's water and/or sewer system and shall furnish service there from in accordance with the Authority's rules, regulations, and rate schedules, subject always to such limitation as may exist because of the size, elevation, and capacity of said utilities.

1.12.10 **Variances From and Effect of Preceding Policy as to Water Main and Sewer Line Extensions**

Whenever the Authority is of the opinion that it is to the best interest of the Authority to construct a water main and/or sewer line extension without requiring strict compliance with its extension policy, such extensions may be constructed upon such terms and conditions as shall be approved by a majority of the members of the Authority's Board.

The authority to make water main and sewer line extensions pursuant to this policy is permissive only, and nothing contained herein shall be construed as requiring the Authority extend service to any entity, person, or persons, even though such prospective customers meet all the requirements contained in the policy necessary to authorize the Authority to make such extensions.

1.13 BONDS FOR WATER AND SEWER IMPROVEMENTS

1.13.01 Performance Bond for Water and Sewer Improvements: The Authority may accept cash, a letter of credit (good for not less than thirteen (13) months), or surety from a corporate surety licensed in the State of Alabama, provided the security offered is deemed acceptable by the Authority's attorney. The amount of the bond shall be estimated by the by the Planning and GIS Coordinator and Board Engineer in an amount equal to at least 150% of the cost of the water and sewer improvements provided. All costs to the Authority incurred in connection with review associated with fixing the amount of and approving the performance bond must be reimbursed by the developer as a condition precedent to approval and acceptance of the bond. The water and sewer performance bond must be posted with the submittal of the plat if improvements are not already in place. The performance bond must be received by the Authority at time of impact fee payment and prior to release of approved construction plans. The bond shall include an automatic thirty (30) day renewal notice from the surety to the Authority advising of pending expiration date.

Improvements must be completed within one (1) year of final plat approval unless this time is extended by agreement of the Authority.

The responsibility for timely seeking an extension of time to complete improvements rests entirely with the developer. Failure to seek and obtain an extension (for a period not to exceed on (1) year) shall void the Authority's approval. Any extension granted by the Authority will be granted only upon renewal of the bond. No reduction or removal of performance bond will be considered until all water and sewer improvements are completed and accepted for service.

In the event of failure by the developer to comply with conditions of the bond, the Authority may declare the security for the bond forfeited and use the receipts of such security to complete the improvements. Unused portions of the security, if any, will be returned as appropriate. The Authority shall not be limited to the amount of the bond if the costs of completing the developer's agreement exceeds said amount.

1.13.02 Maintenance Bond for Water and Sewer Improvements. At the time of completion of subdivision improvements, including the water and sewer improvements (both onsite and offsite), the developer shall apply in writing (by letter) for acceptance of the improvements into the water distribution and sanitary sewer systems of the Authority. The letter must be accompanied by the following:

a. A statement signed by the developer and his contractor, including a notarized affidavit that the required water and sewer improvements are complete, the total construction costs of said improvements, a certification that the improvements were constructed in accordance with standard specifications of the Authority and that they have successfully passed all testing required by the Authority and ADEM. The statement shall also include a certification that the developer and his contractor know of no defects from any cause in the improvements, and that the improvements are free and clear from any encumbrance or lien;

b. An agreement properly dedicating said improvements to the Authority;

c. One (1) copy of as-built drawings of the improvement in paper/hard copy format and one (1) copy in electronic format (.pdf).

d. A Water and Sewer Improvements Maintenance Bond together with sufficient security deemed acceptable by the Authority's attorney. The Authority may accept a letter of credit or surety from a corporate surety licensed in the State of Alabama, provided the security offered is deemed acceptable by the Authority's attorney.

e. The amount of this bond shall be fixed by the Authority's Planning and GIS Coordinator in an amount not less than 15% of the cost of the water and sewer improvements. All costs to the Authority incurred in connection with review associated with fixing the amount of and approving maintenance bonds must be reimbursed to the Authority as a condition precedent to acceptance of the bond and the water and sewer improvements.

f. Prior to closure of the Performance Bond and implementation of the Maintenance Bond, the Authority will complete a Final Inspection of all water and sewer improvements. All deficiencies must be corrected. Upon correction of any deficiencies, the Authority will provide an Acceptance of Utilities letter to the Developer.

g. The Maintenance Bond shall secure the Authority against defects or damage to the improvements arising out of defective or inferior materials or defective or negligent workmanship arising, occurring, or becoming apparent within one (1) year from the date of acceptance of the improvements. Inspection or acceptance of the water and sewer improvements by the Authority shall in no way affect the developer's obligation under the bond.

1.14 OWNERSHIP OF WATER AND SANITARY SEWER FACILITIES

1.14.01 All new water lines, sanitary sewer lines, pumping stations, tanks, treatment facilities and other appurtenances related to water and sanitary sewerage shall be deeded and ownership transferred to the Authority. **No private water or sanitary sewerage facilities will be permitted inside the Authority service area.**

1.15 PRIOR TO START OF CONSTRUCTION OF WATER AND SEWER IMPROVEMENTS

1.15.01 Prior to start of construction of water and sewer improvements, the following shall have occurred:

a. Payment of impact fees

b. Provide performance bond
c. Approval of construction plans
d. Submittal and approval of shop drawings by the Authority for project materials
e. Pre-construction meeting with the Authority

1. The contractor for the developer shall provide submittals and shop drawings as set forth in Section 2.06 of this Manual for all materials proposed to be included in the installation of water and sewer appurtenances for approval by the Authority. No construction installation of water and sewer appurtenances shall occur until the submittals have been reviewed and approved by the Authority.

1.16 PRE-CONSTRUCTION MEETING

1.16.01 After approval of submittals and payment of all impact fees, posting of performance bond and prior to start of construction, the developer or the developer's contractor shall notify the Authority ten (10) working days in advance of beginning work, by letter or email addressed to the Planning and GIS Coordinator, requesting a pre-construction conference.

1.16.02 The Authority will schedule a Pre-Construction Conference which will be conducted on-site to confirm roads are to subgrade and on-site utility materials conform to the approved shop drawing submittals. No water and/or sewer utility work may proceed until roads are to subgrade. The Developer, Contractor, Authority Inspector and Planning and GIS Coordinator shall attend the Pre-Construction Conference.

1.16.03 Failure to request a pre-construction meeting by the Authority will result in the rejection of any water or sewer construction.

1.17 CONSTRUCTION INSPECTION

1.17.01 The Authority will provide inspection of all water and sanitary sewer installations to insure compliance with the provisions of this Manual.

1.17.02 No installation shall be covered until such time that the designated representative of the Authority has performed the appropriate inspection. The developer or his contractor is responsible for coordination with the inspector for timing of inspections. Cost of

uncovering installation which was not inspected shall be borne by the developer or his contractor.

1.17.03 All materials being installed shall meet the requirements of the Authority and shall also be in compliance with the technical requirements of this Manual. Inferior, damaged or unapproved materials will not be installed and shall be removed from the site.

1.17.04 All testing required for approval of water mains and sanitary sewers shall be performed in the presence of the Authority inspector. Failure to perform tests in the presence of the inspector will result in re-testing. Contractor shall provide all equipment for testing of water and sewer lines.

1.17.05 The Authority inspector shall be allowed access at any time as required to perform inspection of water mains and sanitary sewers. The Authority inspector shall not be responsible for interpretation of plans for areas of work other than related to the installation of water mains and sanitary sewers. No construction layout will be performed by the Authority inspector. No supervision or direction in the means and methods of installation by the Contractor will be provided by the Authority inspector. Authority inspector will not be responsible for any safety requirements of the Contractor.

1.17.06 Upon completion of installation of water and sewer improvements, the Authority will conduct a final inspection. Any deficiencies will be noted and a written deficiency list will be provided to the Contractor for correction prior to acceptance of the improvements.

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SECTION 2.02

CONSTRUCTION REFERENCE STANDARDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Applicability of Reference Standards.

B. Provision of Reference Standards at site.

C. Acronyms used in Policy Documents for Reference Standards. Source of Reference Standards.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The date of the standard is that in effect as of the date of the approved construction plans

1.03 SCHEDULE OF REFERENCES

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
P. O. Box 19150
Reford Station
Detroit, MI 48219

AGC	Associated General Contractors of America 1957 E. Street, N.W. Washington, DC 20006
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AITC	American Institute of Steel Construction 333 W. Hampden Avenue Englewood, CO 80110
AISC	American Institute of Timber Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association Association Building Ninth and Minnesota Hastings, NE 68901
ASTM	American Society of Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235

CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1050 15th Street, N.W. Washington, DC 20005
FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wacker Drive Chicago, IL 60606
PS	Product Standard U. S. Department of Commerce Washington, DC 20203
SDI	Steel Deck Institute P. O. Box 3812 St. Louis, MO 63122

SJI	Steel Joist Institute 1703 Parham Road Suite 204Richmond, VA 23229
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
TAS	Technical Aid Series Construction Specifications Institute 601 North Madison Street Alexandria, VA 22314
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2. PRODUCTS

N/A

PART 3. EXECUTION

N/A

END OF SECTION

SECTION 2.03

GENERAL PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General Requirements

1.02 GENERAL REQUIREMENTS

A. Smoking and Fire Precautions: No smoking, fire, or use of any fire or explosion producing tools or equipment shall be permitted on the premises or at any locations where such may endanger said premises or the current operations thereon.

B. Manufacturers Qualifications: The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

C. Contractor Shall Pay for All Laboratory Inspection Service: All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Contractor and approved by the Authority. Contractor to pay for all laboratory inspection services as a part of the Contract. Submit all material test reports to the Authority in triplicate.

D. Compliance With State and Local Laws: Comply with all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

E. Protection of Public and Private Property: Take special care in working areas to protect public and private property. The contractor shall replace or repair at his own expense any damaged water pipes, power and communication lines, or other public utilities, roads, curbs, gutters, sidewalks, drain pipes, ponds or pond structures, sewer drainage ditches, all properties and fixtures (both permanent and temporary) fences, and all plantings, including grass or sod on the site of the work. Leave the site in original or better condition after all cleanup work has been done.

F. Markers: Preserve all USGS, TVA, and State of Alabama property markers and private markers. Do not remove or disturb any such markers without prior approval from the Owner. Any removal and replacement of such markers shall be at the expense of the Contractor.

G. Non-discrimination: The Contractor agrees to hire qualified persons without regard to race, creed, color, sex, or national origin for the performance of the work specified in this contract.

H. Pavement Repair and/or Replacement: Whenever pipe trenches are cut across or along existing pavement or shoulders, backfill same and restore traffic over the cuts as quickly as possible by constructing a temporary surface with twelve (12) inches of Class A, grade D crushed stone. Add material and otherwise maintain such surface until the permanent pavement is restored by the Contractor or until the entire project is accepted.

I. Department of Transportation Permits: The Owner shall secure any permits and provide bond as required by the Alabama Department of Transportation or Limestone County, Alabama for the installation of permanent facilities on highway rights-of-way. All such work shall be coordinated with and be subject to the approval of the Department of Transportation.

J. Approved Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with instructions.

K. Catalogue Data for Authority: Provide duplicate complete, bound sets of a compilation of catalog data of each manufactured item of mechanical and electrical equipment used in the work, and present this compilation to the Authority before final project close-out. Include descriptive data and printed installation, operating, and maintenance instruction (including a parts list for each item of equipment). Provide a complete double index as follows:

1. Listing the products alphabetically by name.
2. Listing alphabetically the names of manufacturers whose products have been incorporated in the work, together with their addresses and the names and addresses of the local sales representative.

L. Operation and Maintenance Instruction to Authority: Where the specifications for specific equipment require that a factory service representative provide operation and maintenance instruction to the Authority for that equipment, this service is to be performed by prior arrangement with the Authority after and in addition to the manufacturer's instructions to the Contractor for installation and start-up. The individual performing the instruction to the Authority shall be trained and/or certified by the manufacturer as its authorized operation, maintenance, and service specialist. If the said specialist is not a regular full-time employee of the manufacturer, the specialist's qualifications shall be submitted to the Authority for review and approval prior to scheduling the site visit for instructions to the Authority.

M. Operation of Authority System: No Contractor shall operate valves, hydrants, pump stations or other appurtenances of the water or sanitary sewer system without the presence of Authority personnel.

N. Utilities: The Contractor shall contact the Owner of all underground utilities before beginning construction in the area. Carefully protect from damage all utilities in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules and regulations of the particular utility involved. Any such work shall be considered incidental to the construction or repairs of utility lines, and no additional payment will be allowed therefor. Existing water mains shall remain in service at all times during construction. Contractor shall provide any temporary piping necessary to maintain water service to existing customers.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

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SECTION 2.04

FIELD ENGINEERING

PART 1 - GENERAL

1.01

A. The Contractor shall be responsible for providing and paying for any surveying or engineering services required during the construction. The Contractor must retain qualified personnel as work may require.

B. The Authority shall be responsible only for inspections of all water and sanitary sewer facilities.

C. The Authority will not supply Contractor with any survey control points.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

N/A

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SECTION 2.05

PROJECT COORDINATION AND ACCESS

PART 1 - GENERAL

1.01 The Contractor shall work in full cooperation with the Authority personnel in order to provide safe access for purpose of inspection of all utility work.

1.02 The Contractor shall organize his work in such a manner that existing utility service is maintained to existing customers at all times.

1.03 The location of existing utilities is approximate only. It is the responsibility of the Contractor to contact the local utility companies for exact locations of all utilities prior to the beginning of construction.

1.04 Contractor shall operate no valves or utility appurtenances in the system without the presence of an Authority representative on site.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

N/A

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SECTION 2.06

SHOP DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit shop drawings and product data to the Authority for review and approval.

1.02 SHOP DRAWINGS

A. Drawings shall be presented in a clear and thorough manner.

1. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on the Construction Drawings.

1.03 PRODUCT DATA

A. Preparation

1. Clearly mark each copy to identify pertinent products or models.

2. Show performance characteristics and capacities.

3. Show dimensions and clearances required.

4. Show wiring or piping diagrams and controls.

B. Manufacturer's standard schematic Drawings and Diagrams.

1. Modify drawings and diagrams to delete information which is not applicable to the work.

2. Supplement standard information to provide that specifically applicable to the work.

1.04 CONTRACTOR RESPONSIBILITIES

A. Review Shop Drawings, Product Data and Samples prior to submission.

B. Determine and verify:

1. Field measurements.

2. Field construction criteria.

3. Catalog numbers and similar data.

4. Conformance with specifications.

C. Coordinate each submittal with requirements of the work and of the Construction Plans.

D. Notify the Authority in writing, at the time of submission, of any deviations in the submittals.

E. Begin no fabrication or work which requires submittals until return of submittals with Authority stamp approval.

1.05 SUBMISSION

A. Make submittals promptly at the pre-construction conference.

B. Number of submittals required:

1. Shop Drawings: Submit three (3) copies plus whatever additional copies the Contractor desires to have returned.

C. Submittals shall contain:

1. The date of submission and the dates of any previous submission.

2. The project title.

3. The names of the Contractor, supplier and manufacturer.

4. Identification of the product.

5. Field dimensions, clearly identified as such.

6. Relation to adjacent or critical features of the work or materials.

7. Applicable standards, such as ASTM or Federal Specification numbers.

8. Identification of deviations from Contract Documents.

9. Identification of revisions on submittals.

10. A six (6) inch square blank space for Authority review stamps.

11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the work and of Contract Documents.

1.06 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by the Authority and resubmit until approved.

B. Shop Drawing and Product Data:

1. Revise initial drawings or data and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those requested by the Authority.

1.07 DISTRIBUTION

A. Shop Drawings and copies of Product Data which carry the Authority's stamp of approval will be distributed as follows:

1. Authority file copy.

2. Authority inspector.

3. Contractor.

B. It is the responsibility of the Contractor to distribute his apoproved copies of Shop Drawings to suppliers.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

N/A

END OF SECTION

SECTION 2.07

TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Provide and maintain methods, equipment and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under the Contractor's control; remove physical evidence of temporary facilities at completion of work.

1.02 DUST CONTROL

A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.03 WATER CONTROL

A. Provide methods to control surface water to prevent damage to the Project, the site or adjoining properties.

1. Control filling, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.

B. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface water.

C. Dispose of drainage water in a manner to prevent flooding, erosion or other damage to any portion of the site or to adjoining areas, as required by local rules and regulations.

1.04 DEBRIS CONTROL

A. Maintain all areas under Contractor's control free of extraneous debris.

B. Initiate and maintain a specific program to prevent accumulation of debris at the construction site, storage and parking areas, or along access roads and haul routes.

1. Provide containers for deposit of debris.
2. Prohibit overloading of trucks to prevent spillage on access roads or haul routes.
3. Provide periodic inspection of traffic areas to enforce requirements.

C. Schedule periodic collection and disposal of debris. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.

1.05 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharging of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth off-site and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of waste, effluents, chemicals or other such substances adjacent to streams or in sanitary sewers.

D. Provide system for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.
2. Prevent harmful disposal of pollutants into the atmosphere.

1.06 TRAFFIC CONTROL

A. Contractor shall provide traffic control devices and signage as set forth by the latest edition of the Manual of Uniform Traffic Control Devices to protect the public where utility work is undertaken inside roadway areas.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

N/A

END OF SECTION

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SECTION 2.08

TRANSPORTATION AND HANDLING

PART 1 – GENERAL

1.01 PACKING AND TRANSPORTATION

A. Require supplier to package products in boxes or crates for protection during shipment, handling, and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion, and other damage.

1.02 DELIVERY

A. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.

B. Coordinate to avoid conflict with work and conditions at the site. Specifically coordinate to determine:
   1. Work of the Authority.
   2. Work of other contractors.
   3. Availability of equipment and personnel for handling products.
   4. Authority's use of premises.

C. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

D. Clearly mark partial deliveries of component parts of equipment to permit easy accumulation of parts and to facilitate and legible.

E. Immediately on delivery, inspect shipments to assure:
   1. Compliance with Construction Plans and approved submittals.
   2. Quantities are correct.
   3. Containers and packages are intact and that labels are legible.
   4. Products are properly protected and undamaged.

1.03 PRODUCT HANDLING

A. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

B. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding spaces.

C. Handle products by using methods that will prevent bending or over stressing.

D. Lift heavy components only at designated lifting points.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 2.09

STORAGE AND PROTECTION

PART 1 – GENERAL

1.01 STORAGE, GENERAL

A. Store products immediately on delivery in accordance with manufacturer's instructions with seals and labels intact. Protect until installed.

B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

1.02 EXTERIOR STORAGE

A. Provide substantial platforms, blocking, or skids to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

B. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials to prevent mixing with foreign matter.

C. Provide surface drainage to prevent erosion and ponding of water.

D. All pipe and valves shall be stored with the ends capped to prevent debris from entering the materials.

E. All PVC pipe stored onsite longer than 30 days shall be covered by tarps to prevent degradation by ultraviolet light.

1.03 MAINTENANCE OF STORAGE

A. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 2.10

PROJECT CLOSEOUT

PART 1 – GENERAL

1.01 FINAL COMPLETION

A. When this project is considered to be complete, Contractor shall submit certification in indication the following:

1. Letter stating work is complete and ready for final inspection.

B. Authority's Action During Final Inspection:

1. Inspect to verify the status of completion within seven (7) working days.
2. If Authority considers Work incomplete or defective, they will promptly notify Contractor in writing, listing deficiencies.

C. Contractor's Duties: Take immediate action to correct deficiencies, and send certification to Authority that deficiencies have been corrected.

D. When Authority determines that Work is acceptable, they will request Contractor to make closeout submittals including Maintenance Bond, dedication of improvements and as-built drawings.

1.02 AUTHORITY OCCUPANCY

A. Authority will occupy the Project, or designated portion of the Project once all deficiencies have been corrected and final acceptance has granted.

B. Contractor's Duties:

1. Make corrections listed on punch list.
2. Perform final clean-up.
3. Provide as-built drawings.

1.03 CONTRACTOR'S CLOSEOUT SUBMITTALS REQUIRED

A. Project Record Documents: Comply with Section 2.11

B. Evidence of Payment and Release of Liens: Contractor shall advertise in local paper for two (2) consecutive weeks of project closure and provide Authority with evidence of same.

C. Copies of all test results.

PART 2- PRODUCTS

Not Used

PART 3- EXECUTION

Not Used

END OF SECTION

SECTION 2.11

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Policy Manual requires the Contractor to maintain a record copy of the following for Authority's review:
   1. Approved construction plans.
   2. Approved shop drawings, product data, and samples.
   3. Records of all changes made during construction.

B. In addition to the above, the Contractor shall maintain a record copy of the following where applicable:
   1. Field test results.
   2. Operation and maintenance manuals.

1.02 RECORDING

A. Record information concurrently with construction progress.
   1. Do not conceal work until required information has been recorded.

B. Contract Drawings: Legibly mark each item to record actual construction, including the following:
   1. Measured horizontal and vertical locations of underground utilities, valves, etc. referenced to building exterior lines or other distinguishable permanent features such as power poles, inlets, etc. Show direction of flow of pipe and depth of piping underground.
   2. Location of sewer services including depth at end of service; length of service line; and distance from nearest downstream manhole.
   3. Field changes of dimensions and details.
   4. Sanitary sewer television logs.
   5. Details not on original Contract Drawings.

1.03 AS-BUILT DRAWINGS

A. As-built Drawings which are required for Authority records shall be recorded on a clean set of construction plans in red ink in a neat, legible manner by the Contractor.

1.04 GRAVITY SEWER VIDEOS

A. The Contractor shall provide the Owner with a video of all installed gravity sewer lines. CCTV video requirements for gravity sewers are set forth in Section 3.01, Paragraph 3.04.A of this document.

1.05 SUBMITTALS

A. At Contract Closeout, deliver As-built Drawings and gravity sewer video to Authority. Performance Bond will not be released and project will not be accepted for service until As-built Drawings and gravity sewer videos are submitted to the Authority.

B. Submit Record Documents under cover of a transmittal letter containing:
    1. Date.
    2. Project title.
    3. Contractor's name and address.
    4. Signature of Contractor.

C. Submit the following for as-built drawings:
    1. One (1) mark-up copy of As-built Drawings.
    2. An electronic color copy of As-built Drawings in .pdf format. Authority will scan drawings at a cost of $10.00/sheet.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 2.12

CLEANING

PART 1 - GENERAL

1.01 CLEANING

A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish caused by operations.

B. Keep streets clean from mud, dirt, debris, and other materials removed from the job site. Promptly remove mud and dirt tracked by vehicles from street surfaces.

C. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials. Clean all sight-exposed surfaces. Leave project clean and ready for occupancy.

D. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.

2. Do not dispose of volatile waste such as mineral spirits, oil and paint thinner in storm drains or sanitary sewers.

E. Hazard Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.

2. Prevent accumulation of waste which might cause hazardous conditions.

3. Provide adequate ventilation during use of volatile and noxious substances.

1.02 DURING CONSTRUCTION

A. Clean building, grounds and public properties and keep free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to prevent dust.

C. At reasonable intervals during progress of Work, but in no case less than once a week, clean site and public properties and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris, and rubbish.

F. No debris shall be permitted to accumulate on site except in a container designed for debris removal.

1.03 FINAL CLEANING

A. Remove waste, debris, and surplus materials from site. Clean grounds; remove stains, spills, and foreign substances from paved areas and sweep clean. Rake clean other exterior surfaces.

B. Maintain cleaning until Final Completion.

C. Prior to Final Completion, or Authority occupancy, Contractor shall conduct an inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 2.13

BUY AMERICAN POLICY

PART 1 – GENERAL

1.01 REQUIREMENTS

A. The Authority shall stipulate or cause to be stipulated a provision whereby the person, firm, or corporation undertaking the project agrees to use in the execution of the contract; materials, supplies, and products manufactured, mined, processed, or otherwise produced in the United States or its territories, if the same are available at reasonable and competitive prices.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

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SECTION 2.14

TRENCHING, BACKFILLING AND COMPACTION FOR UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Excavation for buried utility material.

B. Provide necessary sheeting, shoring and bracing.

C. Prepare trench bottom with appropriate materials.

D. De-water excavations as required.

E. Place and compact granular beds, as required, and backfill.

1.02 RELATED WORK

A. Section 2.22: Pavement Repair.

B. Section 2.15: Unclassified Excavation for Utilities

C. Section 3.01: Sanitary Sewers (Gravity)

D. Section 3.02: Sewage Force Main

E. Section 3.03: Manholes

F. Section 4.01: Water Lines

1.03 PRECAUTIONS

A. Contractor shall shore and brace all open cut trenches as required by State and Federal Laws including 29 CFR 1926.651 and 1926.652 and Local Ordinances; conform with recommendations set forth in AGC Manual of Accident Prevention in Construction; protect life, property, or work; and avoid excessively wide cuts in unstable material. The Contractor is responsible for all compliance with laws and statutes related to trenching and excavation.

B. Notify utility companies when necessary to disturb existing facilities and abide by their requirements for repairing and replacing.

C. Protect all vegetation and other features to remain.

D. Protect all benchmarks, property pins and survey points. Any damaged or destroyed property pins shall be replaced at the Contractor's expense.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

3.01 PREPARATION

A. Install barriers and other devices to protect areas adjacent to construction.

B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION OF TRENCHES

A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

B. Maximum width at the crown of the pipe shall be 18 inches plus 4/3 nominal diameter of the pipe.

C. Cut pavement along neat, straight lines with either a pavement breaker or pavement saw.

D. Trench depth: To provide minimum cover as specified in Section 3.01, 3.02, or 4.01 over the top of the pipe.

E. Align trench as shown on the drawings unless a change is necessary to miss an unforeseen obstruction.

F. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2 or 3.

G. Remove rock encountered in trench excavation to a depth of six (6) inches below the bottom of the pipe barrel, backfill with an approved material,

and compact to uniformly support the pipe. In no case shall solid rock exist within six (6) inches of the finished pipeline.

3.03 SHEETING, SHORING AND BRACING

A. When necessary, furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement.

B. Take care to prevent voids outside the sheeting.

C. If voids are formed, immediately fill and compact to the satisfaction of the Engineer.

D. Unless adjacent facilities will be damaged, remove all sheeting, shoring, and bracing after backfill has been placed to a depth of 18 inches over the pipeline.

E. Cut shoring off at the top of the pipe and leave the lower section in the trench.

3.04 USE OF EXPLOSIVES

A. Conduct all blasting operations in accordance with prevailing municipal, state, or other agency regulations, codes, ordinances, or laws. No blasting materials shall remain overnight on work site.

B. Exercise due caution when blasting adjacent to existing structure and pipe lines.

C. Cover all shots with blasting mats to prevent flying material.

3.05 DISPOSAL OF EXCAVATED MATERIAL

A. Satisfactorily dispose of all excess excavated material that cannot be used for or is not suitable for embankments.

3.06 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation is defined as all excavation outside or below the proposed lines and grades shown on the drawings.

B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to insure the stability of the structure of construction involved.

C. Unauthorized excavation or backfill to replace same shall not be a pay item.

3.07 REMOVAL OF WATER

A. Keep excavated areas free of water while work is in progress.

B. Well-pointing shall be performed if required.

C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

3.08 OBSTRUCTIONS

A. Obstructions shown on the drawings are for information only and do not guarantee their exact locations nor that other obstructions are not present.

B. When utilities or obstructions are not shown on the drawings but are present off the roadway at the location of the proposed pipeline route, the Contractor should notify the appropriate utility owner prior to continuing with any installation.

C. Exercise due care in excavating adjacent to existing obstructions and do not disturb same unless absolutely necessary.

D. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance.

E. Coordinate all obstruction relocation with the appropriate utility owner.

3.09 BEDDING AND BACKFILLING

A. Do not begin backfilling before Authority has inspected the grade and alignment of the pipe, the bedding of the pipe and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.

B. Refer to the Sections of these specifications for details related to the specific bedding and backfilling requirements for sewage force mains, water lines, and gravity sewers.

C. If pipe (water, gravity sewer or force main) is installed in a rock trench, install a 6-inch beggind of No. 67 (ALDOT) curshed stone below the bottom of the pipe. Then add additional No. 67 stone to a point 12-inches above the top of the pipe in accordance with the details. Rock is defined as material non excavatable by a trackhoe.

D. Dispose of and replace all soft or yielding material which is unsuitable for trench backfill with suitable material.

E. Deposit backfill to the surface of the ground by dragline, bulldozer or other suitable equipment in such a manner so as not to disturb the pipe.

F. Neatly round sufficient surplus excavated material over the trench to compensate for after settlement.

G. Backfill all roadways and paved areas with No. 67 stone and with the final 8-inches of backfill to be crushed stone roadway base. Refer to each pipeline specification for details.

H. Dispose of all surplus excavted materials.

I. Prior to final accepatance, remove all mounds to the elevation of the surrounding terrain.

END OF SECTION

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SECTION 2.15

UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Engineer, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.03 JOB CONDITIONS

A. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

C. Do not interrupt existing utilities serving facilities occupied and used by Authority or others, during occupied hours, except when permitted in writing by Authority and then only after acceptable temporary utility services have been provided.

1. Provide minimum of 48-hour notice to Authority before interrupting any water or sanitary sewer line.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

E. Preserve from damage surveying monuments, property pins, and similar items. If disturbed or damaged by construction operations, pay the cost of restoration by a registered surveyor.

F. Protect structures, utilities, sidewalks, pavements, an other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.04 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation work.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

C. Notify Authority and Engineer of Record of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation bottoms against freezing when atmospheric temperature is less than 35°F.

F. Protect trees, shrubbery, fences, poles, and all other property and surface structures during construction operations. Fences, poles, or other man made surface improvements which are moved or disturbed shall be restored to the original conditions after construction is completed. Trees, shrubbery, or other vegetation which are approved for removal in order to facilitate construction operations shall be removed completely, including stumps and main roots. Responsibility for damage or claims for damage caused by construction operations to shrubbery or other landscape improvements shall be assumed by Contractor.

1.05 SAFETY

A. Barricades, Guards, and Safety Provisions: Place and maintain barricades, fences, construction signs, torches, flashing lights, lanterns, guards, and flagmen as required during the progress of the construction work and until it is safe for traffic to use the roads and streets. Material piles, equipment, and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of OSHA and appropriated authorities respecting safety provisions shall be observed.

B. Structure Protection: Provide temporary support, protection, and maintenance of underground and surface, drains, sewers, and other obstructions encountered during the progress of the work. Structures which may have been disturbed shall be restored upon completion of the work.

1.06 DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

A. Wherever obstructions are encountered during the progress of the work which occupy the space required for the pipeline, Authority shall have the authority to order a deviation from the line and grade.

B. Where gas, water, telephone, electrical, or other existing utilities directly interfere with the vertical or horizontal alignment of the pipeline, Authority will order a change in grade or alignment.

1.07 MAINTENANCE OF THE TRAFFIC AND CLOSING OF STREETS

A. Carry on the work in a manner which will cause a minimum of interruption to traffic, and do not close to through travel more than two consecutive blocks, including the cross street intersected. Where traffic must cross open trenches, provide bridges at street intersections and driveways. Post signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Before closing any streets notify responsible municipal authorities.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487unified soil classification system groups GW, GP, GM, SM, SW and SP.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 unified soil classification system GC, SC, ML,MH, CL, CH, OL, OH and PT.

C. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.

D. Backfill and Fill Materials: Satisfactory soil material of clay, rock, or gravel not larger than 2" in any dimension, free of debris, waste, frozen materials, vegetable and other deleterious matter.

PART 3 – EXECUTION

3.01 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the Construction Documents specifically indicate are to be removed.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be specifically listed in the specifications, marked on the site, or identified by the Engineer. In no case damage or remove such growth without written permission from the Engineer.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth and grub the excavated area and remove all large roots to a depth of not less than 2' below the bottom of the proposed construction. Dispose of the growth removed. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely. Take special

precautions to protect and preserve such growth throughout all stages of the construction.

3.02 EXCAVATION

A. Excavation is unclassified, and includes excavation to subgrade elevations.

3.03 UNSUITABLE MATERIALS

A. Whenever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1″ to 2″ crushed stone up to the level of the lines grades, and/or cross sections shown on the drawings. The top 6″ of the refill shall be No. 67 (ALDOT) crushed stone for bedding.

3.04 ROCKS AND BOULDERS

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and /or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as rock excavation. Rock material shall be considered where it cannot be removed by a trackhoe by ripping the material.

B. Should rock be encountered in the excavation, remove it by blasting, rock saws, rock trencher, hoe ram or otherwise. Where blasts are make, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

C. Excavate rock over the horizontal limits of excavation an to a depth of not less than 6″ below the bottom of pipe up to 30″ in diameter and not less that 12″ below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (ALDOT) Crushed stone, tamp to the proper grade, and make ready for construction.

3.05 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Authority shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.

B. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workmanlike condition, as described below.

3.06 SHEETING, SHORING AND BRACING

A. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5′ high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5′ deep when examination of the ground indicates hazardous ground movement may be expected. Guard the wall and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Alabama. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary.

E. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the drawings, ordered by the Owner, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and the cave-ins and slides are avoided.

F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

G. The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater that that of an appropriated shoring system.

H. Dewatering: Prevent surface water and suburface or ground water from flowing into excavations and from flooding project site and surrounding area.

I. Do not allow water to accumulate in excavations. Remove water to prevent softening of subgrade foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundation. Provide and maintain pumps, well points sumps, suction and discharge lines, and other dewatering system components to convey water away from excavations.

J. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

3.08 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may

require the opening of borrow pits at points accessible to the work. Before a borrow pit is opened, the quality and suitablity of its material of its material shall be approved by the Authority.

B. Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit materials before placing it in the backfill.

3.09 BACKFILLING

A. Conduct backfilling around manholes, inlet, outfalls, and/or structures in the same manner as specified for water lines, gravity sewers and/or force mains except that even greater care is necessary to prevent damage to the utility structure.

B. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfilling is being placed. If any pipe or structure is damaged and/or displace during backfilling, open up the backfill and make whatever repairs are necessary.

3.10 MAINTENANCE

A. Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Authority.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Authority. Continue such maintenance until final acceptance of the project, or until Authority issues a written release.

END OF SECTION

SECTION 2.16

EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

C. All erosion control structures and practices shall be implemented and maintained according to the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas. Contractor shall be knowledgeable of the requirements set forth in said document.

D. Developer/contractor shall be responsible for obtaining permits and adhering to the erosion control standards as set forth by the State of Alabama.

PART 2 - PRODUCTS

2.01 TEMPORARY BERMS

A. A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.

B. These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2.02 TEMPORARY SLOPE DRAINS

A. A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, sod, or other material that may be used to carry water down slopes to reduce erosion.

2.03 SEDIMENT STRUCTURES

A. Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.04 CHECK DAMS

A. Check dams are barriers composed of large stones, sand bags, or other non-corrodible materials placed across or partially crossing a natural or constructed drain way.

2.05 TEMPORARY SEEDING AND MULCHING: Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

2.06 BALED HAY OR STRAW CHECKS

A. Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing five (5) cubic feet or more of material.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water runoff is a problem.

2.07 TEMPORARY SILT FENCES

A. Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth imposed or burlap,

plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.

PART 3 - EXECUTION

3.01 The project drawings show the minimum erosion and siltation control measures required for this job. If the Contractor desires to stockpile construction materials, stone, earth, etc., the location of same and protection thereof shall be outlined in an Erosion and Siltation Control Plan.

3.02 The Contractor shall prepare and maintain a spill prevention plan. The contents of this spill prevention plan shall depend on what types of chemicals, lubricants and fuels will be used and if these will be stored on site. As a minimum, if fuel or lubricants or other chemicals are stored on site, either temporarily in vehicular tanks or in skid or trailer mounted tanks, a plan shall be supplied which directs all employees of the Contractor in the proper procedures to be followed should a spill occur. For more complex chemical storage requirements, a more complex plan will be required.

3.03 CONSTRUCTION REQUIREMENTS

A. The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the preconstruction stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

B. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages.

C. In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State or Local agencies, the more restrictive laws, rules, or regulations shall apply.

3.06 CONSTRUCTION OF STRUCTURES

A. Temporary Berms

1. A temporary berm shall be constructed or compacted soil, with a minimum width of 24 inches at the top and a minimum height of 12 inches, with or without a shallow ditch, constructed at the top of fill slopes or transverse to centerline on fills. Temporary berms shall be graded so as to drain to a compacted outlet at a slope drain. The area adjacent to the temporary berm in the vicinity of the slope drain must be properly graded to enable this inlet to function efficiently and with only minimum ponding in this area. All transverse berms required on the downstream side of a slope drain shall extend across the grade to the highest point at approximately a ten (10) degree angle with a perpendicular to centerline. The top width of these berms may be wider and the side slope flatter on transverse berms to allow equipment to pass over these berms with minimal disruptions. When practical and until final roadway elevations are approached, embankments should be constructed with a gradual slope to one side of the embankment to permit the placement of temporary berms and slope drains on only one side of the embankment.

B. Temporary Slope Drains

1. Temporary slope drains shall consist of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, flexible rubber, or other materials which can be used as temporary measures to carry water accumulating in the cuts and on the fills down the slopes prior to installation of permanent facilities or growth of adequate ground cover on the slopes.
2. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4:1 except for short distances of 20 feet or less.
3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base for temporary slope drains shall be compacted and concavely formed to channel the water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain. Energy dissipater would be dumped rock or a small sediment basin which would slow the water as well as pick up some sediment. All temporary slope drains shall be removed when no longer necessary and the site restored to match the surroundings.

C. Sediment Structures

1. Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditch lines atop waste sites; and in the ditch lines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.
2. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural and intended condition.

D. Check Dams

1. Check dams shall be utilized to retard stream flow or restrict stream flow within the channel. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.
2. All check dams shall be keyed into the sides and bottom of the channel. A design is not needed for check dams.

E. Temporary Seeding and Mulching: Seeding and mulching shall be performed in accordance with the Section 02485 - Seeding. Seeding and mulching shall occur as soon as practical, and no later than 10 working days after line installation.

F. Baled Hay or Straw Erosion Checks: Hay or straw erosion checks shall be embedded in the ground four (4) to six (6) inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose. The Contractor shall keep the checks in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris cleanout will be considered routine maintenance.

G. Temporary Silt Fences

1. Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.
2. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project. The silt accumulation at the fence may be left in place and seeded or

removed. The silt fence remains the property of the Contractor whenever the fence is removed.

H. Under no circumstances shall spent oil wastes be discharged on the site.

3.07 MAINTENANCE: The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

3.08 EROSION CONTROL OUTSIDE PROJECT AREA: Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites.

PART 4 - ADDITIONAL REQUIREMENTS

4.01 All erosion control structures and practices shall be implemented and maintained according to the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas.

A. Contractor shall maintain a copy of the approved ADEM Notice of Registration (NOR) permit at all times during construction, and shall be capable of presenting said document to any ADEM personnel who may visit the construction site.

B. An erosion control inspection shall be performed after every rain event, and no less than one (1) inspection shall be performed each month. Contractor shall be in attendance for every inspection.

C. Contractor shall be responsible for providing Facility Identification Signs for the project. Signs shall be located where accessible, including locations where the project crosses paved county, State or Federal highways/roads. Each sign shall include the Registrant (Owner) Name, the ADEM NPDES Registration Number, Project Name and Registrant (Owner) contact information. A sample sign is located at the end of this section. Contractor is responsible for removal of all signs upon approval of the Engineer.

D. Contractor shall provide a rain gauge on-site for the duration of the project. Gauge shall be placed in a location accessible to site visitors (Owner, Engineer, ADEM Personnel) and free from any obstructions which may produce inaccurate measures of rainfall such as trees and

buildings. Contractor is responsible for removal of rain gauge upon approval of the Engineer.

E. Additional inspections may be performed by ADEM personnel during the life of the project. Contractor shall be accommodating to such personnel, and shall note any changes/corrections suggested by said personnel with regards to erosion control. Contractor shall make notes of such visits, including name of inspector, date/time of inspection and items discussed with inspector.

END OF SECTION

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SECTION 2.17

FINISH GRADING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work called for by this section shall include, but not necessarily be limited to, finish grading and the spreading and shaping of topsoil to the finished contour elevations indicated by the drawings.

PART 2 – PRODUCTS

2.01 TOPSOIL

A. Use stripped topsoil that has been stockpiled as specified elsewhere. If the quantity of topsoil on the job is inadequate, furnish enough additional topsoil. Topsoil furnished shall be natural, fertile, friable soil possessing characteristics of representative productive solids in the vicinity. It shall be obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain toxic substances that may be harmful to plant growth. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay, lumps, stones, stumps, roots, or similar substances 2" or more in diameter, debris, or other objects that are a hindrance to planting operations. Such material shall be subject to testing.

PART 3 – EXECUTION

3.01 GRADING

A. Do not begin work until the earth is dry enough to be tillable.

B. Inspect subgrades to see that they generally conform to the standards called for elsewhere in these specifications, particularly with regard to the approximate depths required for the work. After work is completed, inspect it to ensure that all finish grading complies with design requirements.

C. Finish grade all areas to the depths required for the work as follows:

1. Grade uniformly with rounded surfaces at the tops and bottom of abrupt changes of planes.
2. Hand grade steep slopes and areas that are inaccessible for machine work.
3. Protect graded areas from undue erosion, and repair and regrade areas where erosion does occur.
4. Refill areas where noticeable settlement has occurred.
5. Finish grade areas that are to receive topsoil up to 4" below the finished contour elevations called for by the drawings or, over rock, to 12" below these elevations.

D. Place topsoil uniformly over disturbed areas that do not receive other work as follows:
    1. Scarify subgrade to a depth of 3".
    2. Place the topsoil to a depth of 4" when lightly rolled or, on rock, to a depth of 12".
    3. Level the topsoil so that it slopes uniformly and has no water pockets.
    4. Carefully rake the topsoil by hand to remove all clods, roots, sticks, stones over 1" in diameter, and other foreign materials from the surface.

E. Dispose of excess excavated materials and debris away from the site.

END OF SECTION

SECTION 2.18

SEEDING

PART 1 - GENERAL

1.01 This work shall be performed in all disturbed areas not receiving such site improvements as buildings, roads, walks, sod, planting, etc., and shall include, but not necessarily be limited to, all seed bed preparation; the supplying and placing of soil additives, seed, and mulch and maintenance.

1.02 Refer to other sections for items affecting seeding. Coordinate this work with that specified by other sections for timely execution.

PART 2 – PRODUCTS

2.01 MATERIALS

A. GRASS SEED: Kentucky 31 Fescue (Festuca elatior) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended; no "below standard" seed will be accepted.

B. FERTILIZER: commercially manufactured; Grade 10-10-10; furnished in standard containers that are clearly marked with the name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

C. AGRICULTURAL LIMESTONE: containing a minimum of 85% calcium carbonate and magnesium carbonate combined, 85% of which passes a No. 10 mesh sieve.

D. MULCH: stalks of rye, oats, wheat, or other approved grain crops properly cured prior to bailing, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

PART 3 - EXECUTION

3.01 SEEDING

A. Perform all seeding and related work as a continuous operation. Sow seed as soon as the seed bed has been prepared, and perform subsequent work in a continuous manner

B. Before beginning seeding operations in any area, complete the placing of topsoil and final grading.

C. Scarify, disk, harrow, rake, or otherwise work each area to be seeded until the soil has been loosened and pulverized to a depth of not less than two (2) inches. Perform this work only when the soil is in a tillable and workable condition.

D. Apply fertilizer and agricultural limestone uniformly over the seed bed, and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately one (1) inch at the following rates:

Fertilizer: 40 pounds per 1,000 square feet
Agricultural Limestone: 80 pounds per 1,000 square feet

E. Sow seed uniformly with a rotary seeder, wheelbarrow seeder, hydraulic equipment or by other satisfactory means.

F. The seeding rate shall be five (5) pounds per 1,000 square feet for Kentucky 31 Fescue (Festuca elatior) .

G. For temporary stabilization seeding rate shall be three (3) pounds per 1,000 square feet of annual rye grass.

H. Perform no seeding during windy weather or when the ground surface is frozen, wet, or otherwise untillable. Seeding shall not occur during the months of May through August.

I. When seeding with mulch is specified spread mulch material evenly over the seeded areas immediately following the seeding operation.

Mulch Rate: Two (2) bales (100 pound minimum) per 1,000 square feet

J. The mulch rate may be varied, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25% of the ground is visible.

K. No equipment, material storage, construction traffic, etc., will be permitted on newly seeded ground.

3.02 INSPECTIONS

A. The Authority shall inspect the seeding within 60 days after planting and determine if it is acceptable.

3.03 GUARANTIES

A. Secure an acceptable growth of grass in all areas designated for seeding.

B. An area is considered acceptable if it is represented by a minimum of 100 seedlings per square foot of the permanent species of grass representative of the seed mixture. If an acceptable growth is not obtained on the first planting, reseeding and remulching will be required.

C. If the planting is less than 50% successful, rework the ground, refertilize, reseed, and remulch.

END OF SECTION

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SECTION 2.19

BORING AND CASING FOR SANITARY SEWERS AND WATER LINES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing water line. It shall include the excavation of a boring pit, auger boring between the points as specified on the drawings, furnishing and installing of the casing pipe and carrier pipe, and disposing of the excavated materials in the manner herein provided.

B. Water lines and force mains crossing beneath existing concrete drives shall be bored. No casing pipe is required for drives. Water line and force main shall be installed beneath drive so that no bell or spigot is located beneath drive.

C. All crossing of County or State roads shall be installed by bore and jack methods with steel casing unless otherwise approved by the local roadway governing agency.

PART 2 - PRODUCTS

2.01 CASING PIPE

A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications" for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall be a ASTM A252, Grade 2 and shall have a minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
FOR E72 LOADING

Carrier Pipe Diameter	Casing Pipe Diameter	Nominal Thickness
4 inches	8 inches	0.250 inches
6 inches	12 inches	0.250 inches
8 inches	16 inches	0.312 inches

10 inches	20 inches	0.312 inches
12 inches	24 inches	0.312 inches
15/16 inches	24 inches	0.375 inches

B. When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown.

2.02 CARRIER PIPE: The water lines and force mains, the carrier pipe shall be as noted on the plans. For gravity sewer installations, ductile iron Class 350 with epoxy lining shall be used.

2.03 CASING SPACERS: Casing spacers shall be Model C, painted steel spacers by Pipeline Seal and Insulator Co.; Model SI8 by Advanced Product Systems, Inc. or approved equal.

2.04 END SEALS: Ends of casing pipe shall be closed by installing a 1/8" thick synthetic rubber end seal, Model W by Pipeline Seal and Insulator Co.; Model AW by Advanced System Products, Inc. or approved equal.

PART 3 - EXECUTION

3.01 BORING: The boring shall be accomplished by means of augering to the size, line, and the grade shown on the drawings.

3.02 INSTALLATION OF CASING PIPE

A. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together with continuous welds to provide watertight joints. Tack welding of casing will not be permitted.

B. Do not remove unacceptable casing without prior approval from the A/E. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing. Void spaces shall be filled with grout or flowable fill. At a minimum, abandoned bore holes shall be pumped full with grout or flowable fill.

3.03 INSTALLATION OF CARRIER PIPE

A. The carrier pipe shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing.

B. Casing spaces shall be used to provide alignment and support of the carrier pipe inside the casing. At a minimum carrier pipe shall be supported at the midpoint of pipe joint and at 1' from each end of pipe joint, (3 per pipe segment).

C. No wood blocking of carrier pipe will be permitted.

D. Where gravity sewer pipe is installed, casing spacers with appropriate length skids shall be used in order to prevent flotation of carrier pipe which might impact vertical grade alignment.

E. Upon completion of installing carrier pipe in casing pipe, seal both ends with end seals.

3.04 LAYOUT OF WORK: The Contractor will provide all layout required to keep the bore on grade and alignment.

END OF SECTION

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SECTION 2.20
HORIZONTAL DIRECTIONAL DRILLING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. For the supply of domestic water during construction, the contractor shall utilize an Authority supplied meter assembly (meter & backflow device) and pay for all water consumed.

1.02 RELATED SECTIONS

A. Section 3.02 Force Main

1.03 QUALITY ASSURANCE

A. The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper horizontal directional drilling installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification or within any associated permit. Adherence to the specifications contained herein, or the Authority approval on any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract. The HDD contractor shall be responsible for the repair of all damage to private and/or public property (at no expense to Authority). Repair work shall meet all local and state rules and requirements.

1.04 PROJECT SCHEDULE AND COOPERATION

A. The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, and eight hours per day or four days per week, single shift, ten hours per day. Unless approved otherwise by Authority, normal or general items of work, such

as bacteriological testing, leakage and pressure testing, density testing and final inspections, shall be scheduled during the normal work schedule.

1.05 WARRANTY

A. The contractor shall supply to Authority a two (2 year unconditional warranty. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

1.06 REFERENCED STANDARDS

A. The work shall conform to applicable provisions of the Authority's Water and Sewer Standards, and the following standards, latest editions, except as modified herein.

American Water Works Association (AWWA) Standards:

AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution American Society for Testing and Materials (ASTM) Standards.
ASTM D618	Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing.
ASTM D638	Standard Test Method for Tensile Properties of Plastics.
ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D1248	Standard Specifications for Polyethylene Plastics Molding and Extrusion Materials.
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Techniqu.
ASTM D1598	Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
ASTM D1599	Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
ASTM D1603	Standard Test Method for Carbon Black in Olefin Plastics.
ASTM D2122	Standard Method of Determining Dimensions of Thermoplastics Pipe and Fittings.

ASTM D2290	Standard Test Method for Apparent Tensile Strength or Tubular Plastics and Reinforced Plastics by Split Disk Method.
ASTM D2683	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipig and Tubing.
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM D2839	Standard Practice for Use of a Melt-Index Strand for Determining Density of Polyethylene.
ASTM D3035	Standard Specification for Polyethylene (PE) Plast Pipe (SDR-PR) Based on Controlled Outside Diameter.
ASTM E3261	Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
ASTM D3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
ASTM D4218	Standard Test Method for Determinatio of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
ASTM F412	Standard Terminology Relating to Plastic Piping Systems.

1.07 PERMITS

A. Permits for all work within the DOT, local county rights-of-way shall be obtained by the Developer. The Contractor shall verify the existence of all permits before commencing any work on the project.

1.08 SUBMITTALS

A. Contractor shall provide an example of similar successful project experience. Minimum requirements are 8" outside diameter, HDPE pipe, and 600 LF single pull. Provide project contact name, title, telephone number, mailing address, email address, etc. for whom the successful project was performed.

B. Contractor shall provide calculations (in accordance with ASTM F 1962 or equal) for pull back force required and the resulting rig size proposed for this project.

C. Contractor shall provide calculations demonstrating that the pipe will not be overstressed.

D. Contractor shall verify that the information and calculations presented herein will be fully incorporated into the work plan.

E. Contractor shall identify which, if any, items of the basis of design that the Contractor proposes to change (entry/exit angles, depth, radius, etc.). These changes shall be reflected in the calculations and information required in these evaluation criteria.

F. Work Plan: Prior to beginning work, the Contractor must submit to the Authority, a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the vent that an individual is unavailable), list of sub-contractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and a contingency plan. The work plan should e comprehensive, realistic and based on actual working conditions for this particular project. Plan should document the thoughtful planning required to successfully complete the project. The HDD contractor shall submit and obtain Authority's approval of a pre-construction bore-log depicting a plan ad profile (horizontal and vertical alignment) of the proposed bore path. The bore-log shall show all utility corssings and existing structures. All deviations from the drawings included in the contract documents shall be clearly identified. The work plan shall specifically address the following potential problems:
    1. A Frac-Out and Surface Spill Contingency Plan
    2. Loss of Returns
    3. Obstructions along bore path during reaming or pullback
    4. Drill pipe or product pipe cannot be advanced
    5. Deviations from design line and grade exceed allowable tolerances
    6. Drill pipe or product pipe broken off in borehole
    7. Collapse or product pipe or excessive deformation
    8. Damage to a utility
    9. Excessive subsidence or heave

G. Calculations – The following calculations shall be submitted prior to beginning any HDD work:
    1. Pullback load calculation
    2. Pipe stress calculation

3. Contractor shall confirm that the design parameters do not result in installation stresses that exceed allowable pipe stress.

H. Existing Utilities – Provide a plan to locate and protect all adjacent utilities and infrastructure.

I. Record Drawing:
   1. Submit for the Authority's approval, the record drawing to the Authority within te days after completing the pull back for review and approval. The drawings (24 x 36 (min.), 20 horizontal max scale with 2 foot vertical max scale) shall include a plan, profile (data every 25 LF of main, at a minimum), and all information recorded during the progress of the work. The entry and exit points shall be located with GPS coordinates based on an Alabama State Plane reference system (lat/long, state plane coordinates, etc.). The HDD contractor shall certify the accuracy of all record drawings.

1.09 NOTIFICATION

A. The Authority must be notified 48 hours (minimum) in advance of starting the drilling work. The HDD work shall not begin until the proper preparations (see work plan) for the operation have been completed and approved.

1.10 SITE PREPARATION

A. Protection of Existing Utilities – Contractor shall abide by the Common Ground Alliance, Best Practices Version 1.0 or latest, unless exceptions are specifically agreed to by Authority. Also, the Contractor shall coordinate utilities locates with the state one-call. Once the locate service has field marked all utilities, the Contractor shall verify each utility (including any service laterals, I.e. water, sewer, cable, gas, electric, phone, etc.) and those within each paved area. Verification may be performed utilizing Ground Penetrating Radar, hand dig, or vacuum excavation. Prior to initiating drilling, the Contractor shall record on the drawings both the horizontal and vertical location of the utilities off of a predetermined baseline. The Contractor shall manage and control drilling practices to prevent damage to existing utilities. The Contractor shall be responsible for all losses and repairs as a result of damage to underground utilities resulting from drilling operations. The Contractor shall make a reasonable effort to locate evidence of any other potential subsurface obstructions such as piles or piers.

B. Work site shall be graded and filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

C. Following drilling operations, Contractor will de-mobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to 90% of original density (at a minimum), or as otherwise specified.

1.11 UTILITY LOCATING

A. The Contractor shall be responsible for following the procedures in this specification to identify, locate, and verify the presence of existing utilities along the route of the proposed pipeline or work areas.

B. Utility Locating will be performed in three parts: identification, designating, and verification.
   1. Utility Identification – Identify the presence of underground utilities through One Call and visual observation of surface markers or other indicators such as manholes, valve boxes, fire hydrants, etc.
   2. Utility Designation – Marking the location of underground utilities with paint or flags based on utility owner information or third party locating equipment.
   3. Utility Verification – Verification of Utility Identification and Designation by excavation or other methods to determine the horizontal and vertical location of the underground utility. This also provides the size and material of the underground utility. Approved methods to accomplish this task include vacuum excavation, potholing, and test holes with traditional equipment (backhoes, etc.).

C. The Contractor shall record the location (horizontal and vertical) of all known utilities, as defined within this specification, on the construction plans. At a minimum, utilities shall be located by station and offset from the project baseline or with state plane coordinates. Vertical location can be based on depth from existing grade or elevation using the project vertical datum.

1.12 ENVIRONMENTAL PROTECTION

A. Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection

by contract documents, state, federal and local regulations. Contractor shall place hay bales, or approved protection, to limit intrusion upon project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations stated in local, state and federal permits.

1.13 SAFETY

A. Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

1.14 PERSONNEL QUALIFICATIONS CERTIFICATION

A. Directional Drilling: All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. (Each person must have been fully trained for over 1,000 hours on all facets of directional drilling, including, but not limited to machine operations, mud mixing, locating, and material fusion.) A responsible representative who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual HDD operation. The Contractor shall have a sufficient number of competent workers on the job at all times to insure the HDD work is made in a timely and satisfactory manner.

B. Pipe and Fitting Jointing: Joints between plain end pipes and pipe fittings shall be made by butt fusion when possible. The on-site welder making the joints shall have received specific training from the manufacturer of the fitting and/or pipe being welded and shall have written proof of proper training/certification from the associated manufacturers. Only certified welders who have written training certifications from the fitting and/or pipe manufacturer will be allowed to perform this work. That is, to weld a fitting in place, the on-site welder (employee) must be trained and certified by the fitting manufacturer. To butt weld pipe, the on-site welder (employee) must be trained and certified by the pipe manufacturer. The fusion work shall be accomplished (welding and cool-down/closing times) in accordance with the fitting ad pipe manufacturers' recommendations, at a minimum. External and internal beads shall not be removed unless approved by Authority.

PART 2 – MATERIALS

2.01 Refer to Section 3.02 for force main technical specifications.

PART 3 – INSTALLATION

3.01 EQUIPMENT REQUIREMENTS

A. GENERAL: The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the pilot hole, reaming, and pullback the pipe; a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the drill; a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used; a guidance system to accurately guide boring operations; a vacuum truck of sufficient capacity to handle the drilling fluid volume; and trained, competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. DRILLING SYSTEM
   1. Drilling Rig: The directional drilling machine shall consist of a power system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The power system shall be self-contained with sufficient pressure and volume to power drilling operations. The hydraulic system shall be free of leaks. The rig shall have a system to monitor maximum pull-back force during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current form the drilling string and an audible alarm which automatically sounds when an electrical current is detected.
   2. Drill Head: The drillhead shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
   3. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.
   4. Drill Pipe: Shall be constructed of high quality heat-treated, forged alloy steel.

C. GUIDANCE SYSTEM:
   1. The position of the drill head shall be continuously tracked and recorded by a 'walkover' tracking locator system between the entry

point and the exit point. The guidance system shall be capable of tracking at all depths up to forty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate to +/- 2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within 1.5 meters horizontally.

2. The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.
3. Bore Tracking and Monitoring: At all times during the pilot bore the Contractor shall provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. The Contractor shall record these data at least once per drill pipe length or every twenty-five (25) feet, whichever is most frequent.
4. Downhole and Surface Grid Tracking System: Contractor shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark. The data shall be continuously monitored and recorded at least once per drill pipe-length or at twenty-five (25) feet, whichever is more frequent.
5. Deviations between the recorded and design bore path shall be calculated ad reported on the daily log. If the deviations exceed plus or minus 5 feet (horizontal or vertical deviation) from the design path, such occurrences shall be reported immediately to the Authority. The Contractor shall undertake all reasonable and necessary measures to correct deviations and return to design line and grade.

D. DRILING FLUID (MUD) SYSTEM and pressure monitoring system:
1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.
2. Drilling Fluid Pressures and Flow Rates: Drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. The pressures shall be monitored at the pump. These measurements shall be made during pilot bore drilling, reaming, and pullback operations.

3. Drilling Fluids: Drilling fluid shall be composed of clean water, appropriate additives and clay. Water shall be from an authorized source with a minimum pH of 6.0. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No potentially hazardous material may be used in drilling fluid.
4. Delivery System: The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.
5. Drilling Fluid Recycling System: Control of Drilling Fluids: The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid re-usable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal. The Contractor shall follow all requirements of the Frac-Out and Surface Spill Contingency Plan as submitted ad approved and shall control operational pressures, drilling fluid weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spills. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. The Contractor shall maintain on-site mobile spoil removal equipment during all drilling, pre-reaming, reaming and pullback operations and shall be capable of quickly removing spoils. The Contractor shall immediately notify Owner of any inadvertent returns or spills and immediately contain and clean up the return or spill.

E. OTHER EQUIPMENT:
1. Pipe Rollers: Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.
2. Pipe Rammers: Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of the Owner's Representative.
    a. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those defined above

in the preceding sections shall not be used unless approved by the OWNER Representative prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the projects.

3.02 DRILLING PROCEDURES

A. Drill Path: Prior to drilling, Contractor shall utilize all verified locate information to determine drill pathway. Marked up drawings (see Site Preparation paragraph) shall be on site at all times, and referred to during the drill operation.

B. Drilling fluid pressures and flow rates: Drilling fluid pressures and flow rates shall be continuously monitored and recorded.

C. Subsidence and Heave: Subsidence or heave of utilities, roads, or other features above the HDD centerlines and within the zone influenced by the HDD construction shall be limited to values that avoid damage. These values shall be determined by the utility or right-of-way owner. The Contractor shall repair any damage resulting from settlement or heave caused by HDD activities. The Contractor shall grout any voids caused by or encountered during drilling.

D. Pilot Hole: The pilot hole shall be drilled along the path shown on the plans and profile drawings or as directed by the Authority in the field. Unless approved otherwise by Authority, the pilot-hole tolerances shall be as follows:
   1. Elevation: As shown on the plans.
   2. Alignment: ±5 feet and within 3 feet of right-of-way or easement boundary.
   3. Curve Radius: The pilot hole radius shall be no less than 150% of the minimum bending radius as recommended by the pipe manufacturer of the pipe being installed.
   4. Entry Point Location: The exact pilot hole entry point shall be within ±5 feet of the location shown on the drawing or as directed by the Owner's Representative in the field.
   5. Exit Point Location: The exit point location shall be within ±5 feet of the location shown on the drawing.

6. Water Main and Non-Water Main Separation Requirements: The minimum separation requirements between water main and a non-water main shall be as defined in ADEM Design Criteria.

E. Pull Back: After successfully reaming bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor will not apply more than the maximum safe pipe pull pressure at any time. Maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safe pull (or tensile) strength.
   1. Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.
   2. The pullback section of the pipeline shall be supported during pullback operations so that it moves freely and the pipe is not damaged.
   3. External pressure shall be minimized during installation of the pullback section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost ot the Owner.
   4. Locate wire shall be attached to the leading end of the pipe pulling head and shall extend the full length of the installed pipe.
   5. Buoyancy modification shall be at the discretion of the Contractor and shall be approved by the Owner's Representative. The Contractor shall be responsible for any damage to the pull section resulting from such modifications.
   6. In the event that pipe becomes stuck, Contractor will implement the submitted and approved contingency plan. If pipe remains stuck, Contractor will notify Owner Representative. The Owner's Representative and Contractor will discuss options and then work will proceed accordingly.
   7. The Contractor shall cease operations if the pipe is damaged and shall remove the pipe from the bore hole and repair the pipe using the manufacturer's recommended procedure or replace the damaged pipe before resuming installation.

END OF SECTION

SECTION 2.21

PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The work specified by this section shall consist of repairing or replacing all damaged pavement disturbed by utility construction. Dirt shoulders, roads, streets, drives, and walks shall be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the pavement replacement schedule.

B. Both these specifications and the drawings make reference to the current edition of the standard specifications of the Alabama Department of Transportation (ALDOT). Even though the weather limitations, construction methods, and materials specifications contained in the ALDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the ALDOT specifications shall not be considered applicable.

C. All pavement repair shall be in accordance with the requirements of the Limestone County Engineer's office or the Alabama Department of Transportation where applicable.

PART 2 – PRODUCTS

2.01 MATERIALS

A. MINERAL AGGREGATE BASE: crushed stone (ALDOT specifications, Section 825)

B. BITUMINOUS PRIME COATS: Cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (ALDOT Specifications- Section 401.02 and 804)

C. CRUSHED STONE CHIPS: Size 6 or Size 7 (ALDOT Specifications – Section 801)

D. DOUBLE BITUMINOUS SURFACE: for both courses, either cutback asphalt, Grade RC-800, or RC-3000, or emulsified asphalt, Grade CRS-2 (ALDOT Specifications- Section 401.02 and 804)

E. BITUMIOUS CONCRETE BINDER: Grading AC-20 or AC-30, as directed by the Engineer (ALDOT Specifications- Section 414).

F. BITUMINOUS TACK COAT: Emulsified asphalt or asphalt cement (ALDOT Specifications - –Section 405).

G. WEARING CONCRETE SURFACE: Asphalt Cement, Grade AC-20 or AC-30 (ALDOT Specifications – Section 416)

PART 3 - EXECUTION

3.01 TEMPORARY PAVEMENT REPAIR

A. Road surfaces shall be temporarily restored by placing a layer of crushed stone or cold mix material.

B. Temporary pavement repair shall be maintained in a safe condition until a permanent repair is made.

3.02 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 95% of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of two (2) to three (3) miles per hour over the entire surface. Make further improvements on all areas that show a deflection of one (1) inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of one (1) foot beyond the limit of the joint

between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.02 BASE

A. Install a mineral aggregate base of the type specified above. The maximum compacted thickness of any one layer shall be six (6) inches and total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.03 SEAL COAT SURFACE

A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds per square yard.

3.04 DOUBLE BITUMINOUS SURFACE

A. Apply the first course at a rate of 0.38 to 0.42 gallon per square yard with either emulsified asphalt, Grade RS-2, or cutback asphalt, Grade RC-800 or RC-3000, and then immediately cover the Size 6 crushed stone chips at a rate of 33 to 37 pounds per square yard. After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallon per square yard, and at once uniformly cover the Size 7 chips at a rate of 20 to 25 pounds per square yard. Then roll the entire area.

B. After the application of the cover aggregate, lightly broom or otherwise maintain the surface for a period of four (4) days. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface with rotary brooms.

3.05 ASPHALTIC CONCRETE BINDER

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material splashing on exposed faces of curbs and gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime coat has been properly

cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.06 ASPHALTIC CONCRETE SURFACE

A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallon per square yard.

Take care to prevent the bituminous material splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown of the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.07 SMOOTHNESS

A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge shall be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.08 PAVEMENT STRIPING

A. All disturbed pavement markings shall be replaced to match existing striping.

3.09 ACCEPTANCE

A. Contractor shall obtain approval of the Limestone County Engineer for all repairs to County Roads, and the Alabama Department of Transportation for all repairs to State Roads.

END OF SECTION

SECTION 2.22

CHAIN LINK FENCING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fencing and all accessories shall be produced by a single manufacturer. Submit 2 copies of the manufacturer's technical data and installation instructions. **Color of all materials related to fencing shall be black.**

PART 2 – PRODUCTS

2.01 POSTS, RAILS AND BRACES

A. All tubular members shall comply with the provisions of ASTM F1083, Schedule 40 Steel Pipe. All steel parts shall be hot-dipped galvanized as per ASTM, prior to vinyl coating. Thickness of vinyl coating shall be 10-14 mils applied by fusion bonding.

C. End, Corner, and Pull Post: For fence up to and including 12'-0" in height, (2.875 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 381 pounds.)

D. Line Posts: (10'-0" maximum spacing): Fabric over 8'-0" height: (2.375 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 201 pounds).

E. Gate Posts: Gate leaves up to and including 6'-0" wide: (2.875 inches outside diameter, Schedule 40 pipe).

F. Top Rail: (1.660 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 202 pounds).

1. Furnish in the manufacturer's standard lengths of approximately 21'-0" with couplings approximately 6 inches long for each joint. One coupling in five shall have an expansion spring. Provide means for attaching top rails securely to each gate, corner, pull and end posts. The top rail shall form a continuous brace from end to each run of fence.

G. Tension Wire: A vinyl-coated heavy duty, seven (7) gauge coiled spring tension wire shall be provided along the bottom of fabric.

H. Post Bracing Assembly: To match top rail. Brace rail assembly shall be complete with a 3/8" diameter rod and adjustable take-up.

2.02 CHAIN LINK FABRIC

A. The fabric shall consist of one piece fabric widths for fences up to 12'-0"; 2" mesh, 9 gauge.

B. Selvage Edges: Fabric in heights 60" and less shall be knuckled at both selvages. Fabric 72" and more shall be knuckled at the bottom and shall be twisted and barbed at the top.

C. Finishes: Heavy galvanized, 2.0 ounces of zinc per square foot, complying with ASTM A392, Class II vinyl clad, black in color.

2.03 ACCESSORIES

A. All accessories, except tie wire and barbed wire shall be vinyl coated.

B. Post Tops: Pressed steel or malleable iron (designed as a weathertight closure cap for tubular posts). Where top rail is used, provide tops to permit the passage of the top rail.

C. Stretcher Bars (for tubular end, corner, pull or gate posts only): One piece lengths equal to the full height of the fabric, with a minimum cross section of 3/16" x ¾". Provide one stretcher bar for each gate and end post and two for each corner and pull post.

D. Stretcher Bar Bands: Heavy pressed steel spaced not over 15" on center to secure stretcher bars to tubular end, corner pull and gate posts.

E. Wire Ties: For tying fabric to line posts, use a minimum 9 gauge aluminum wire ties for tubular posts spaced 14" on center. For tying fabric to rails and braces, use 9 gauge aluminum wire ties spaced 24" on center. For tying fabric to tension wire, use 11 gauge hog rings spaced 24" on center.

2.04 GATES

A. Fabricate gate perimeter frames of 1.90" outside diameter tubular members with vinyl coating. Provide additional horizontal and vertical members to insure proper gate operation and to allow for attachment of fabric, hardware and accessories.

B. Assemble gate frames by welding for rigid connections. Use same fabric as for fence. Install fabric with a stretcher bars at vertical edges, and tie at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" on center. Attach hardware with rivets or other means that will provide security against removal or breakage.

C. Provide diagonal cross bracing that consists of 3/8" diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.

D. Gate Hardware: Provide the following hardware and accessories with a vinyl coating, for each gate. Movable fittings shall be field coated with a vinyl coating specially prepared for this purpose.

1. Hinges: Pressed steel or malleable iron to suit gate size, non-liftoff type, offset to permit 180 degree gate opening. Provide one pair of hinges for each leaf.
2. Latch: Forked type or plunger bar type to permit operation from either side of the gate. Provide padlock eye as an integral part of the latch.
3. Keeper: Provide a keeper for all vehicle gates that automatically engages the gate leaf and holds it in the open positions until manually released.
4. Double gates: Provide gate stops for all double gates consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, with one padlock for locking both gate leaves.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set all posts in a 3,000 psi concrete footing. Trowel smooth the top of the footing at a 20 degree angle from the post to the surrounding ground so as to prevent water from ponding around the post. The post shall extend to the full depth of the footing. The depth of the footing shall be a minimum of 24 inches.

B. Install end or corner posts at any break in the alignment greater than 20 degrees. Install intermediate posts between end or corner post, spaced equally at a maximum of 10 foot center to center. Install end, corner, or gate posts on both sides of a gate. Only one end or corner post shall be installed at the junction of different heights of fence and shall be consistent

with the largest post required at the junction. Install gates to allow a clear and level swing in either direction to their maximum limit. Set all posts with a vertical tolerance of less than 1″ in 10′ as measured with a plumb bob.

C. All corner, terminal and gate posts for fence 6 feet and higher shall have a midrail and 3/8″ round adjustable truss rod to the next post.

D. All gates shall have a full wraparound hinge system with a positive latch with provision for a padlock.

E. All fences shall have a bottom tension wire attached to the fabric and posts.

END OF SECTION

SECTION 3.01

SANITARY SEWERS (GRAVITY)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Pipe material for gravity sewer lines shall be as shown on the drawings.

B. All contractors installing water or sewer infrastructure in any way related to the distribution of collections systems of the Authority, must be a licensed General Contractor in the State of Alabama. This license must also declare a major classification of Municipal and Utility (MU) and/or Municipal and Utility Specialty (MU-S). Work performed by any person or company not possessing the proper license will not be accepted into service for the water distribution and sewer collection system.

C. Lateral Branches: Service lines shall have a four (4)-inch inside diameter for residential service and six (6)-inch inside diameter for commercial/industrial services unless otherwise specified or noted. Service branches and laterals must be able to withstand all test pressures involved without leakage. Service lines shall be PVC Schedule 40 with solvent weld fittings where PVC sewer lines are used. Service lines shall be DIP CL 350 with epoxy lining where DIP sewer lines are used. Tees shall be constructed of the same material as the main sewer line and gasketed. PVC sewer tees shall be configured to accept PVC SDR 26 for the main sewer line and Schedule 40 PVC for the branch sewer service line in 4-inch service line. For 6-inch service line, the tee shall accept SDR 26 pipe and then the service pipe shall be transitioned to Schedule 40 PVC using an appropriate transition piece.

1.02 OTHER APPLICABLE SECTIONS

A. Section 2.14 - Trenching, Backfilling and Compaction for Utilities
B. Section 2.15 - Unclassified Excavation for Utilities
C. Section 3.03 – Manholes & Wet Wells
D. Section 3.02 – Sewage Force Main
E. Section 3.04 – Cementitious Waterproofing for Manholes
F. Section 3.05 – Sewage Valves
G. Section 3.06 – Sewage Flow Control

PART 2 - PRODUCTS

2.01 PVC PIPE

A. Polyvinyl Chloride (PVC) 4" – 15":
To meet and/or exceed the requirements of ASTM D3034, SDR 26; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard lengths of 20-feet and 12.5-feet plus or minus one (1) inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); six (6) inch long sections of pipe to be subjected to impact from a free falling top (20 pounds, Type A) in accordance with ASTM D2444 with no evident splitting or shattering (denting not considered a failure). Joints shall meet the requirements of ASTM D3212. Joint design shall be tested and certified to result in no leakage under prescribed laboratory test conditions of joint alignment, load conditions, pressure and vacuum, and deflection. Pipe and fittings shall have integral bell with elastomeric seal joint.

B. For PVC pipe, pipe manufacturer shall furnish a certificate indicating that the pipe meets all applicable requirements of these specifications. If requested by the Engineer, the Contractor shall provide copies of the actual tests performed as outlined in other paragraphs of this section.

C. The minimum pipe stiffness for PVC pipe at five percent (5%) deflection shall be 46 for all sizes when tested in accordance with ASTM D2412; external loading properties of plastic pipe shall be by parallel plate loading.

D. A specimen of PVC pipe six (6) inches long shall be flattened between parallel plates in a suitable press until the distance between the plates is 40% of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete in two (2) to five (5) minutes.

E. After being immersed for two (2) hours in a sealed container of anhydrous acetone (99.5% pure), a sample ring of PVC pipe shall show no visible spalling or cracking when tested in accordance with ASTM D2152 (swelling or softening is not considered a failure).

F. Polyvinyl Chloride (PVC Schedule 40) 4"-6" for Service Laterals and fittings shall be manufactured from a Type I, Grade PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and ASTM D2665,

consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality. Schedule 40 pipe systems shall be assembled using solvent weld joints. Solvent cements for Schedule 40 PVC pipe and fittings shall conform to the requirements of ASTM D2564.

2.02 DUCTILE IRON PIPE

A. Ductile Iron: with push-on joints conforming to ASTM A746, Class 350 unless otherwise shown on the drawings.

B. Ductile Iron Pipe Joints: Gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with the applicable provisions of ANSI A21.11.

C. Ductile Iron pipe shall be lined with an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

1. A permeability rating of 0.00 when test according to Method A of ASTM E96, Procedure A with a test duration of 30 days.
2. The following test must be run on coupons from factory lined ductile iron pipe:
    a. ASTM B117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two year.
    b. ASTM G95 Cathodic Disbondment 1.5 volts @ 77^0F. Results to equal no more than 0.5mm undercutting after 30 days.
    c. Immersion Testing rated using ASTM D714.
        i. 20% Sulfuric Acid – No effect after 2 years.
        ii. 25% Sodium Hydroxide – No effect after 2 years.
        iii. 160^0F Distilled Water – No effect after 2 years.
        iv. 120^0F Tap Water (scribed panel) – 0.0 undercutting after 2 years with no effect.
3. An abrasion resistance of no more than 4 mils loss after one million cycles – European Standard EN 598: 1994 Section 7.8 Abrasion resistance.
4. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

5. Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease of any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.
6. After surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the ambient or substrate temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free.
7. Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The joint compound shall be applied by brush to ensure coverage. Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot shall be done after the application of the lining.
8. The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.
9. Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.
10. Inspection
    a. All ductile iron pipe and fittings shall be checked for the thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2, Film Thickness Rating.
    b. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2500 volt test. Any defect found shall be repaired prior to shipment.

c. Each pipe joint and fitting shall be marked with the date of application on that date and records maintained by the applicator.

11. The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

12 Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. Shall be placed inside the pipe or fittings for lifting, positioning of laying.

D. For ductile iron pipe, pipe manufacturer is to furnish Engineer a certificate of inspection, sworn to by the factory inspector in the presence of a notary public, stating that pieces of pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in shipment, length of each piece of pipe, and identification number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipment is to be listed opposite the identification number of each pipe length and attached to the certificate of inspection.

2.03 COMPRESSION COUPLINGS

A. Compression couplings may be used in transition of service laterals between the end of Authority service line and private service line (generally located at R.O.W.) The compression couplings shall be of natural or synthetic rubber or rubber-like material and shall comply with the requirements and test methods specified in Table 2 of ASTM C425. The coupling shall meet the leak requirements specified in ASTM C425, and the bands for attaching the couplings to the dissimilar pipes shall be of stainless steel meeting ASTM A167 or A240. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

B. Compression couplings will not be allowed in the new sewers (main line). Repairs shall be made with ductile iron mechanical joint sleeves or gasketed, PVC compression (knock-on) fittings.

PART 3 - EXECUTION

3.01 EXCAVATION FOR GRAVITY SEWERS

A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of sewer lines and their appurtenances (including manholes, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Engineer, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the Engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: (4/3)d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Owner, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula (4/3)d + 15 inches shall be at the expense of the Contractor and may be cause for the Engineer to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For all pipe, provide a minimum of 6-inches of No. 67 (ALDOT) crushed stone for bedding below the pipe.

E. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and not more than two hundred (200) feet of open ditch shall be left behind the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossing when and where the Engineer deems necessary to maintain vehicular or pedestrian traffic.

F. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

G. Refer to Section 2.15, Unclassified Excavation for Utilities, paragraph 3.06, for sheeting, shoring and bracing requirements.

3.02 PIPE LAYING

A. Lay no pipe except in the presence of an inspector representing the Authority.

B. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 2.15, Unclassified Excavation for Utilities.

C. Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the Engineer. Cradles shall be of concrete and conform to the dimensions shown on the drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.

D. Lasers must be used after the type and procedures are approved by the Engineer. When lasers are used, set reference points for both line and grade at each manhole. Where grades are 0.6% or less, check the elevation of the beam each 100 feet with an offset point or engineer's level.

E. Do not allow water to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to de-water.

F. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have started, bringing them to exact line and grade with crushed stone as necessary.

G. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.

H. Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out bell holes no more than two (2) joints ahead of

the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

I. Before constructing or placing any joints, demonstrate to the Authority, by completing at least one (1) sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar and experienced with the type of joint proposed.

J. No other type of joint may be used unless authorized in writing by the Authority.

L. Install tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid and at such other locations as may be designated by the Owner. If tee branches are not to be used immediately, close them with approved stoppers that are held in place to prevent infiltration and withstand all test requirements. Tees shall be of the same material as the main pipe. Tees shall be located at either 10 o'clock or 2 o'clock position when viewed upstream. No other positioning of tees will be permitted. Tees shall not be placed in back-to-back position. Tees installed consecutively in the sewer main shall be separated by at least 6-foot of main line pipe.

M. For all tees that are plugged and laid in rock, blast a minimum of six (6) linear feet of ditch line in the direction and to the approximate grade of the future lateral as directed by the Authority, but do not excavate the material. This shall be done at no extra cost to the Authority. Furnish the Authority with a record of the exact horizontal and vertical location of each tee installed. Distance shall be measured from the nearest downstream manhole. Length and depth of service lateral shall also be provided.

N. If the work consists of constructing a new sewer to replace an existing one, connect existing service lines to the new line.

O. New service laterals shall conform to the standard drawings.

P. As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior. Pipe shall be

temporarily plugged with a watertight plug at the conclusion of each day's work.

Q. After the joints have been completed, they shall be inspected, tested, and accepted by the Authority before being covered. The pipe shall meet the test requirements for watertightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe re-laid at the Contractor's expense. Carefully protect all pipe in-place from damage until backfilling operations are completed.

R. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the Authority.

S. Lay sewers at least five (5) feet horizontally from any existing or proposed water main. If this is not practical, the sewer may be laid closer than ten (10) feet to a water main provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.

T. Where a sewer crosses under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, relocate the water main to provide this separation, or else reconstruct it with mechanical joint ductile iron pipe for a distance of ten (10) feet on each side of the sewer with a full joint of the water main centered over the sewer.

U. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, construct both the water main and the sewer of mechanical joint ductile iron pipe, and pressure test each.

V. Make connections to all existing sewer lines as shown on the drawings or as directed by the Owner. Make connections either by removing a section of the sewer from the existing line and inserting a wye or tee branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the drawings.

W. Make connections to existing manholes or inlets by core drilling a hole in the wall of the existing structure, installing a resilient pipe connector, inserting a length of sewer pipe into the hole. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe.

X. Join dissimilar pipe by using suitable compression couplings on service laterals at property line/R.O.W./ edge of easements. Repairs or coupling of dissimilar pipe materials on main line sewers shall be accomplished by use of mechanical joint, long-pattern ductile iron sleeve and glands.

Y. Provide concrete protection or concrete cap as shown on the drawings for pipe sewers that, when completed, have less than 2.5-feet of cover in non-traffic areas and 4-feet of cover in traffic areas. Ductile iron pipe shall be used on all sewer applications with less than 4' of cover.

Z. Provide check dams downstream of creek crossings.

AA. Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other sections of these specifications or as required by the appropriate utility. Any such work shall be considered incidental to the construction of pipe sewers, and no additional payment will be allowed.

BB. Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Contractor at his own expense as an incidental part of the work.

3.03 BACKFILLING

A. For the PVC pipe, begin backfilling after the line construction is completed and then inspected and approved by the Engineer. On each side of the line from the a point measured 6-inches below the bottom of pipe to to 12 - inches above the top of the pipe the backfill material shall consists of No. 57 or 67 (ALDOT) stone. Place this backfill simultaneously on either side of pipe in even layers that before compaction are no more than 6-inches deep. Thoroughly and completely tamp each layer into place before placing additional layers.

B. For ductile iron pipe, begin backfilling after the line construction is complete and then inspected and approved by the Owner. On each side of the line, from the bottom of barrel to the crown of the pipe, the backfill material shall consist of No. 57 or 67 (ALDOT) stone. From the crown of the pipe to 1-foot above the crown the backfill material shall be selected backfill consisting of either fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone,

and/or other objectionable materials and that has a size of no more than 2-inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6-inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. If the excavation is in a rock trench, then the backfill from the crown of the pipe to a point 12-inches above the top of the pipe shall consist of No. 57 or 67 crushed stone.

C. From 12-inches above the pipe upward for PVC pipe and 1-foot above the pipe upward for ductile iron pipe, the backfill material may contain broken stones that make up approximately ¾ of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6-inches, and the backfill material shall be placed and spread in even layers not more than 12-inches deep.

D. At locations beneath or closely adjacent to pavement, inside roadways and traffic areas or at locations of improvements subject to damage by displacement, the backfill shall be entirely No. 57 or 67 stone to within 8-inches of the surface. The final 8-inches of backfill shall be crushed roadway base stone. Tamp and thoroughly compact the backfill in layers that before compaction are 6-inches deep.

E. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

F. If earth material for backfill is, in the opinion of the Owner, too dry to allow for thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Owner considers too wet or otherwise unsuitable.

G. Wherever excavation has been made within easements across private property, the top 1-foot of backfill material shall consist of fine loose earth free from large clods, vegetable matte, debris, stone, and/or other objectionable materials.

H. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 8-inches of the backfill. Maintain this

temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner.

I. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

J. Wherever pipes have diameters of 15-inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1-foot above the pipe.

K. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary.

L. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Owner requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

3.04 TESTING OF GRAVITY SEWERS

A. TELEVISION INSPECTION

1. Upon completion of the construction or earlier if the Authority deems advisable, the Contractor shall provide for a visual inspection of the sewer by use of remote television camera. Immediately repair all leaks and defects found by such inspection.

2. Prior to televising, Contractor shall thoroughly clean the pipelines of debris, grease, roots, sediment or other obstructions that could retard the movement of the television camera.

3. Immediately after cleaning, 100% of the line segments shall be visually inspected by means of closed-circuit television to verify cleaning results, the condition of the line and to locate existing service connections. The Contractor shall furnish the mobile television inspection studio, all television equipment and other necessary types of equipment, and all materials, electricity, labor, technicians, etc., as may be needed to perform the closed circuit television inspection of the new sewers for the purpose of documenting deficiencies and lateral locations prior to acceptance and placement in service of the

sewer. A recorded verbal narrative describing pipe conditions and lateral locations shall be placed on the video recording and coincide with the written comments on the videotape. No work is authorized under this Section unless the Authority's representative is present or has been notified 24 hours prior.

4. Sewer shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the flood water drains off so that no remaining puddle of water is deeper than ½ inch on 36 inches internal diameter or small and ¾ inch on pipe larger than 36 inch internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or re-laid at the Contractor's expense.

5. The contractor shall be held strictly responsible that all parts of the work bear the load of the backfill. If cracks 0.01 inch develop in the pipe within one (1) year from the date of final acceptance of the work, the Contractor shall be required to replace, at this expense all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer guaranteeing proper service of sewer pipe under local conditions established by the drawings, specification and local conditions at the site of the work.

6. Camera Requirements - The camera used for this inspection shall be color. The camera head shall be capable of at lest 340 degrees axial rotation and 270 degrees lateral swing. The camera shall operate under a minimum scene illumination of 3 lux with a horizontal resolution of no less than 460 lines. Sufficient lighting shall be provided on the camera so that videotapes will show images that are clear and well illuminated.

7. The internal inspection shall be performed in one section of sewer at a time between adjacent manholes. The inspection shall be performed by pulling the television camera on a skid or by transporting the camera with a mechanical transport device through the section of the sewer along the axis of the pipe. The camera shall travel in the direction of the flow or from the upstream manhole to the downstream manhole unless an obstruction in the pipe requires video taping upstream. The camera shall not pass through the sewer at a rate greater than ¾ ft/sec. The camera shall stop at each lateral and defect and rotate

so that the lateral or defect is seen from a perpendicular field of view. Each lateral and defect shall be extensively filmed.

8. The sewer main shall be clean prior to televising. If the main is new or recently rehabilitated, cleaning may not be necessary. The camera operator shall take necessary precautions to prevent "hanging" the camera in the sewer main. If the camera should get stuck in the main, the contractor will be responsible for removing the camera at his expense and making any above and below ground repairs. The Contractor shall exhaust all other means to retrieve the camera before excavating. A representative of the Authority must be notified before excavation takes place. The distance measured to defects and lateral shall be referenced to the center of the beginning manhole. Measurements to defects and laterals shall be accurate to within +/-1 foot.

B. Documentation

1. The Contractor shall keep a daily log or record covering the television inspection work and the information acquired there from. This daily log or record shall contain at least the following data:

   a. Date and Time of Inspection

   b. Contract Name and Number

   c. Name of Contractor

   d. Name of Internal Video Inspection Company (if different from Contractor)

   e. Name of Street

   f. Identification Number of Upstream and Downstream Manholes based on Authority numbering system.

   g. Description of the Location

   h. Direction of the Video

   i. Size, Length, Depth, and Type of Pipe

j. Size, Depth, and Material of Manholes

k. Distance, Position on Periphery of Pipe in Clock Orientation, Type, and Description of all Laterals and Defects

l. Computer generated diagram of pipe and manholes which graphically provides information in "k" and "l" above.

m. An Index of Video System Codes and Abbreviations

2. Two copies of log or record with the diagrams and index, typed and bound, shall be delivered to the Authority.

3. The purpose of the video recordings shall be to supply a continuous visual and audio record of the inspection using a DVD system. The Contractor shall fill each DVD as much as practical to minimize the number of DVD's. All sections of runs shall be recorded on one DVD. In no event, shall a segment be divided between two DVD's. Pipe runs shall be grouped in areas and submitted in sequential order relating to the area designation.

4. Video recordings shall be enclosed in vinyl plastic containers, which shall clearly indicate the date the video was taken, the street and the designated section(s) of sewer line(s) contained on the video, the name of the project, the name of the Contractor and the index number of the video. The index number shall indicate the sequential number of the DVD out of the total number of DVD's for the project, i.e. 2 of 5.

5. Warranty: The Contractor warrants the accuracy and completeness of the DVD for a period of two years. If the Authority determines that the video does not meet the requirements as identified herein, the Contractor shall re-video the line segments for which the reporting was faulty. There shall be no discrepancies between the video and the written report.

6. A copy of any software required to view the DVD shall be provided to the Authority at no additional charge.

C. AIR TESTING

1. Perform low pressure air testing as follows:

a. Furnish all equipment, facilities, and personnel necessary to conduct the test. The test shall be observed by a representative of the Engineer.

b. Make the air test after all services have been installed and backfilling has been completed and compacted.

c. Perform the first series of air tests after 1,000 linear feet but before 2,000 linear feet of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the Engineer that the materials and methods of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 2,000 linear feet has been laid.

d. Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

e. Prior to testing, check the pipe to see that it is clean. If not, clean it by passing a full gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe cleaned.

f. Immediately following this check or cleaning, test the pipe installation with low pressure air. Supply the air slowly to the plugged pipe installation until the internal air pressure reaches 4.0 psi more than the average back pressure of any ground water that may submerge the pipe. Allow at least two (2) minutes for temperature stabilization. For air pressure correction due to groundwater, divide the average height of groundwater above the crown of pipe by 2.31 and add the result to 3.5 psig. The allowable drop in pressure is not changed by the additional air pressure correction. In no case should the starting test pressure exceed 9.0 psig.

g. The pipeline shall be considered acceptable if the time shown in Table 1 for the designated pipe size and length, elapses before the air pressure drops 0.5 psig; then the section undergoing test shall have passed and shall be presumed free of defects. The test may be discontinued once

the prescribed time has elapsed even though the 0.5 psig loss has not occurred.

h. The pipeline shall be considered as unacceptable if the pressure drops 0.5 psig before the appropriate time shown in Table 1 has elapsed. If the test fails, the Contractor at his own expense shall determine the source(s) of failure and shall repair or replace all defective materials and/or workmanship to the satisfaction of the Engineer.

Table 1 – Minimum Specified Time Required for a 0.5 PSIG Pressure Drop

Pipe Diameter (inches)	Min. Test Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Minimum Test Time (min:sec) for Specific Length (L)						
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24

2. Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug, which can become a high velocity projectile. Locate gauges, air piping manifolds, and valves at the top of the ground. No one shall be permitted to enter a manhole where a plugged pipe is under pressure. Four (4) pounds per square inch air pressure (gauge) develops a force against the plug in a 12 inch pipe of approximately 450 pounds. Pipes more than 30 inches in diameter shall not be air tested because of the difficulty of adequately blocking the plugs. Provide a safety release device set to release at ten (10) psi between the air supply and the sewer under test.

3. All new pipe including new services will be required to be air tested. If existing sewage flow has been restored, temporary flow control will be required while air testing is performed. New services will be plugged at the curbside cleanout and tested at the same time as the main sewer line. Length of service lines can be ignored in the determination of line lengths noted in Table 1.

D. REPAIRS

1. Regardless of the outcome of any tests, repair any noticeable leak.

3.05 CLEANUP

A. After completing each section of the sewer line, remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire area in a clean, neat, and serviceable condition.

END OF SECTION

SECTION 3.02

SEWAGE FORCE MAIN

PART 1 – GENERAL

1.01 Wherever reaction blocking is necessary, it shall be considered an integral part of the force main work.

1.02 All contractors installing water or sewer infrastructure in any way related to the distribution of collections systems of the Authority, must be a licensed General Contractor in the State of Alabama. This license must also declare a major classification of Municipal and Utility (MU) and/or Municipal and Utility Specialty (MU-S). Work performed by any person or company not possessing the proper license will not be accepted into service for the water distribution and sewer collection system.

1.03 Refer to other sections for work related to that specified by this section. Coordinate this work with that required by other sections.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile Iron: with push-on joints conforming to ASTM A746, Class 350.

B. Ductile Iron Pipe Joints: Gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with the applicable provisions of ANSI A21.11.

C. Ductile Iron pipe shall be lined with an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.

1. A permeability rating of 0.00 when test according to Method A of ASTM E96, Procedure A with a test duration of 30 days.
2. The following test must be run on coupons from factory lined ductile iron pipe:
    a. ASTM B117 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two year.

b. ASTM G95 Cathodic Disbondment 1.5 volts @ 77^{0}F. Results to equal no more than 0.5mm undercutting after 30 days.

c. Immersion Testing rated using ASTM D714.
   i. 20% Sulfuric Acid – No effect after 2 years.
   ii. 25% Sodium Hydroxide – No effect after 2 years.
   iii. 160^{0}F Distilled Water – No effect after 2 years.
   iv. 120^{0}F Tap Water (scribed panel) – 0.0 undercutting after 2 years with no effect.

3. An abrasion resistance of no more than 4 mils loss after one million cycles – European Standard EN 598: 1994 Section 7.8 Abrasion resistance.
4. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.
5. Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease of any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.
6. After surface preparation and within 8 hours of surface preparation, the interior of the pipe shall receive 40 mils nominal dry film thickness of Protecto 401. No lining shall take place when the ambient or substrate temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free.
7. Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The joint compound shall be applied by brush to ensure coverage. Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot shall be done after the application of the lining.

8. The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoatable with itself without roughening of the surface.
9. Protecto Joint Compound shall be used for touch-up or repair in accordance with manufacturer's recommendations.
10. Inspection
    a. All ductile iron pipe and fittings shall be checked for the thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2, Film Thickness Rating.
    b. The interior lining of all pipe barrels and fittings shall be tested for pinholes with a non-destructive 2500 volt test. Any defect found shall be repaired prior to shipment.
    c. Each pipe joint and fitting shall be marked with the date of application on that date and records maintained by the applicator.
11. The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.
12 Protecto 401 lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. Shall be placed inside the pipe or fittings for lifting, positioning of laying.

D. For ductile iron pipe, pipe manufacturer is to furnish Engineer a certificate of inspection, sworn to by the factory inspector in the presence of a notary public, stating that pieces of pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in shipment, length of each piece of pipe, and identification number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipment is to be listed opposite the identification number of each pipe length and attached to the certificate of inspection.

E. Standard and special fittings shall be ductile iron. Use compact mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.10/AWWA C153. All fittings for sewage application shall be epoxy-lined with Protecto 401 as specified above.

2.02 PVC PIPE

A. All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

B. PVC pipe used to transport sewage shall be green in color.

C. All Class 200, 250, or 315 pipe shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each size and type of piping being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.
2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling , cracking, or visible deterioration on the inside or outside surface after completion of the test.
3. Quick Burst Test: once per 24 hours in accordance with ASTM D1599.

SDR	Pressure Rating	Minimum Bursting Pressure, psi
21	200	800

4. Impact Tests: For six (6) inches and larger, once per shift in accordance with ASTM D2444; for four (4) inches and smaller, once each two (2) hours in accordance with ASTM D2444.
5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.
6. Bell Dimension Test: once per hour in accordance with ASTM D3139.

D. If any specimen fails to meet any of the above mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

E. Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimension, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

F. All pipe shall be manufactured in the United States of America. All pipe for any one project shall be made by the same manufacturer.

G. All four (4) inches and six (6) inches pipe may be furnished in the manufacturer's standard laying lengths of 20 feet, 38 feet, or 40 feet. Pipe eight (8) inches and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the Engineer. All pipe shall be supported within five (5) feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed routes shall not be allowed in advance of more than one (1) day.

H. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:
   1. Nominal size
   2. Type of material
   3. SDR or class
   4. Manufacturer
   5. NSF Seal of Approval
   6. Color of pipe shall be green

I. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

J. The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. Gasket materials shall meet the requirements of ASTM F477. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular

groove shall be designed and shaped so that when the joint is assembled, the gasket will be radically compressed to the pipe and locked in place against displacement, thus forming a positive seal.

K. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced wit a temperature shift of at least 75 degrees F.

L. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support or promote any bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

M. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

N. Standard and special fittings shall be ductile iron. Use compact mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.53/AWWA C153. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

O. All fittings for sewage application shall be epoxy lined with Protecto 401 as described in Paragraph 2.01.D.

P. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

2.03 HDPE PIPE

A. Pipe: Pipe shall be DR -17 where pipe is installed in open-cut applications or DR – 11 where pipe is installed by HDD applications. Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-02 with a minimum cell classification of PE345464C. Pipe O.D. sizes 4" to 24" shall be ductile iron pipe sizes (DIPS). Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects. All pipe shall feature a green stripe on the external surface of the pipe to identify it as sewer pipe.

B. Fittings:

1. Butt Fusion Fittings: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
2. Electrofusion Fittings: Electrofusion fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02 and be the same base resin as the pipe. Electrofusion fittings shall have a manufacturing standard of ASTM F1055.
3. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

4. Mechanical Restraint: Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

   a. Serrated restrainer shall be ductile iron ASTM A536-80 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.
   b. The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 150 psi which ever is lesser. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serrations/Inch
4", 6"	1-1/2"	8
8", 10" & 12"	1-3/4"	8

   c. Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION OF FORCE MAIN

A. Lay the force main to and maintain it at the lines and grades required by the drawings. All fittings shall be at the required locations and the spigots centered in the bells.

B. Unless otherwise indicated by the drawings, all force main shall have at least 36 inches of cover. Ductile iron pipe shall be required when installed under sidewalks, storm drains, roadways and paved areas. Where these transitions occur between PVC/HDPE and ductile iron pipe, the detector wire shall be continuous where ductile iron pipe is required for crossings. No departure from this policy shall be made except with the approval of the Owner.

C. For detection purposes, a 10 gauge solid strand copper, green clad tracing wire (shielded) shall be installed with the plastic force main pipe. Connections between wires shall be soldered or connected with wire nut fasteners and wrapped and sealed to be watertight.

D. Any pipes strung out along the route of the proposed lines before the actual installation of those lines is due to take place shall not be lowered into the trench until they have been swabbed to remove any mud, debris , etc., that may have accumulated within them. Pipe shall be strung out a maximum of one (1) day ahead of pipe laying. Remove all unnecessary material from the bell and spigot end of each pipe. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell, and leave dry and oil-free.

E. Place no debris, tools, clothing, or other materials in the pipe during laying operations.

F. After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

G. Bell holes shall be large enough for ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so each pipe barrel rests on a solid foundation for its entire length.

H. Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug. If the joints of any pipe in the trench cannot be completed until a later time, caulk them with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

I. Cut pipe so that valves, fittings, or closure pieces can be inserted in a neat workmanlike manner without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

J. Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the Authority.

K. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer.

L. Lay no pipe in water or when trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use.

M. Joint all pipe in the exact manner specified by the manufacturer of the pipe and jointing materials.

N. Install a sewage air release valve and / or an air and vacuum valve at all relative high points. Contractor shall adjust force main depth as needed to insure air release manholes remain flush to grade.

O. Force mains shall be connected to existing manholes by use of exterior drop connections as shown on the details. Interior drop connections shall only be used with permission of the Authority's General Manager and the Authority's Engineer.

3.02 BEDDING AND BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the Owner. In an earth trench, for PVC, HDPE or DIP pipe material, on each side of the line, from the bottom of barrel of pipe to 12 inches above the top of the pipe, the backfill material shall be select backfill consisting of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that, before compaction, are no more than 6" deep.

Thoroughly and completely tamp each layer into place before placing additional layers.

B. In a rock trench, backfill shall be No. 67 crushed stone to a point 12-inches above the top of PVC, HDPE or DIP pipe.

C. In all paved areas or roadways, all backfill for PVC, HDPE or DIP pipe shall be No. 67 crushed stone to a point within 8-inches of paved surface. The final 8-inches shall be crushed roadway base stone.

D. If PVC, HDPE or DIP pipe is installed in a rock trench or paved area, install a 6" bedding of No. 67 crushed stone below the pipe.

E. From 1' above the pipe upward (if outside paved area or roadway)the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6", and the backfill material shall be placed and spread in even layers not more than 12" deep. Tamp and thoroughly compact the backfill in layers that, before compaction, are 6" deep. In other areas, the backfill for the upper portion of the trenches may be place with out tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

3.03 HDPE JOINING:

A. BUTT FUSION: Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All field welds shall be made with fusion equipment equipped with a McElroy Data Logger. Temperature fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.

B. SIDEWALL FUSION: Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

C. MECHANICAL: Bolted joining may be used where the butt fusion method cannot be used. Flange joining will be accomplished by using a HDPE flange adapter with a ductile iron back-up ring. Mechanical joint joining will be accomplished using either a molded mechanical joint adapter or the combination of a Sur-Grip Restrainer and Pipe Stiffener as manufactured by JCM Industries, Inc. Either mechanical joint joining method will have a ductile iron mechanical joint gland.

D. OTHER: Socket fusion, hot gas fusion, threading, solvents, and epoxies may not be used to join HDPE pipe.

3.02 HYDROSTATIC TESTS

A. Pressure Test

1. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 100 psi. All services are to be laid prior to testing the main and tested as part of the test of the main
2. The duration of each pressure test shall at least be one (1) hours.
3. Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the Authority. Furnish the pump, pipe, connections, gauges, and all necessary apparatus.
4. Before applying the specified test pressure, expel all air from pipe. If hydrants or blow-offs are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.
5. Carefully examine all exposed pipes, fittings, valves, and hydrants during the test. Remove any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the Owner.
6. No air testing of force mains will be permitted.

B. Leakage Test

1. Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.
2. The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 100 psi.
3. Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valved section in order to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
4. No pipe installation shall be accepted until the leakage is less than the number of gallons per two (2) hour period listed below:

Pipe Sizes	Gallons per 1,000 Feet of Pipe
2 inches - 2 1/4 inches	0.15
3 inches	0.20
4 inches	0.27
6 inches	0.41
8 inches	0.54
10 inches	0.68

5. Should any section of pipe laid display leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

3.03 CLEANUP

A. After completing each section of force main, remove all debris and all construction materials from the work site. Then grade and smooth over the surface of both sides of the line. Leave the entire area clean and in a condition satisfactory to the Authority.

END OF SECTION

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SECTION 3.03

PRECAST MANHOLES AND WET WELLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gravity sewer manholes shall be pre-cast with eccentric cone sections unless otherwise approved by the Engineer. Wet wells shall have precast concrete flat tops with openings as defined on the drawings and as required by pump manufacturer requirements. Air release valve manholes shall have flat-top sections.

B. Refer to other sections for items affecting manholes. Coordinate this work with that specified by other sections for timely execution.

C. Section shall also apply to concrete wetwells.

1.02 QUALITY ASSURANCE

A. Material Testing: All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the Engineer prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

B. The commercial testing laboratory shall be engaged and paid for by the Contractor.

C. Manholes and wet wells shall be watertight and of high quality and meet the requirements of ASTM C478.

1.03 SUBMITTALS

A. Shop drawings are required in accordance with Section 2.06, for castings, plastic gaskets, manhole steps, resilient pipe connection, and pre-cast manholes specified in this section.

B. Supply certified copies in duplicate for the inspection and acceptance reports of the testing laboratory to the Engineer before using the materials.

C. Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY

A. Reinforced, meeting the applicable requirements of Section 5.01, Concrete for Utility Lines.

2.02 GRADE ADJUSTMENT RING (FOR CASTING ADJUSTMENT)

A. Reinforced concrete adjustment rings shall be allowed. Adjustment casting by the use of adjustment rings in excess of 6 - inches in height shall not be permitted. No grade adjustment rings shall be utilized where top of pre-cast section is scheduled to remain above the existing grade.

2.03 MORTAR

A. Composed of one (1) part Portland cement and two (2) parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in the work; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, re-tempered, or previously set shall not be allowed.

2.04 STANDARD FRAMES AND COVERS

A. The standard frame and cover shall be traffic typed gray cast iron ASTM Designation A48 – Latest Revision, with a 24" (minimum) diameter opening weighing not less than 410 lbs. The covers shall be the solid self-sealing type with no holes except watertight pick notches. The surface between the cover and frame shall fit smoothly without rocking and shall be thoroughly cleaned. The gray iron castings shall be painted with a bituminous coating.

B. Cover shall be of the solid indented type with the words "Sanitary Sewer" cast in raised letters thereon. Manhole frames and covers shall be John

Bouchard & Sons, Co., No. 1150; or East Jordan Iron Works, No. 1045 or approved equal.

C. For shallow type manholes with measured depth of 4-feet or less, the cover shall be John Bouchard & Sons, Co., No. 1312; East Jordan Iron Works, No. 1320.

2.05 WATERTIGHT FRAMES AND COVERS

A. The manhole frames shall be set in the same manner prescribed for standard frames except special attention shall be paid to securing a watertight connection to the manhole barrel.

B. The watertight manhole frame and cover shall be a traffic type of grey cast iron ASTM A48-64 with a 24-inch diameter minimum clear opening weighing not less than 550 pounds and shall be of the two-cover design as shown on the Plans.

C. The surface cover shall be the solid type with no holes except watertight pick notches or a heavy lifting ring. The surface between this cover and frame shall fit without rocking. The outer cover shall be marked "Sanitary Sewer" cast in raised letters thereon. The inner cover shall be of the solid type with no holes, shall have not less than two lifting handles and shall have a neoprene sealing gasket at least 3/8-inch diameter cross-section. The inner cover shall be mechanically sealed by means of a removable metal bar located over the inner cover with a centrally-located stainless steel tightening bolt. This bolt shall be fitted for a tee-handle or bent-handle for turning which shall be included with each cover. The bolt shall have Acme threads for durability. The inner cover shall have appropriate reinforcing ribs to prevent cracking or distortion when tightened. The inner cover shall have sufficient clearance to allow easy installation of the cover. Manhole frame and cover shall be John Bouchard & Sons, Co., No. 1123; East Jordan Iron Works, No. 1893 or approved equal.

2.06 JOINT SEALANT FOR PRECAST MANHOLES AND WET WELLS

A. One strip of flexible plastic sealant for joints in pre-cast manhole sections shall be installed on the tongue and groove sections of the precast manholes to provide permanent flexible watertight joints which shall remain workable over wide temperature ranges and shall not shrink, harden or oxidize upon aging. Two (2) strips of sealant shall be used on wet well joints. Material shall be butyl resin sealant ConSeal CS-102 or CS-202 as manufactured by Concrete Sealants, Inc. of New Carlisle, Ohio,

RUB'R-NEK L-T-M manufactured by K.T. Snyder Company, Inc. of Houston, Texas, or other approved equal.

2.07 EXTERNAL JOINT WRAP FOR MANHOLES AND WET WELLS

A. Joint wrap, at all joints between riser sections, shall be installed in accordance with ASTM C909. Joint wrap shall be 6-inch minimum width, and as manufactured by Press-Seal Gasket Corporation of Ft. Wayne, Indiana, or equal.

2.08 MANHOLE STEPS

A. Manhole steps shall be made of copolymer polypropylene plastic meeting the latest revision of ASTM D2146-82, Type II, Grade 16906 and shall have a ½ inch diameter Grade 60 reinforcing rod meeting the latest revision of ASTM A615 through its center. Each step shall be 12-inches in width and capable of carrying a load of 1,000 pounds in the center of the step when projected 6-inches from the wall. Each step shall be equipped with non-skid grooves.

B. Manhole steps shall not be installed in the wet well or air release manholes.

2.09 MANHOLE INVERTS

A. Manhole inverts shall be formed from 3,000 psi concrete. Inverts for "Straight-through" manholes may be formed by laying the pipe straight through the manhole, pouring the concrete invert and then cutting out the top half of the pipe. Curved inverts shall be constructed of concrete and shall form a smooth even, half-pipe section as shown on the Plans. The inverts shall be factory constructed when the manhole is being built.

B. The bench or top portion of the invert shall slope to the flow line to prevent standing water.

2.10 RESILIENT PIPE CONNECTIONS

A. Resilient pipe connectors shall be manufactured in accordance with ASTM C923 and shall provide a positive watertight joint and minimum of 7-degrees deflection in any direction. There shall be no water leakage through the connector when pipe is in its maximum deflected position. Connectors shall be manufactured of durable construction.

Connectors shall be manufactured of durable rubber which offers superior resistance to water, sewage, oils, acid, ozone, weathering and aging.

1. Connections to new or existing manholes shall use a conical type flexible boot which shall be clamped securely to the cut out in the manhole wall and to the pipe by means of stainless steel clamps or bands. The flexible boot shall meet ASTM C923. Flexible connectors to manholes shall be Kor-N-Seal I Series 106/406 Toggle or Wedge style or ALok G3 Series.

2.11 PRE-CAST CONCRETE MANHOLES AND WET WELLS

A. Pre-cast manholes and wet wells shall be constructed on a reinforced concrete foundation and shall be wet cast as modified herein. The bottom section of the manhole shall be pre-cast integrally with the pre-cast ring and shall be 4'-0" in interior diameter unless otherwise noted on the plans. All concrete used in connection with the construction of manholes shall be 4,000 psi concrete. Wet well bases shall have adequate weight and thickness to prevent flotation. A minimum of 12" of additional base width (anti-flotation collar) beyond the outside edge of the wet well wall shall be included. The field poured base of the wet well shall be interlocked with steel inserts to tie the precast section to the field-poured base section. Design Engineer shall provide flotation calculations to support the anti-flotation of the wet well. There shall be a factor of safety of at least 2.0 in the calculation. All gravity sewer manholes shall be constructed with a minimum of 0.2' of fall between the inlet and outlet.

B. The precast manhole manufacturer shall use the additive Xypex Concentrate Admix C-2000/C-1000 at the rate of 2-3 percent by weight of cement in the concrete mix for all manholes. The Xypex Concentrate Admix must be added to the concrete at the time of batching as recommended by the manufacturer (Xypex Chemical Corporation, Richmond, British Columbia, Canada, local contact (615) 333-1000). Red colorant shall be added to show that Xypex has been used in the construction of the manhole. The Xypex additive is not required on manhole segments used to construct sewer air release valve structures. The Xypex additive is not required on pump station wet wells. Wet well shall be lined with cementitious linings in accordance with Section 3.04 of this document.

C. Pre-cast concrete rings shall be constructed using standard forms and shall conform to ASTM C478 including steel reinforcement.

D. Align all steps in each section so they are in straight vertical alignment.

E. The pre-cast sections shall be manufactured and installed in a manner so that there is no visible leakage in the manholes. The manhole section shall be manufactured in lengths such that a finished manhole will have the least possible number of joints. One section less than 4' in length will be allowed per manhole and that being the section required to bring the manhole to grade. The pre-cast rings shall be of the tongue and groove design sealed watertight, and the joint shall be grouted smooth on the inside of the manhole so that no crack is visible. A resilient pipe connection shall be utilized in the sewer line to manhole connection, unless specifically noted on the drawings. No resilient connector is required on air release manholes but the opening shall be sealed to a watertight condition.

E. The manhole sidewall may be adjusted with concrete grade adjustment rings as required to bring the casting to grade. Grade ring adjustment in excess of 6 -inches will not be allowed. Where grade adjustment rings are used, a flexible manhole frame seal device shall be provided to seal between the manhole frame and the throat of the precast manhole.

2.11 INTERNAL MANHOLE FRAME SEAL

A. Internal manhole frame seals shall be an internal flexible rubber frame seal extending from the frame casting down to the top of the manhole cone.

B. The manhole frame seal shall be designed to prevent leakage of water through the chimney/frame area throughout a 50 year design life. The seal shall also be designed so that it can be installed in manholes where the diameters of the frame and chimney differ by up to 20%.

C. The frame seal shall be capable of repeated vertical movement of not less than 2 inches and/or repeated horizontal movement of not less than ½ inch after installation and throughout its design life.

D. Frame seals shall consist of a flexible internal rubber sleeve and stainless steel expansion bands conforming to the following requirements:

1. Rubber sleeve – The flexible rubber sleeve shall be extruded or molded from a high grade rubber conforming to the material requirements of ASTM C923 with a minimum 1500 psi tensile strength, a maximum 18% compression set and a hardness (durometer) of 48±5. The sleeve shall be double, triple or

quadruple pleated with a minimum unexpanded vertical height of 8-inches, 10-inhces or 13-inches respectively and a minimum thickness of 3/16 inches. The top and bottom section of the sleeve that compresses against the manhole frame casting and the chimney/cone shall have an integrally formed expansion band and a series of sealing fins to facilitate a watertight seal.

2. The top section of the extension shall have a minimum thickness of 3/32 inches and shall be shaped to fit into the bottom band recess of the sleeve under the bottom chimney seal band and the remainder of the extension shall contain an integrally formed expansion band recess and multiple sealing fins matching that of the rubber sleeve.

3. Expansion bands – The expansion bands used to compress the sleeve against the manhole shall be integrally formed from 16 gauge stainless steel conforming to the requirements of ASTM C923, Type 304 with no welded attachments and shall have a minimum width of 1-2/4 inches. The bands shall have a minimum adjustment range of 2-1/2 diameter inches and the mechanism used to expand the band shall have the capacity to develop the pressure necessary to make a watertight seal. The band shall be permanently held in place with a positive locking mechanism which secures the band in its expanded position after tightening.

E. Internal manhole frame seals shall be Cretex Specialty products Internal Chimney Seals or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation.

B. Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers or as directed by the Engineer. Wherever water is encountered at the site, place all cast-in-place bases or monolithic structures on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.

3.02 INSTALLATION

A. When the foundation sub-grade has been prepared for pre-cast manholes, carefully block the base section above the prepared surface so that it is fully and uniformly supported in true alignment; make sure that all entering pipe can be inserted at proper grade. Then place the concrete foundation and invert under and upon this base section as shown in the standard drawings. A base section with monolithic foundation (bottom) shall be used.

B. Thoroughly wet and then completely fill all interior and exterior lift holes and all joints between pre-cast elements with non-shrink grout. Smooth and paint them both inside and outside to ensure water tightness. Surface deficiencies noted by the Authority shall be filled with non-shrink grout and wiped flush.

C. Place manhole joint sealant between riser sections and trim excess on interior walls.

D. Align all steps in each section so they are in straight vertical alignment.

E. Construct monolithic concrete manholes and bases of 4,000 psi concrete in accordance with the provisions of this section and applicable provisions of Section 03303, Concrete for Utility Lines. The manhole steps shall be cast in place. Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with two (2) strips of butyl sealant beneath the frame. A grout course shall be installed atop the frame. Wherever manholes are constructed in paved areas, tilt the top surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement. Existing frames and covers reused for elevation adjustment shall be thoroughly cleaned before reinstallation.

G. Use flexible watertight manhole couplings on all pipe at connections to manholes and wet wells. Connector shall meet the requirement of ASTM C923. Connector shall be as specified in Paragraph 2.10 of this section. Pipes entering and exiting the manholes shall be a minimum of 6 feet in length. No sections of pipe less than 6 feet will be permitted at the manhole connections. No flexible connections are required on air release manholes but openings shall be sealed to a watertight condition.

H. Where the difference in the invert elevation of two or more lines intersecting in one manhole is 24 inches or more, construct a drop manhole. Drop manholes shall be similar in construction to standard manholes except that a drop connection of pipe and fittings of the proper sizes and materials shall be constructed outside the manhole and supported by 3,000 psi concrete as indicated by the standard drawings.

I. Place backfill by hand around the manhole and to a distance of at least one (1) pipe length into each trench, and tamp with selected material up to an elevation of twelve (12) inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

J. Where force mains discharge into manholes, the manhole interior shall be lined with cementitious manhole waterproofing as set forth in Section 3.04. Where force mains discharge into manholes, exterior drop connections are required. Interior drop connections can only be used with the approval of the Authority's General Manager and the Authority's Engineer.

K. Air release manholes shall be set such that the flat-top and casting are at grade. The flat-top section of the manhole shall not extend above grade unless directed by the Authority. The frame of the air release manhole shall be cast integrally into the precast flat-top section. Contractor shall plan his pipe-laying activities for force mains in a manner such that additional depth of the pipe is achieved to allow for installation of the air release manhole casting and flat-top to be flush to grade.

L. Vacuum Testing of New Manholes:

1. This test is only applicable to pre-cast concrete manholes.
2. All lifting holes and exterior joints shall be filled and pointed with an approved non-shrink mortar.
3. Each manhole shall be vacuum tested immediately after installation or rehabilitation and prior to backfilling. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test.
4. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while the vacuum is drawn.
5. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specifications and instructions provided by the manufacturer.

6. The test head shall be placed to include the manhole casting (frame).
7. A vacuum of 10 inches of mercury shall be drawn. The time for the vacuum to drop to 9 inches shall be recorded.
8. Acceptance for four (4) feet diameter manholes shall be defined as when the time to drop to 9 inches of mercury conforms to the table below. Contractor shall keep a log of all tests which shall be submitted to the Engineer for approval.

Manhole Depth	Time to Drop One (1) Inch
10 feet or less	60 seconds
10.1 feet to 15 feet	75 seconds
15.1 feet to 25 feet	90 seconds

9. For manholes five (5) feet in diameter, add an additional 15 seconds. For manholes six (6) feet in diameter, add an additional 30 seconds.
10. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test.
11. If the manhole joint mastic or gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole re-tested.
12. No additional payment will be made for testing and cost shall be merged into cost of manholes.

M. All manholes shall be set in such a manner that manhole casting is flush with the ground surface unless otherwise noted on plan. No manhole casting shall be lower than the surrounding existing ground surface. Contractor is responsible to confirm overall depth at time of fabrication to prevent the need for excessive grade adjustment rings. No grade rings in excess of 6-inches will be permitted. If grade rings are used, a flexible internal manhole frame seal shall be provided at no additional cost. Cone sections set above ground level shall only occur with the pre-approval of the Authority. No grade rings shall be utilized to adjust castings above finished grade. Above grade extensions if utilized shall be executed with solid precast sections.

3.03 ACCEPTANCE TEST FOR MANHOLE GRADE ADJUSTMENT

A. After the manhole has been adjusted to the proper grade, the manhole shall be visually inspected by the Contractor in the presence of the Authority. Any defects noted shall be corrected by the Contractor until

the work is found satisfactory to the Authority. In addition, at the Authority's request, the Contractor may be required within one year to visually inspect the manholes that were adjusted. Any work that has become defective shall be redone by the Contractor at no additional expense to the Authority.

END OF SECTION

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SECTION 3.04

CEMENTITIOUS WATERPROOFING FOR MANHOLES

PART 1 – GENERAL

1.01 SUMMARY

A. This specification shall govern all work, materials, and equipment required for lining new manholes for the purpose of providing corrosion protection, repair of voids, and restoration of the structural integrity of the substrate as a result of applying a monolithic fiber-reinforced structural cementitious liner to the wall and bench surfaces of concrete manholes.

B. Material shall be applied to any manhole which receives direct discharge from a force main.

C. Related Sections:

1. Section 3.03 Manholes and Wet Wells

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with conditions of the Contract and with Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications. Also include manufacturer's certification or other data substantiating that products comply with requirements of Contract Documents.

C. Test Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.

D. Manufacturer's Certification: Provide certificates signed by manufacturer or manufacturer's representative certifying that the materials to be installed comply in all respects with the requirements of this specification, and that the applicator is qualified and approved to install the materials in accordance with manufacturer's product data.

E. Manufacturer's Field Report: Provide copy of report from manufacturer's representative confirming that the surfaces to which waterproofing material is to be applied are in a condition suitable to receive same.

1.03 QUALITY ASSURANCE

A. Applicator: Waterproofing applicator shall be experienced in the installation of cementitious waterproofing materials as demonstrated by pervious successful installations, and shall be approved by the manufacturer in writing.

B. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged waterproofing materials to project site in original undamaged containers, with manufacturer's labels and seals intact.

1.05 PROJECT CONDITIONS

A. Compliance: Comply with manufacturer's product data regarding condition of substrate to receive waterproofing, weather conditions before and during installation, and protection of the installed waterproofing system.

PART 2 – MATERIALS

2.01 ACCEPTABLE MANUFACTURER

Strong-Seal® by the Strong Company, Inc.
4505 Emmett Sanders Road
Pinebluff, AR 71601
Telephone: 800-982-8009
Fax: 870-850-6933

2.02 PATCHING MATERIAL (Strong-Seal® QSR)

Strong-Seal® QSR, a quick setting fiber reinforced calcium aluminate corrosion resistant cementitious material, shall be used as a patching material and is to be mixed and applied according to manufacturers' recommendations and shall have the following minimum requirements.

Strong-Seal® QSR Minimum Requirements		
Compressive Strength	ASTM C109	1400 psi, 6 hrs.
Bond	ASTM C882	>1600 psi, 28 days
Calcium Aluminate Cement		Sulfate resistant
Applied Density		105 lbs/ft^3 ± 5
Shrinkage	ASTM C490	0% at 90% R.H.
Placement Time		5 to 10 minutes
Set Time		15 to 30 minutes

2.03 INFILTRATION CONTROL MATERIAL (Strong-Seal® Strong-Plug®)

A. Strong-Plug®, a rapid setting cementitious product specifically formulated for leak control, shall be used to stop minor water infiltration and shall be mixed and applied according to manufacturers' recommendations and shall have the following minimum requirements:

Strong-Seal® Strong-Plug® Minimum Requirements		
Compressive Strength	ASTM C109	>400 psi, 1 hr. >1000 psi, 24 hrs.
Sulfate Resistance	ASTM C267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw	ASTM C666 "Method A"	100 cycles
Pull Out Strength	ASTM C234	14,000 lbs.
Set Time		<1.0 minute

2.04 GROUTING MATERIAL

A. Strong-Seal® Grout 250, a cementitious grout, shall be used for stopping very active infiltration and filling voids and shall be mixed and applied according to manufacturers' recommendations. The cementitious grout shall be volume stable, and have a minimum 28 day compressive strength of 250 psi.

B. Strong-Seal® Grout 1000, a cementitious grout, shall be used for same application as Grout 250, but is designed for special soil conditions, and shall be used per manufacturers' recommendations. The cementitious grout shall be volume stable and have a minimum 28 day compressive strength of 1000 psi.

C. Chemical grouts may be used for stopping very active infiltration and shall be mixed and applied per manufacturers' recommendations.

2.05 LINER MATERIAL

Strong-Seal® cementitious liner products shall be used to form a structural monolithic liner covering all interior substrate surfaces and shall have the following minimum requirements:

Item	Specification	Time	MS-2® C
Compressive Strength	ASTM C109	28 days	>8000 psi
Tensile Strength	ASTM C496	28 days	>800 psi
Flexural Strength	ASTM C293	28 days	>1500 psi
Shrinkage @90% R.H.	ASTM C490	28 days	0%
Bond	ASTM C882	28 days	>2000 psi
Density, When Applied		N/A	134 ± 5lbs/ft^3
Freeze/Thaw	ASTM C666	N/A	100 cycles no visible damage

A. Strong-Seal® MS-2® C shall be made with calcium aluminate cement and shall be used according to manufacturers' recommendations in manholes with force main discharges. Strong-Seal® MS-2® C product or approved equivalent shall be factory blended requiring only the addition of water at the jobsite. The bag weight shall be 63-67 pounds. The contents shall have a dry bulk density of 82-85 pounds per cubic foot. When mixed with manufacturers' recommended amount of water it shall have a wet nozzle density in the range of 129-139 pounds per cubic foot and shall have a typical yield of .57 cubic feet per bag.

B. The material should meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limits for any heavy metal.

2.06 WATER

Water used to mix product shall be clean and potable. Questionable water shall be tested by a laboratory per ASTM C-94 procedure. Potable water need not be tested.

PART 3 – EXECUTION

3.01 EQUIPMENT

A. Applicator must use approved equipment designed and manufactured by the material supplier specifically for the application of cementitious liners in sanitary systems.

B. Specially designed machines consisting of a progressive cavity pump and an air system for low velocity spray application of product, shall be used for applying Strong-Seal® Systems products. Equipment is complete with water storage and metering system. SprayMate® models 35C and 35D are approved machines for applying Strong-Seal® Systems products. Other models may be approved after review by Strong-Seal® personnel.

3.02 APPLICATION

A. Preparation:

1. Place covers over invert to prevent extraneous material from entering the sewer lines before cleaning.
2. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (Minimum 3000 psi). Unusual conditions such as heavy grease build-up or residues of industrial or processing wastes may require hydro-blasting or chemical cleaning. Loose and protruding brick, mortar, and concrete shall be removed using a masons hammer and chisel and/or scraper. Fill any large voids with quick setting patching mix Strong-Seal® QSR.
3. Active leaks shall be stopped using quick setting, specially formulated mixes, such as Strong-Plug® according to manufacturers' recommendations. Some leaks may require weep holes to localize the infiltration during the application. After application the weep holes shall be plugged with the quick setting material Strong-Seal® Strong-Plug® prior to the application of the final coat. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout, Strong-Seal® Grout 1000 or chemical grouts. Manufacturers' recommendations shall be followed when pressure grouting is required.

B. Invert Repair:

1. After all preparations have been completed, remove all loose material and wash wall again.
2. Any bench, invert, or service line repairs shall be made at this time using the quick setting patching mix, Strong-Seal® QSR and shall be used per manufacturers' recommendations.
3. Invert repair shall be performed on all inverts with visible damage or where infiltration is present or when vacuum testing is specified. After blocking flow through manhole and thoroughly cleaning invert, the quick setting patch material Strong-Seal® QSR shall be applied to the invert in an expeditious manner. The material shall be trowelled uniformly onto the damaged invert at a minimum thickness of ½ inch at the invert extending out onto the bench of the manhole sufficiently to tie into the structural monolithic liner to be spray applied. The finished invert surfaces shall be smooth and free of ridges.
4. The flow may be re-established in the manhole within 30 minutes after placement of the material.

C. Mixing of Liner Materials:

1. For each bag of product, use the amount of water required per manufacturers' recommendations following mixing procedures noted on product bag using only enough water to produce a mix consistency to allow application of liner material one (1) inch thick in a single application without material "sagging" on vertical surface and using the approved equipment for mixing and application.
2. Prepared mix shall be discharged into a hopper and another batch prepared to occur in such a manner as to allow spraying continuously without interruption until each application is complete.

D. Spraying:

1. The surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water, but totally saturated just prior to application of material. Materials shall by spray applied up to one (1) inch thick in one or more passes from the bottom of the frame; however, minimum total thickness shall not be less than ½ inch. The surface is then trowelled to a relatively smooth finish being careful not to over trowel.
2. A brush finish shall be applied to the trowel-finished surface. Manufacturers' recommendations shall be followed whenever more than 24 hours have elapsed between applications.

E. Bench Application:

1. The wooden covers shall be removed at this time and the bench sprayed with materials mixed per specifications as per 3.02.C. and spray applied in such a manner that a gradual slope is produced from the walls to the invert with the thickness at the invert to be no less than ½ inch. The wall/bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

3.03 CURING

A. Caution should be taken to minimize exposure of applied product to quick surface drying and air movement. If time between application of additional coats is to be longer than 15 minutes, place cover on the manhole. In extremely hot and arid climates, manhole should be shaded while reconstruction is in process and a concrete curing agent should be used. Contact manufacturer for curing compound recommendations.

1. Strong-Seal® liner products shall have the following minimum cure times before being subjected to flow:

Hold Times Before Releasing Flow		
		MS-2® C
Storm Run-off & Surcharge		4 hours
Force Main Impact		6 hours

2. After final application of the Strong-Seal® liner product, street traffic shall be withheld as noted per the following:

Hold Times Before Allowing Traffic		
		MS-2® C
		6-8 hours

3.04 WEATHER

A. No application shall be made if ambient temperature is below 40 degrees Fahrenheit. No application shall be made to frozen surfaces or if freezing is expected to occur within the substrate within 24 hours after application.

B. Precautions shall be taken to keep the mix temperatures at time of application below 90 degrees Fahrenheit. Water temperature shall not exceed 80 degrees Fahrenheit. Chill with ice if necessary.

3.05 PRODUCT TESTING

A. Four – two inch cubes may be cast each day or from every pallet of product used, and shall be properly packaged, labeled and returned to manufacturer for testing in accordance with the owners' or manufacturers' directions for compression strength per ASTM C 109 procedure.

3.06 FINAL ACCEPTANCE TESTING

A. Perform final acceptance testing in accordance with Section 3.03.

END OF SECTION

SECTION 3.05

SEWAGE VALVES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Installation of valves as specified below.

B. Refer to other sections for work related to that specified under this heading.

PART 2 – PRODUCTS

2.01 PLUG VALVES

A. All plug valves shall be eccentric plug valves with 100% full port unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with mechanical joint end connections.

C. Valve bodies shall be of ASTM A126 Class B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset fro the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

E. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated Type 316 ASTM A743 Grade CF-8M or AISI Type 317L stainless steel. Non-metallic bearings shall not be acceptable.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12″ and 150 psi for 14″ through 72″. Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Non-buried manual valves shall have handwheel gear actuators. Buried valves shall be provided with tee wrenches and extension stems. All valves 6″ and smaller may be equipped with gear actuators. All manual actuators shall be rated for the full pressure rating of the valve. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

I. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washer shall be stainless steel.

J. All valves shall be as manufactured by DeZURIK Model PEF.

2.02 COMBINATION AIR VALVES

A. All force mains shall have combination air valves installed as they are indicated on the plans.

B. The body of the valves shall be conical shaped to maintain maximum air gap with the spring loaded float and seal plug connection combining to ensure no contact between the sewage and the seal.

C. The valve shall have a double float design with the upper float being enclosed in the upper section of the valve and shall be made of polypropylene.

D. The lower float shall be in the main body of the valve and shall be constructed of 316 stainless steel.

E. The body, cover flange, and lower flange shall be constructed of 316 stainless steel, and shall have a funnel shaped lower body to automatically drain sewage back into the system.

F. All internal metal parts are to be made from corrosion resistant 316 stainless steel, with all operating parts in the upper section to be non-metallic plastic materials.

G. The hinge for operation for the opening and closing of the seal on the orifice shall be made of EPDM rubber.

H. The rolling resilient seal shall provide smooth positive opening, closing and lean free sealing over the fluctuation of the pressure differentials.

I. The working pressure shall be 230 psi and tested to 460 psi.

J. All hardware shall be of stainless steel bolts and nuts, and the entire valve, except to upper outlet, shall be constructed of 316 stainless steel.

K. The connection on all pipelines shall be the following sizing with an isolation valve of the same size:

1. 8-inch and smaller 2-inch threaded

L. Combination air valves shall be model A.R.I. D-025.

M. All valves shall be installed in accordance with manufacturer recommendations and shall have an isolation bronze gate valve connection for control.

2.03 VALVE BOXES AND CLEAN OUT BOXES

A. Valve boxes shall be cast iron sectional type. The lower section shall have a minimum diameter of five inches, enlarged to fit around the bonnet of the valve if a 2-section box is used, or to fit a circular or oval base section if a 3-section box is used. The upper section shall slide or screw down over the adjoining lower section and shall be full diameter throughout. Valve boxes shall have cast iron lids or covers. The boxes shall be long enough to permit the top to be set flush with the established ground surface grade.

B. Clean out boxes shall be cast iron with frame and separate cast iron lid. Lid shall be marked SEWER. Boxes shall sit on four precast manhole brick and shall be flush with finish ground surface. Casting weight to be minimum of 150 pounds for frame and 45 pounds for cover. Clean out boxes shall be John Bouchard No. 8006 or approved equal.

2.04 RUBBER FLAPPER STYLE SWING CHECK VALVE

A. The check valve shall be a flanged, swing type, full body, domed access cover with Buna-N rubber flapper disc suitable for use with raw wastewater.

B. The valve body shall be a one piece ductile iron ASTM A536 Grade 65-45-12 with integral flanges. The flanges shall be faced and drilled in accordance with ANSI B16.1 Class 125. the valve body shall be full flow equal to nominal pipe diameter at all points through the valve. Valve shall be capable of passing a 3-inch sphere. The seating surface shall be on a 45 degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator, without special tools or removing the valve from the line.

C. The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operating in lines containing high solids content. A threaded port with pipe plug shall be provided in the access cover to allow for field installation of a mechanical, disc positioner indicator.

D. The disc shall be of one-piece construction, precision molded with an integral o-ring type sealing surface and contain alloy steel and nylon reinforcement in the flexible hinge area. The flex portion of the disc shall be warranted for twenty-five years. Non-slam closing characteristics shall be provided through a short 35 degree disc stroke and a memory disc return action.

E. The valve disc shall be cycle tested 1,000,000 times in accordance with AWWA C508 and show no signs of wear, cracking or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. Tests shall be independently certified.

F. A mechanical indicator shall be provided to indicate open/closed position. The indicator shall have continuous contact with the disc under all operating conditions to insure accurate disc indication.

G. All valves shall be hydrostatically tested and seat tested to demonstrate zero leakage. The interior and exterior of the valve shall be coated with an ANSI/NSF 61 approved fusion bonded epoxy.

H. The valve shall be a Valmatic Series 500, or APCO Series 100.

2.05 OUTSIDE LEVER AND WEIGHT SWING CHECK VALVE

A. The check valve shall be a flanged, counterweighted, rubber seated swing check valve. The valve shall permit flow in one direction only and shall close tightly without slamming when the discharge pressure exceeds the inlet pressure. The cushioned swing check valve shall be installed with the flow direction either horizontally or vertically up and shall function to prevent reverse flow. The valve shall provide a full equivalent pipe area when open fully.

B. The valve body shall be a one piece cast iron or cast steel casting with integral flanges. The flanges shall be faced and drilled in accordance with ANSI B16.1 Class 125.

C. The hinge shaft shall be located completely above the waterway and shall be constructed of stainless steel with the disc arm and counterweight arm keyed there on. The hinge shaft shall be one piece and shall extend through both sides of the valve body.

D. The body seat shall be bronze or stainless steel, and the disc shall be cast iron conforming to ASTM A126 Class B. The seat ring shall be a resilient field replaceable ring that can be replaced without the use of special tools.

E. A lever and adjustable weight shall be provided to initiate closure.

F. The valve shall be a Golden Anderson Model 250, or APCO Series S-6000.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Valves shall be installed per manufacturer's recommendations.

B. Buried plug valves shall be installed with a cast iron valve box. Flanged plug valves shall be installed with removable, operating lever.

C. Buried valves shall include mechanical joint ends. All valves for aboveground or vault installation shall include flanged ends.

D. Valves shall be plumbed for level installation so as not to place end connection in a bind.

E. Valves shall be installed plumb. Valves installed outside paved areas shall include a concrete collar around the valve lid at ground surface.

F. Clean out assemblies shall be installed with a cast iron clean out box over the top of the assembly. Box shall be flush with the finished ground surface. Top of clean out assembly shall be at least 3-inches below the inside surface of the box lid.

G. All check valves shall be mounted in a horizontal position in a valve vault. No check valves shall be installed in the wet well.

H. Air Release/Vacuum Valves shall be installed in a 4-foot diameter precast concrete manhole with vented cover in accordance with the details of the Limestone County Water and Sewer Authority. Valves shall be located at high points or as directed by the Owner. Additional force main depth may be required to allow for height of valve body inside the manhole. Manhole cover shall be flush with existing grade. Valve body shall be adequately supported and braced inside the manhole and not solely dependent upon support by the pipe nipple. All pipe nipples shall be bronze. A cut-off valve with handwheel or lever shall be included to isolate the air valve from the force main. Combination air valves shall be mounted with a tapping boss or tapping saddle with bronze isolation valve with handwheel. No galvanized piping shall be used.

END OF SECTION

SECTION 3.06

FLOW CONTROL OF SEWER LINES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes all materials, labor, and equipment required to provide bypass flow control for sanitary sewer lines construction, upgrade, or rehabilitation.

B. Also, furnish all power, maintenance, etc. to implement the bypass flow control and diversion pumping to divert the existing flow around the work area for the work's duration.

C. The design, installation, and operation for the temporary bypass pumping system shall be solely the Contractor's responsibility.

1.02 PERFORMANCE AND PENALTIES

A. The Contractor shall ensure:

1. All temporary sewer bypass pumping activities for the work are completed in full compliance with the Owner's, local and State requirements and no water quality or quantity compliance issues are encountered.

2. No illicit pollutant discharges to (or to a location that would create contaminated water runoff to) a storm sewer, a stormwater conveyance, or a water body within the State.

3. All temporary sewer bypass pumping activities for the work are completed in full compliance with the Alabama Department of Environmental Management and the U.S. EPA regulations, and no water quality or quantity compliance issues are encountered.

B. No discharge of sewage or debris shall be released to the environment. Should the Contractor's actions cause a sewage or debris overflow or bypass to the environment, site cleanup will be the Contractor's responsibility consistent with Owner and State regulators directions. All overflow or bypass environmental cleanup activities shall be immediately commenced and prosecuted continuously by the Contractor. Any associated fines or penalties enacted by the Alabama Department of Environmental Management, the U.S. EPA, and/or any other regulatory groups or programs will be borne solely by the Contractor.

1.03 SUBMITTALS

A. At least two weeks prior to commencing work including plugging any line, bypass pumping, or similar actions, the Contractor shall submit to the Owner a detailed Bypass Sewage Pumping Plan (Plan), as further described in these specifications, for review and approval. Any Plan approval does not relieve the Contractor from any responsibility for the Plan's adequacy or proper execution. The Contractor is responsible for conducting his work in a manner which will not cause overflows or system backups that could damage private and/or public property.

B. Submit the following in accordance with Section 2.06.

1. *Bypass Sewage Pumping Plan*. Plan shall contain, at minimum, the following:

a. Staging areas for pumps

b. Sewer plugging method and plug types

c. Size and location for manholes or access points for suction and discharge hose or piping

d. Size for pipeline or conveyance system to be bypassed

e. Number, size, material, location, and method for installing suction piping

f. Number, size, material, location, and method for installing discharge piping

g. Provide bypass pump sizes, capacity, number of each size to be on site, and power requirements. Pump sizing shall clearly indicate compliance with requirements in this Section.

h. Calculations for static lift, friction losses, and flow velocity (pump curves showing pump operating range)

i. Standby power generator size, location, and spill prevention and control measures

j. Downstream discharge plan

k. Method to protect discharge manholes or structures from erosion and damage

l. Thrust and restraint block sizes and locations

m. Sections showing suction and discharge pipe depth, embedment, select fill, and special backfill

n. Noise control method for each pump and/or generator

o. Any temporary pipe supports and anchoring required

p. Design plans and computations for access to bypass pumping locations indicated on the Drawings

q. Calculations for selecting bypass pumping pipe size

r. Schedule for installing and maintaining bypass pumping lines

s. Plan indicating selection for bypass pumping line locations

t. All items related to testing, inspection, maintenance, and monitoring as described in this Section

u. All other incidental items necessary and/or required to ensure facilities are properly protected including protecting the access and bypass pumping locations from damage due to the discharge flows and compliance with the requirements and permit conditions specified in the Contract Documents

v. For sewer rehabilitation by lining methods, generic plans may be developed for typical situations and various sizes to be implemented.

PART 2 - PRODUCTS

2.01 BYPASS EQUIPMENT

A. All equipment used for bypass pumping shall be specifically designed for intended purpose. All piping, pumps, etc. in contact with sanitary sewage shall be manufactured with materials designed for use in a sewage environment.

B. All pumps used shall be fully automatic self-priming units which do not require foot valves or vacuum pumps in the priming system.

C. The pumps shall be electric, hydraulic, or diesel powered.

D. All pumps used shall be constructed to allow dry running for long time periods to accommodate effluent flows cyclical nature.

E. Above-ground pumps and/or power units shall be located inside a temporary portable berm to contain any fuel or sewage that may spill during the normal course of operation.

F. Hard discharge piping shall be butt-welded HDPE with a minimum pressure rating of 2.5 times the total dynamic pump head.

G. Under no circumstances will irrigation type piping or glued PVC pipe be allowed.

H. Discharge hose may be allowed on rehabilitation projects for short-term setups (less than or equal to 48 hours) on short sections with approval from the Owner. Hoses shall have no leaks, and all couplings shall be quick connecting with gaskets.

I. The multiple pump header system shall check valves to facilitate pump removal, service, and/or replacement while the system remains operational.

J. All above ground pumps and/or power units shall be equipped with sound attenuation measures which reduce noise levels to 75-decibels maximum at a 30-foot distance from the equipment during all operation periods. If equipment is operated between 8:00 PM and 6:00 AM, this equipment shall also be provided with a sound attenuation 3-sided enclosure including a roof constructed of 2 X 4 lumber frame with ½-inch plywood sheathing and 2-inch extruded polystyrene foam panels attached to the inside of the entire enclosure. The enclosure shall be portable to allow the enclosure to be moved when bypass pumping equipment is moved.

K. The discharge location (the point where the bypass main reenters the gravity sewer system) shall be constructed with adequate sealant materials to minimize sewer gas and odor release to the maximum extent possible.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Provide bypass sewage pumping, as required, around the section in which work is to be performed. Bypass pumping shall be the Contractor's full responsibility. The bypass system shall be a sufficient capacity to handle 2.0 times the peak flow of the pipeline section being bypassed. At least two weeks prior to the desired start date of construction requiring bypass pumping, submit a detailed description of the method proposed for bypass pumping to the Owner for review and approval. The description shall include all materials and equipment to be used, personnel, spare equipment, and sketches showing proposed pump-around setups. No work shall commence until the Owner approves.

B. Bypass pumping equipment shall include pumps, conduits, engines, and related equipment necessary to divert sewage flow around the section in which work is to be performed. Backup pumps shall be online and isolated from the primary system by valves. Include 100% mechanical redundancy installed online with a float or ultrasonic type system to switch to the standby system automatically if the primary system fails.

C. Piping redundancy may be required for relatively long bypass piping lengths or large diameter bypass pipes as deemed necessary by the Owner. Special design considerations shall be made for pump suction lifts greater than 23 feet.

D. Make all arrangements for bypass pumping when the main is shut down for any reason. The system shall overcome any existing force main pressure on discharge.

E. Suction and discharge points shall only be located at manholes.

F. If at any time the Contractor is unable to properly bypass pump the sewage, construction will be stopped until the Contractor can continue work in an acceptable manner. Additional contract time for delays caused by improper equipment, labor, or breakdowns will not be considered.

G. Service shall be maintained at all times. Surcharges due to plugging the sewer line for bypass pumping shall be maintained to prevent service backups and overflows at any point in the system.

H. For rehabilitation projects, hose may be used for short runs with the Owner's approval. If the anticipated bypass time exceeds 48-hours, use hard piping only. If using hose and the bypass time reaches 48-hours, the Contractor may either install hard piping to accomplish the bypass or restore flow until an approved bypass method can be employed.

I. The bypass or diversion pumping system shall be able to pump all the sewage in the existing line under all weather and seasonal conditions. All pumping equipment to be used shall be submitted to the Owner for review and approval.

J. Bypass pumping systems are required to be operated and continuously monitored 24-hours per day for flow diversion.

K. The bypass pumping must be done one manhole upstream and continue for one manhole downstream of the line being rehabilitated in order to use flow through plugs at the insertion and end points. The liner bag may not be used as part of the bypass pumping system or as a plug in the line.

L. For bypass or diversion pumping in overnight operations greater than 2 days, provide and maintain portable lighting systems as needed for monitoring and operation activities at the bypass pumping site(s).

M. The temporary diversion pumping system shall be placed in operation prior to the commencement of work in the areas being bypassed. Minimum times of operation prior to the commencement of work are 1 hour for small diameter CIPP lining and 4 hours for any other major system work such as trunk sewer diversion, large diameter sewer lining, or pumping station work.

N. Protect the bypass lines from damage in the areas of backhoe and excavation operations.

O. Provide the necessary stop/start controls and a visual alarm indicating a pump malfunction for each pump. Each pump shall have a 0-30 inch Hg vacuum gauge on the inlet and a 0-60 psi pressure gauge on the outlet.

3.02 PERFORMANCE REQUIREMENTS

A. It is essential for operating the existing system being bypassed that no interruptions in the flow occur throughout the project's duration. Provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (primary and backup units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the incoming flow before it reaches the point where it would interfere with the work, carry it past the work area, and return it to the existing system downstream of the work.

B. The temporary pumping system's design, installation, and operation shall be the Contractor's responsibility. The bypass system shall meet all codes and requirements for regulatory agencies having jurisdiction.

C. Provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the sewer main flows under any circumstances.

D. No flow diversion around the work area shall be performed in a manner that will cause damage to or surcharging of Owner's system. The diversion shall protect public and private property from damage and flooding.

E. Protect water resources, wetlands, and other natural resources.

3.03 FIELD QUALITY CONTROL AND MAINTENANCE

A. Testing: Prior to actual operation, test the bypass pumping discharge hard piping system for leaks and pressure using clean water. Bypass hard piping shall be hydrostatically tested following each setup and prior to flow diversion or bypass to a minimum pressure 2.5 times the pump(s) total dynamic head. The Owner shall be given a 24-hour notice prior to testing.

B. Inspection: Inspect the bypass pumping system on a continuous basis to ensure the system is working properly. A daily checklist for physically inspecting the piping shall be required. The checklist shall contain all bypass pumping system components and shall be specifically developed to address aspects for the individual project. The daily checklist shall be submitted to and approved by the Owner. The completed daily checklists will be maintained, available for review, and on-site for the project's duration. A sample checklist is included in this Section.

C. Maintenance Service: Ensure the temporary bypass pumping system is properly maintained and that a responsible operator shall be readily available at all times when pumps are operating.

D. Monitoring

1. During bypass pumping, continuously monitor all bypass pumping system components.

2. A telemetry system or designated personnel to maintain 24-hour onsite monitoring shall be required to alert the Contractor to system malfunctions or high liquid levels in manholes.

E. Additional Materials

1. Spare parts for pumps and piping shall be kept on site as required.

2. Adequate hoisting equipment for each pump and accessories shall be maintained on site.

3. Keep an HDPE fusion machine on site for the duration of bypass pumping to facilitate immediate repairs to hard piping.

F. Preparations and Precautions

1. Locate any existing utilities in the area selected for the bypass pipelines. Locate the bypass pipelines to minimize any disturbance to existing utilities and obtain approval for the pipeline locations. Pay all costs associated with relocating utilities and obtaining all approvals.

2. During all bypass pumping operations, protect the Metro system (pumping station, conveyance system, etc.) as applicable from damage inflicted by any equipment. The Contractor is responsible for all physical damage to the system caused by human or mechanical failure.

G. Installation and Removal

1. Remove manhole sections or make connections to the existing conveyance system. Construct temporary bypass pumping structures only at the access location(s) indicated on the Drawings and as may be required with Owner's approval to provide adequate suction conduit.

2. Plugging or blocking flows shall incorporate a primary or secondary plugging device. When plugging or blocking is no longer needed for work performance and acceptance, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge flows to prevent surcharging or causing other major disturbances downstream.

3. When working inside manholes, sewers, or force mains, exercise caution and comply with all applicable OSHA requirements.

4. Bypass pipeline installation is prohibited in all wetland areas. The pipeline shall be located, if possible, off streets and sidewalks and on road shoulders. If in easements, the bypass pipeline shall be within the easement area acquired for the project.

5. When the bypass pipeline crosses local streets and private driveways, place the bypass pipelines in trenches and cover with temporary pavement. Obtain any property owner approvals for placing the temporary pipeline.

3.04 CLEANUP

A. Upon acceptance of the installation work and testing, restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

3.05 CLOSEOUT ACTIVITIES

A. Provide in accordance with Section 2.10.

END OF SECTION

SECTION 3.07

SUBMERSIBLE SEWAGE PUMPS AND CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall provide and install submersible, non-clog wastewater pumps complete with motors, bases, control panel, hatch and all related accessories.

B. Pump supplier shall bear the responsibility of supplying all equipment required for complete, operating, pumping systems including control panel and level controls.

1.02 REFERENCES

A. ANSI B16.1: Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

B. ASTM A48: Gray iron Castings.

C. ASTM A276: Stainless and Heat-Resisting Steel Bars and Shapes.

D. ASTM A311: Steel Bars, Carbon, Stress-Relieved Cold-Drawn, Subject to Mechanical Property Requirements.

E. ASTM A532: Abrasion-Resistant Cast Irons.

F. ASTM A576: Steel Bars, Carbon, Hot-Wrought, Special Quality.

G. The Hydraulic Institute: Standards.

1.03 PERFORMANCE

A. Make certain that equipment does not exceed space allocation and provide the manufacturer with Contract Drawings where necessary.

B. Pumps must operate at specific speeds below the "Upper Limits of Specific Speeds" established by the Hydraulic Institute so that the pumps may operate at the stated capacity, head, and suction lift with reasonable assurance of freedom from cavitation.

C. Pumps and motors shall conform to the requirements set forth in the following pages as to capacity, head, and other requirements. Motors shall be of ample size to operate without overload through the entire range of the pump characteristic curve.

1.04 TESTS

A. Factory Test: Each pump and motor shall be given the following tests at the factory prior to shipment:
   1. The mechanical and electrical integrity of the pump shall be established by the use of physical inspection and the use of a megger for verification of the stator resistance to short circuit.
   2. The power leads shall be connected to the motor in accordance to the jobsite voltage and the pump started to verify rotation and no load amp readings.
   3. The pump shall be installed in a test tank on a wet pit discharge elbow and complete hydraulic tests conducted. The KW input, power factor, flow rate and head shall be measured and recorded. The pump shall be operated at the duty point for the project and checked for compliance with Hydraulic Institute Standards prior to being certified. The pump shall then be removed and given a physical inspection and additional megger insulation test to reverify the mechanical and electrical integrity.
   4. Certified copies of the results of the pump performance tests run in the factory shall be submitted to the Authority for approval prior to pump delivery.

B. Field Test: Contractor is responsible for supplying water to fill the wet well for field testing of five (5) consecutive start-stops of each pump through a pump cycle prior to request of Substantial Completion. Should the equipment fail to operate as prescribed, the equipment shall be repaired and the field test procedures shall be repeated until the equipment operates as required by these documents.

1.05 SUBMITTALS

A. The submittals required in this section include (but are not limited to) the following:
   1. Certified characteristic pump curves
   2. Components and component materials of construction
   3. Seal descriptions
   4. Impeller diameter

5. Maximum impeller permissible
6. NPSH requirements
7. Operating point
8. Certified pump test
9. Electrical characteristics of motors
10. Outline dimensions.

1.06 WARRANTY

A. The pumps shall be warranted for a period of five (5) years.

PART 2 – PRODUCTS

2.01 SUBMERSIBLE, NON-CLOGGING SEWAGE PUMPS

A. Requirements: Furnish and install two submersible non-clog wastewater pumps as shown in the plans. Each pump shall be equipped with a submersible electric motor connected for operation on 460 volts, 3 phase, 60 hertz, with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval. The pump shall be supplied with a mating cast iron discharge connection and be capable of delivering the flow and total dynamic head as listed in the pump characteristics. Each pump shall be fitted with stainless steel cable or lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

B. Pump Characteristics:
1. Number of Units: Two – (2)
2. Design Condition: As dictated by the design engineer for site specific application.
3. Rated Speed: min. 1170 rpm; max. 3500 rpm (with pre-approval by the Authority).
4. Rated Hp: As dictated by the design engineer for specific site application.
5. Minimum Discharge Size: 3-inches (unless otherwise approved by the Authority).
6. Voltage: 460 V
7. Phase: 3

C. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guided by a 304 or 316 SS Schedule 40 guide bar extending from the top of the station to the discharge connection. Intermediate guide brackets shall be supplied for rail lengths over 15 feet. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished to provide non-leaking connection. No portion of the pump shall bear directly on the sump floor.

D. Pump Construction:

1. Major pump components shall be grey cast iron, ASTM A-48, Class 35B or 40, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 or 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
2. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
3. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

E. Cooling System: Each unit shall be provided with an adequately designed cooling system of water jackets or integrally cast motor cooling fins. Internal oil circulation or oil filled units for heat dissipation will not be allowed.

F. Cable Entry Seal: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The entire end of the cable shall be sealed inside the cable entry housing through the use of a non-shrink epoxy resin. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

G. Motor:

1. The pump motor shall be a NEMA B design induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and the pump shall be produced by the same manufacturer.
2. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (140°F) ambient and with a temperature rise not to exceed 80°C.
3. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
4. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

H. Bearings: The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Bearings shall provide for B10 bearing life of a minimum of 100,000 hours.

I. Mechanical Seal

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft.
2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.
3. Seal lubricant shall be FDA Approved, nontoxic.

J. Pump Shaft: Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be AISI type 420 stainless steel.

K. Impeller: The impeller(s) shall be of gray cast iron, Class 35B or 40, dynamically balanced, semi-open, multi-vaned, non-clogging design having a long throughlet without acute turns capable of passing a 3" (min) spherical solid.. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Impeller(s) shall be keyed or bolted to the shaft. All impellers shall be coated or hardened to provide long life.

L. Wear Rings: A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet to insure long impeller life and continuing high efficiencies.

M. Volute: Pump volute(s) shall be single-piece grey cast iron, Class 35B or 40, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

N. Protection:
1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.
2. The thermal switches shall be connected to a monitoring unit. The unit shall be designed to be mounted in any control panel.

O. Pumps shall be Flygt.

2.02 PUMP CONTROLS

A. A control system shall be supplied by the pump manufacture containing all the mechanical and electrical equipment necessary to provide for the operation of the submersible pump or pumps as depicted on the drawings.

B. Enclosure:
1. The control panel enclosure shall be rated Nema 4X stainless steel with cam-lock and of sufficient size to enclose the flow meter transmitter and all other devices required for operation of the system.
2. The enclosure door shall be gasketed with a rubber composition material around the perimeter and shall be installed with a retainer to assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. A padlock hasp shall be provided.
3. A polished inner door shall be mounted on a continuous aluminum aircraft type hinge and shall contain cutouts for the protrusion of the circuit breakers and provide protection of the personnel from internal live voltages. All control switches, pilot indicators, elapsed time meters and other operational devices shall be mounted on the external surface of the dead front.
4. The dead front door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A ¾" break shall be formed around the perimeter of the dead front to provide rigidity.
5. A back plate shall be manufactured from 12 gauge sheet steel and be finished with a primer coat and two {2} coats of baked-on white enamel. All hardware shall be mounted using stainless steel machine thread screws. Sheet metal screws shall not be acceptable.

6. All installed devices will be permanently identified with engraved legends.
7. Panel shall be sized to accommodate mounting of flow meter transmitter.
8. The control panel shall be provided with a panel for telemetry interface. At a minimum, the telemetry interface shall monitor the following:
    a. High water level alarm in wet well
    b. Motor thermal overload
    c. Seal leakage
    d. Pump motor on/off.
    e. Five (5) spare interface connections.
9. A minimum area of 12"x12" shall be provided for the flow meter transmitter.
10. Furnish with appropriate overcurrent/overload protection for all devices.
11. Furnish with a suitable transient voltage surge suppression (TVSS) device.
12. Panel construction shall comply with NFPA 79.

C. Power Distribution:
1. The panel power distribution shall include all necessary components and be wired with stranded copper conductors rated at 90 degrees "C". Conductor terminations shall be as recommended by the device manufacture.
2. The power system shall contain incoming power terminals, motor circuit breakers and control circuit breaker.
3. All circuit breakers shall be heavy duty thermal magnetic or motor circuit protector similar and equal to Square "D" type "FAL". Each breaker shall be sized to adequately meet the operating conditions of the load and have a minimum interrupting capacity of 10,000 amps at 230v and 18,000 at 460v.
4. Breakers shall be indicating type, providing an "on-off-tripped" position of the handle. They shall be quick make-quick break on manual and automatic operation and have inverse time characteristics.
5. Breakers shall be designed so that tripping of one pole automatically trips all poles.
6. Motor starters shall be open frame, across the line, NEMA rated with individual overload protection in each phase. Motor starter contacts and coil shall be replaceable from the front of the starter without removal of the starter from its mounted position.

7. Overload heaters shall be block type, utilizing melting alloy spindles, sized for the full load amperage of the load. Adjustable overloads, definite purpose contactors, fractional size starters and horsepower rated contactors or relays shall not be used.
8. A lightning-transit protector shall be provided. The device shall be a solid state device with a response time of less than 5 nano-seconds with a withstanding surge capacity of 6500 amperes. Units shall be instant recovery, long life and have no holdover currents.
9. The following components will be supplied as standard equipment:
    a. 12 pin plug in phase/voltage monitor shall be supplied with two double pole
    b. double throw contacts
    c. Nema 4 rated Hand Off Auto or spring loaded Hand Auto switches for bypass of each pump
    d. control depending on the control selections
    e. Run/ failure lights as required for each pump
    f. Elapsed time meters for each pump
    g. Alternation with lead /lag selector/ test switch/indicators
    h. 50 watt condensation heater and thermostat.
    i. Control wiring to be 18 AWG copper-tinned rated at 105 degrees C.
    j. Each wire shall be numbered corresponding to the wiring diagram.
    k. Single phase capacitor banks will be provided when required.

D. Control Voltage Devices
1. Control transformers shall be provided to provide the 120 VAC and/or 24 VAC for control circuits. Transformers shall be fuse on the primary and secondary circuits. The secondary circuits shall be grounded.
2. A line voltage rated, adjustable phase monitor shall be installed to sense low and high voltage, loss of power, reversed phasing and loss of a phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.

E. Level Control System:
1. A 24vac control system shall be provided for the level control system. The system shall provide for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well.
2. Levels shall be sensed by stainless steel submersible liquid level transmitter adjusted to the levels as shown on the plans.

3. Each pump shall be controlled by the level control system. The pump(s) shall remain "on" until a common "off" level is reached.
4. Three (3) back-up float, mercury-type regulators shall also be provided.
5. At the conclusion of each pump cycle, an alternator shall switch the pumps on the next cycle to equalize run time on the pumps.
6. In the event the submersible transducer fails, the system shall sense the failure and switch the "off/on" level to the float regulators.
7. The system shall provide indication for the regulators and indicate a failure of the submersible transducer.
8. Controls contingent on the "off" float regulator supplying control power to the other regulators is not acceptable.
9. The third float regulator shall serve as a back-up high water alarm in the event of failure of the submersible transducer.
10. A. Level Control System Controller shall include the following features.
    1. Bar graph level display – 30 segment LED
    2. All level settings may be viewed or changed from front of unit
    3. Analog level input source
    4. Level input zero and span calibration
    5. 24 vdc power supply
    6. Phoenix style connectors
    7. Two (2) pump call relay outputs
    8. High level and low level alarm relay outputs
    9. Duplex alternation
    10. 10 second power-up delay
    11. 5 second lag pump delay
    12. 90 second low level alarm delay
    13. Level simulation

    B. Controller shall be Motor Protection Electronics Station Controller SC100, or approved equal.

F. Pump Protection Features
1. Thermals or Clixons in the pump that will de-energize the pump starter and allows for automatic restart when the condition clears.
2. Moisture sensing and thermal failure solid state plug in control devices shall be installed to measure out of tolerance conditions in the pump motor. Failure indicators shall be provided. In addition, the alarm circuit shall be activated and show the cause of failure.

G. High Level Alarm Features

1. A high level alarm horn shall be provided with alarm silence button and relay. The alarm horn shall be mounted on the left side of the enclosure with a back box. The alarm horn shall provide a signal of not less than 90db at 10 feet.
2. A 40W high level alarm light shall be provided with globe, guard and mounting hardware. Mount externally on top of control panel.

H. Provide the following spare circuit breakers in the Control Panel

1. 1 – 120 V SPST, 20 amp breaker for GCFI convenience outlet.
2. 1 – 120 V SPST, 20 amp breaker for telemetry.
3. 1 – 120 V SPST, 20 amp breaker for flow meter.
4. 1 – 120 V SPST, 20 amp breaker for GFCI outlet in backflow preventer enclosure.
5. 1 – 120 V SPST, 20 amp breaker for sump pump in valve vault.

2.03 Access Hatches

A. Hatch shall be sized by the pump manufacturer to insure adequate opening and clearance for removal of either pump.

B. Cover: Shall be reinforced to support a minimum live load of 150 psf.

C. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of the opening and closing.

D. Operation of the cover shall not be affected by temperature.

E. Entire door, including all hardware components, shall be highly corrosion resistant consisting of aluminum or stainless steel.

F. Cover: Shall be ¼" aluminum diamond pattern.

G. Frame shall be extruded aluminum with drain coupling under the frame for a pipe connection to a disposal system.

H. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

I. Hardware:

a. Hinges: Heavy forged aluminum with ¼" type 316 stainless steel hinge pins.
b. Cover shall be equipped with a hold open arm which automatically locks the cover in the open position.
c. Latch shall be type 316 stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle and locking mechanism.

2.04 Pressure Gauges

A. Provide two (2), four-inch diameter, oil-filled pressure gauges with snubbers. Gauge shall be marked incrementally to 100 psi (or higher if pump design conditions exceed this point). Gauges shall be tapped and mounted on the discharge header for each pump in the valve vault.

2.05 Miscellaneous

A. A final as built drawings of the control panel schematic encapsulated in Mylar shall be attached to the inside of the front door. A list of all legends shall be included.

B. All control panels shall be listed by a nationally recognized testing laboratory [NRTL] and apply the certification necessary to indicate the NRTL approval.

C. All intrinsically safe controls shall be certified under UL Hazardous location with UL913 devices acceptable for use in class I, II, III, division I locations in addition to the NRTL recognition.

D. All equipment shall be guaranteed for a period of three (3) years from the date of shipment. The guarantee is effective against all defects in workmanship and / or defective components. The warranty is limited to the replacement or repair of the defective equipment.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install base elbows with embedded anchor bolts. Use of expanding anchor bolts to secure base elbows is not permitted.

B. Install pumps in accordance with manufacturer's instructions.

C. Provide for connection to electrical service.

D. Lubricate pumps before start-up.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection testing.

B. Manufacturer's Field Services: Furnish factory-authorized service representatives to inspect equipment during installation, to assist in adjusting and testing, to supervise initial operation, and to make final adjustments as necessary to assure satisfactory operation.

C. Minimum Length of Field Services: 2 trips, 1 day per trip, exclusive of travel time from pump manufacturer.

D. Test pumps in presence of the Authority to verify specified capacities and operating characteristics are developed. A minimum of 72 hours notice shall be provided to the Authority for scheduling observation of pump testing. Failure to notify Authority of pump testing will require re-scheduling of testing. Trips made by manufacturer representative without proper advance notice will not be considered as meeting the requirements of this section.

E. Make repairs and retest pumps and drives until specified capacities and operating characteristics are achieved.

F. Furnish labor, piping, equipment, and materials necessary for conducting tests.

3.03 DEMONSTRATION

A. Equipment demonstrations and instructions are in addition to other Manufacturer's Field Services specified in Paragraph 3.02.

B. Check each pump for correct rotation.

C. Check each pump motor for amperage draw.

D. Check each pump for specified discharge head and flow rate. Cross-check pump drawdown in wet well versus the flow rate given by the flow meter.

E. Check all level controllers for proper sequencing and operation. Check back-up level switches for operation. Check for all alarm conditions by simulating failures.

3.04 INSTRUCTION MANUALS

A. Manufacturer shall furnish, prior to initial testing, two (2) copies of an indexed maintenance manual composed of maintenance manuals on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished. Maintenance manuals are to be of a hardback, loose-leaf type and of a durable quality. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted.

B. Each set is to include the following:
   1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
   2. Control and wiring diagrams.
   3. Installation, operation, lubrication and maintenance instructions.
   4. Manufacturer's recommended spare parts lists.

END OF SECTION

SECTION 3.08

FIELD INSTRUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes:

1. In-line Flow Meters.

1.02 REFERENCES

A. I.S.A. – Instrument Society of America

B. Hydraulic Institute

C. ANSI – American National Standards Institute

D. NEMA – National Electrical Manufacturers Association

E. UL – Underwriters Laboratories

F. NEC – National Electric Code

1.03 PERFORMANCE – GENERAL REQUIREMENTS

A. The instrumentation equipment shall be furnished by a manufacturer regularly engaged in the manufacture of process instrumentation equipment and systems for water and wastewater treatment facilities. The instrument manufacturer shall produce detailed drawings for the complete coordination and installation of the various system components; shall provide the services of a qualified engineer to supervise the installation; and shall test and make any adjustments required, at no additional cost to the Owner, to the extent that the system initially functions as intended by this specification to the satisfaction of the Owner.

B. Owner's Representative will check after the Contractor certifies that all the instruments are installed and are operating as per intended specification. The Contractor shall be required to correct, at no extra cost to the Owner, all deviations and/or deficiency from the intended use of the instruments individually as well as the system in its entirety, which the Owner's Representative may find during the detail checkup of the system(s).

C. Equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Contractor shall examine the architectural, structural, mechanical, electrical and shop drawings for the various pieces of equipment in order to determine the exact routing and final terminations for conduits and signal lines. Instrumentation work shall be carefully coordinated between the various trades in order to secure the best arrangement of the work as a whole. No changes in the work shall be made without written acceptance of the Owner.

D. The Instrument Contractor shall submit evidences of his prior experience, technical skill, capacity to handle a project of the volume and reference of other clients for whom he has performed similar installations.

E. Services by Manufacturer and Guarantee:

1. Certification sheets shall be prepared by the Instrumentation Manufacturer to guarantee that each component has been calibrated and commissioned prior to start-up. Certification sheets shall be signed and dated by the Instrumentation Manufacturer. All instruments shall be calibrated by an instrument traceable to a primary standard. All instruments shall be calibrated to within the accuracy stated by the manufacturer. Each instrument shall be checked for zero and full span and in addition, a check shall be made of minimum of 5 points between 10 and 90 percent of the actual span for each analog instrument. The certification sheets shall show "as found" and "as left" readings.

2. After all tests and adjustments have been made, the manufacturer shall fully instruct the Owner's Representative in all details of operation and maintenance of equipment installed under his work.

3. The Contractor and his surety shall guarantee in writing for a period of one year from the date of final acceptance that all materials,

equipment and labor furnished by him are free from defects. The Contractor shall further guarantee that if any piece is found to be defective within the guarantee period because of faulty manufacturing, faulty installation or workmanship, in the opinion of the Owner's Representative, the Contractor will replace and install such material or equipment without any additional expense to the Owner.

F. Installation, Calibration, Commissioning and Start-Up Assistance

1. Work Included
   a) Install, calibrate, commission and assist in the start-up of instrumentation and controls including those furnished with purchased equipment in accordance with this specification section, the applicable design drawings and other Contract Documents.
   b) Furnish and install all necessary instrumentation materials and piping required to perform the work.

1.04 GENERAL INSTRUMENT CONSTRUCTION

A. Attachments and Supports

1. All instrumentation and electrical equipment shall be securely supported. It shall be the responsibility of the Contractor to provide adequate support for all equipment he installs. Methods of support shall be subject to the approval of the Owner.
2. All fastenings, supports, hangers, clamps, and anchors shall be of the type made for the specific purpose for which they are to be used. Toggle bolts or machine bolt fastenings shall be used for hollow tile, terra-cotta, or lath construction. Machine screws shall be used for structural steel fastening. Lead expansion shield and machine screws shall be used for solid masonry fastening. Lag screws or bolts shall be used for wood fastening. All conduit and tubing shall be rigidly and firmly installed to prevent swaying, vibration or sagging by malleable or wrought steel hangers of standard design, pipe clamps, or fabricated steel supports of approved design. Hangers for horizontal conduit runs shall be adjustable clevis type. Perforated strap iron hangers are not permitted.
3. All exterior fastening devices shall be Series 304 stainless steel.
4. Panels and other equipment that are located on subgrade walls in unfinished areas or in damp locations, shall be mounted on square aluminum channel.

B. Identification Nameplates

1. All sensors, transmitters, terminal and junction boxes, and similar or related items shall be identified by name, function, and/or control. Nameplates shall be at least 1" x 3" with characters not less than ¼ inch. They shall be made up of 2 laminated white plastic sheets bonded with a middle sheet of black plastic and characters engraved in one white sheet to the depth of the black plastic. Nameplates shall be attached with sheet metal screws or bolts and nuts.
2. Plastic tape embossed nameplates will not be acceptable.

C. Instructions

1. After all tests and adjustments have been made, this Contractor shall fully instruct the representatives of the Owner in all details of operation and maintenance of equipment installed under his work.

D. Materials

1. All material shall be new, free from defects, and of the quality specified or shown. Each type of material shall be of the same manufacture throughout the work. All material shall be the product of established, reputable manufacturers normally engaged in the production of the particular item being furnished.
2. Care shall be exercised in the installation of all equipment to avoid damage or disfiguration of any kind. All equipment shall be protected from dust and moisture prior to and after installation. The panels and consoles shall be covered with a heavy polyethylene plastic sheet or laminated kraft paper having a moisture barrier during all stages of construction.
3. Equipment which is stored in unheated or open areas on the job shall be provided with thermostatically controlled heating units of sufficient size to keep the temperature of the equipment above the dew point.
4. Failure of the Contractor to protect the equipment as outlined herein shall be grounds for rejection of the equipment.

E. Indicating Scales

1. All instrument components furnished under this Contract requiring indicating scales or meters shall be furnished with the appropriate

ranges and engineering units. Indicating scale reading 0-100 percent will not be acceptable.

1.05 TESTING, CALIBRATION AND COMMISSIONING

A. As preparation for the calibration and commissioning of the instrumentation, the Contractor shall:

1. Visually inspect electrical devices and connections for compliance with specifications, drawings and manufacturer's recommended installation practice.
2. Remove all shipping stops and install components such as charts, etc., which have been supplied separately but are integral parts of the instruments.
3. Operationally check all instruments, including those provided with equipment and marked on the "piping and Instrument Diagrams". After, or during checking, each instrument shall be calibrated and commissioned.
4. Furnish and report forms recording the calibration of all devices and settings of all final adjustments.
5. Check calibration of all instruments with respect to zero, span and linearity. Calibrate instruments individually. Attach a calibration sticker to each item after calibration. Furnish a signed calibration report for each instrument.
   a) If, during calibration procedures, any reason is discovered to question the conformance of any device or installation with applicable codes and regulations, the Owner shall be notified so that corrective measures may be taken.
   b) When doubt exists as the correct method of calibrating an instrument, the manufacturer's printed recommendations shall be used.

1.06 INSTRUCTION MANUALS

A. The Contractor shall provide the Owner with 3 complete sets of manufacturer's operating and maintenance instructions and recommended spare parts lists for all instrumentation equipment furnished.

PART 2 – PRODUCTS

2.01 IN-LINE MAGNETIC FLOW METERS

A. Size as shown on Contract Drawings.

B. Flow Meter Characteristics:

1. Accuracy: ± 0.5% of reading ≥ 2.0 fps; ± 0.01 fps for < 2.0 fps.
2. Flow range: 0 – 2 fps minimum to 0 – 50 fps maximum.
3. Coil excitation: Pulsed DC excitation.
4. Environmental Protection: NEMA 6 and IP68 indefinitely submersible to 30 feet water column.
5. Internal grounding electrode on each sensor or stainless steel grounding ring.
6. Carbon steel body with polyamide or 2 component coating.
7. Stainless steel flow tube.
8. Liner: Hard-rubber or ebonite.
9. Electrodes: Hastelloy C22 or C276.
10. AISI/ASME 150 lb. flanged connections.
11. Cable length from flow meter to transmitter: Contactor to field verify to meet field conditions.
12. Medium to be measured: Domestic raw sewage.
13. Ambient temperature operating range: -40^0 F to 149^0F.
14. Medium temperature range: 32^0F to 158^0F.
15. Junction box: aluminum.
16. Rating: FM ordinary; CSA Class 1, Division 2.
17. Meter Manufacturer: Foxboro 9100A Series or Krohne OptiFlux 2000 Series.

C. Transmitter:

1. Wall-mount, epoxy coated, cast aluminum or polyester coated aluminum enclosure, NEMA 4 rating. Transmitter to be mounted in the pump control panel.
2. Cable entry: 4 non-threaded holes for ½" conduit.
3. Communication interface: HART protocol
4. Analog outputs: 4-20 mA outputs.
5. Transmitter Power Supply: 120V
6. Low flow cut-off.
7. Self-diagnostic with empty pipe detection.
8. Display: LCD display with integral push-button operation.
9. Operating language: English
10. Diagnostics: All necessary diagnostics, readings and system status to be available via front panel keypad.
11. Capable of measuring instantaneous flow and bi-directional flow in units of gallons/minute.
12. Capable of totalizing flow by day and by month.

13. Transmitter Manufacturer: Foxboro IMT25 Series or Krohne IFC 100 Series.

PART 3 – EXECUTION

3.01 MANUFACTURER'S SERVICES

A. All manufacturer's visits to construction site prior to final performance test shall be the responsibility of the Contractor. The Contractor shall furnish the Owner with services of equipment manufacturer's representatives for a period of 1 man-day. The pumping station shall be fully operable and capable of pumping medium at its designed flow rate so start-up and calibration can occur. If station is not operable, then start-up services flow the flow meter will not be considered complete until such time pump station is fully operable.

B. Applicable contract prices shall include the furnishing of all said services. Furthermore, said services shall be additional to those furnished in connection with equipment erection, installation, testing and the correction of deficiencies. Services provided shall consist of furnishing detailed instructions to personnel of the Owner regarding equipment operation and maintenance.

3.02 INSTRUCTION MANUALS

A. Contractor shall furnish, prior to initial testing, three (3) copies of an indexed maintenance manual composed of suppliers' maintenance manuals on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished. Maintenance manuals are to be a hardback, loose-leaf type and of a durable quality. Manuals are to be for the specific equipment provided. Manuals describing general equipment lines will not be accepted.

B. Each set is to include the following:
   1. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.
   2. Control and wiring diagrams.
   3. Installation, operation, and maintenance instructions.

3.03 INSTALLATION

A. Install per manufacturer's recommendations. Device shall be calibrated per manufacturer's recommendations. If inadequate sewage flow into pumping

station is not available for testing and calibration of the flow meter, Contractor shall provide adequate water into the station in order to perform testing and calibration of the flow meter.

B. Flow meter transmitter/signal converter shall be mounted in the pump control panel.

C. Maintain manufacturer's recommended distance upstream and downstream of flow meter with no other pipe interferences such as bends or tees.

D. Install power wiring and communication signal wiring between the meter and the transmitter/signal converter in two (2) separate conduits. Placement of power wiring and signal wiring in the same conduit is not permitted.

E. Where required by the manufacturer for correct operation, grounding rings shall be employed on the meter flanges.

3.04 WARRANTY

A. Warranty shall be for one (1) year from date of acceptance of the entire pumping station by the Owner. Operational start-up of the meter alone without the entire pumping station being placed into service will not be considered as beginning of warranty date for flow meter devices.

END OF SECTION

SECTION 3.09

TELEMETRY

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system for the sanitary sewer pumping station to function as specified herein and as shown on the drawings. The system integrator's shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the system integrator's responsibility to supply a system that is compatible with existing equipment, new equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.

B. Scope of Work

1) This section covers a new radio telemetry based SCADA and Instrumentation System for the new pumping station site.

2) The Central Terminal Unit located at the Limestone County Water and Sewer Authority Office shall be the basis of control and shall interrogate the remote units to send control data and receive level, flow, and status and alarm data as detailed from the remote unit. The existing CTU and Man Machine Interface (MMI) software will be modified to support the addition of the Pump Station (additional tag points).

1.02 APPENDIX: DETAILED EQUIPMENT DESCRIPTION

A. Sewer Pump Station Requirements:

1) Installation Requirements:
   a) Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Indicating lamps shall display the status of these outputs on the front of the enclosure.

b) Flow rate and totalizing shall be as specified in Section 3.08.
c) The pump station equipment shall be housed in a NEMA rated enclosure as described herein located adjacent to the pump station control panel as noted on the plans. The station equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor. Provide a receptacle for programming laptop fused at 3-5 amps.
d) The antenna shall be mounted on a on an antenna tower as specified herein with 3/4" rigid conduit and a weather-head run to the RTU enclosure. Height shall b dependent on signal strength and distance from the CTU. Telemetry provider shall conduct a antenna assessment at each telemetry site and determine the actual antenna height/

2) CTU Communications Method:
   a) The CTU shall communicate with these RTUs via UHF radio communications as detailed previously.

3) Front Panel Display Requirements: Indicating lamps for discrete inputs.

4) Discrete Outputs:
   a) Pump #1 CALL
   b) Pump #2 CALL

5) Discrete Inputs:
   a) Power Failure
   b) Pump #1 RUNNING
   c) Pump #2 RUNNING
   d) Pump #1 High Temperature (Contact by others)
   e) Pump #2 High Temperature (Contact by others)
   f) High Water Alarm
   g) Communications Failure
   h) Phase alarm

6) Analog Inputs:
   a) Provide for five (5) analog inputs
      1) speed feedback (2 pumps)
      2) motor current (2 pumps)
      3) flow rate or line pressure input

7) Pulse Inputs:
   a) Pump Station Out-Flow Rate & Total

8) Analog Outputs:
   a) Provide for two (2) analog outputs
   b) If a VFD is used, output Speed Command for each VFD.

1.03 WORK TO BE SUPPLIED

A. All equipment required by schedule.

B. All labor and material for RTU installation at the Pump Station.

C. Engineering submittal and shop drawings prior to installation.

D. All the paper work and fees necessary to obtain a FCC radio license in the name of the Owner including update of existing site list and any applicable fees.

E. All ancillary equipment, hardware, software, and appurtenances needed for proper installation and operation of equipment including PLC programming software and instrument programming software if used.

F. Installation of the RTU panel and wire terminations from the RTU to the interface panel.

G. Operations and maintenance manuals as detailed below.

H. All start-up labor and services.

I. All operator training on use of the RTU and software.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio telemetry/control systems for water and wastewater installations.

The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacture and shall certify this to the Engineer in writing at the time of bidder pre-qualification.

1.05 CODES AND STANDARDS

A. The control system and its components shall comply will all applicable requirements of the following:
   1) Electrical Code Compliance (National & Local)
   2) UL 508A
   3) NEMA Compliance
   4) IEEE Compliance
   5) EIA Compliance
   6) FCC Compliance

1.06 APPROVED SYSTEM INTEGRATORS

A. The base bid shall be based upon a system as supplied by **Control System Inc., Montevallo, AL (contact John Gordan)** to insure compatibility with existing system.

1.07 SUBMITTALS

Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

A. Product Data

Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

B. Shop Drawings

Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.

C. Panel Layout Drawings

A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.

D. Installation Drawings

Typical installation drawings applicable to each site in the system shall be included.

E. Operator Interface Software

The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:

1) Sample text screens and menus
2) Sample graphics screens
3) Sample report logs and printed graphs

1.08 JOB CONDITIONS

All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

A. Outdoor:

The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.

1.09 DELIVERY, STORAGE AND HANDLING

All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.10 SEQUENCING AND SCHEDULING

A. Coordination:

The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B. Sequence:

Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 DISTRIBUTED CONROL OPERATION DESCRIPTION

A. General:

The control system shall use "Programmable Logic Controllers" (PLCs) for the Central Terminal Unit (CTU) and Remote Terminal Units (RTUs). The system shall be a "distributed intelligence" type control system that provides the features of both a "Central Control" (i.e. centralized control of RTUs from the CTU) and "Distributed Control" (i.e. RTU self control using local inputs and peer-to-peer communications) in to a unified control system. The control system shall support master-slave (i.e. CTU to RTU) and peer-to-peer (i.e. RTU to RTU) communications to provide completely automatic control with no single point of system failure.

The control system will operate over the existing licensed radio system and will support serial communications as required by these specifications. Each remote site in the system shall be assigned a unique digital address.

The software programs used at all locations shall be stored in non-volatile EEPROM or Flash type memories that are field re-programmable using software detailed later in these specifications. The system shall be "self-initializing" and not require operator intervention after power interruptions, transients from lightning storms, or component changes. All units in the system shall include "watch-dog" circuitry to insure automatic restarts of the system.

The term "Central Control Unit" shall refer to the combination of computers and display devices used at the existing Main Control location. The existing "Central Unit" is composed of two separate computer systems communicating over an Ethernet Network. The first computer (called the Central Terminal Unit or CTU) provides all communications with remote units. The second computer (called the Operator Display Console or ODC) is responsible for the operator

interface to the system and provide display, alarm, and logging of all data.

The CTU addresses each remote site in sequence, to send command data and receive status, alarm, flow, pressure, and level data as required from each site. The Central Unit shall indicate, display, alarm, and record (by CTU hardware and/or ODC software as detailed in the Central Unit section of this specification) all information received. Data received shall be compared to set points, hand-off-auto control selections, and pump control logic to generate control outputs.

B. Central Unit "Centralized Control" Software Features:

The Central Unit control algorithms shall have the ability to integrate both hardware and software operator inputs at the Central Unit along with hardware inputs at the remote sites in to a cohesive automatic operating control system. As data is received, changes, or lost (i.e. a loss of signal from a RTU or CTU), the Central Unit control logic shall automatically adjust the controlling algorithm to the new situation. At a minimum the control logic shall provide the following features:

1) Monitor input conditions at RTUs to determine the validity and/or usability of controlling input signals (i.e. altitude valves must be open before controlling pumps from the associated tank level). Additionally, determine the correctness of generating pump call commands (i.e. monitoring high discharge and low suction cut-off controls at pump stations) before starting or running pumps.

2) Integrate fully automatic control of up to 8 pumps (at up to 8 separate locations) from up to 8 different levels. The Central Unit shall be able to automatically transfer control from one level to another or from one pump to another in the event of RTU failure.

3) Automatic alternation/staging type operation pumps of identical or differing capacities. The CTU shall integrate different combinations of pumps in to the operation of each stage and automatically choosing alternate combinations of pumps for each stage should a pump fail or otherwise not be available (i.e. HOA is off). The CTU shall automatic alternate like sized pumps and automatic transfer to the next available pumping stage in the event of pump failure. Provide a local/remote selector switch when in "remote" the CTU does all control and in "local", the local PLC handles alternation and other control.

4) Automatic transfer of pump call to the next available pump on pump failure with out waiting for the controlling level, pressure, or flow to degrade to the next start level.

5) The Central Unit shall be capable of integrating both software (on the ODC) and HOA selector switches at remote units (if specifically listed in the RTU input/output requirements).

C. RTU "Distributed" Control Software Features:

All RTUs shall be capable of providing local control to augment and/or replace Central Control operations as detailed in the appendix. Setpoints for "distributed" control at the RTUs shall be operator settable from the Central Unit, and an optional portable computer. The RTUs shall be capable of implementing the following control operations

1) Automatic Flow pump staging operation of pumps.

2) Logging and alarming of high level event in the wet well.

3) The RTU shall be able to implement back-up modes of control in the event of CTU failure.

2.02 RADIO CHANNEL DATA OPERATION

A. General:

The control system shall be specifically designed for radio channel data communications. All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed. The Systems Integrator shall select radio equipment as detailed below to insure reliable operation and be able to implement all software features listed in this specification whether currently required or described as a "shall be capable" feature.

B. Communications:

The control system shall operate in a half-duplex mode over a single UHF (450-470 MHz) frequency. The UHF shall operate under Part 90.35 and 90.238 for secondary fixed operations. The system will still be required to operate with point-to-point operation within the FCC rules and regulations and provide the same RF path margins as detailed in

these specifications. The existing frequency shall be confirmed with the Authority.

To facilitate system layout and future expansion all RTUs shall under the direction of the CTU be able to implement store-and-forward communications to relay data and commands to and from other RTUs as required to establish the desired path. Should the assigned relay site for a distant remote be inoperative, the Central Unit shall automatically choose another remote site to access the distant remote. Any RTU shall be able to provide automatic antenna switching as part of their relaying operations.

All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission. All transmissions shall include the address of the sender and the receiver, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the sites and to provide a means of extensive de-bugging.

C. FCC Licensing:

The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required obtaining a license on behalf of the Owner.

2.03 RADIO TRANSCEIVERS AND ACCESSORIES

A. General:

The radio transceivers shall be standard "un-modified" mobile two-way that an be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60seconds. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the 3KHz to 6KHz narrow band splinter in the Industrial/Business radio service.

B. UHF Radio Transceiver (Existing Frequency):

The system manufacturer shall supply a 5-watt UHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:

RF output power	5 watts minimum (adjustable to 2)
Spurs & Harmonics	16 dBm (25uW) (or –50dBc)
Frequency stability	±0.00025% (-30 to +60 degrees C)
Emission	6F2 (2.5kHz DEV max) or 3F2 (1.2kHz DEV max)
FM hum and noise	-40 dB

Receiver:

Sensitivity	.35uV @ 12 dB SINAD (.5uV @ 20db quieting)
Selectivity	-65 dB
Spurious image rejection	-50 dB
Intermodulation	-65 dB
Frequency stability	±0.00025% (-30 to +60 degrees C)
Receive bandwidth	*6 kHz (or 3kHz) as required to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db.

The radio transceivers shall be a current model Kenwood radio or equivalent.

C. Antenna & Coaxial Cable:

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter solid aluminum rod elements and 1-1/16" diameter aluminum pipe element support with a type N coaxial connector. The antenna shall have a minimum 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100-MPH wind speed. The VHF antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390S. The UHF antennas shall be MC-Yagi or Celwave PD688S.

Antennas shall be cabled to the transmitter enclosure connection by a coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. Size of antenna cable shall be determined by the overall length of cable from the antenna cable to the transmitter enclosure.

D. Antenna Lightning Protection:

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1.

E. Antenna Mounting Systems:

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

1) Antenna Towers (>20 feet): A bracketed antenna tower shall be supplied where specifically noted on the plans. The tower shall be assembled from 10 ft. sections built on a 12-1/2" (or 18" for ROHN 45G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Self-supporting Model 25G (for heights of up to 40 feet) or ROHN Self-supporting Model 45G (for heights up to 45 feet).
2) Antenna Towers shall be properly grounded per the National Electric Code.

2.04 INSTRUMENTAION AND ACCESSORIES

A. General:

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction, make use of a

plug-in wiring harness, use plug-in terminal blocks, and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU and CTU input/output sections of this specification.

B. Power Supplies:

The DC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. They shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supplies shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power supplies shall be a Mini-Line PULS ML50.102 or approved equal.

C. Power Back-up Operation:

The remote units indicated shall be supplied with un-interruptable power source. APC BX 350 or equal.

D. Single Phase 120VAC Power Line Lightning Protection:

Every site in the system shall be equipped with AC line filtering and lightning protection. The equipment shall provide 2-stage lighting/transient protection including inductive and capacitive filtering and MOV over-voltage protection.

2.05 REMOTE TERMINAL UNIT & LOCAL I/O EQUIPMENT

A. General:

1) The Remote Terminal Units (RTUs) shall be "smart" Programmable Logic Control (PLC) units at all locations. The core software program used at all locations shall be identical and stored in non-volatile FLASH type ROM memories that can be upgraded in the field by the owner using configuration software supplied as part of this contract. The core RTU software shall provide the basic operational logic including communication with other sites in the system, responding to control commands from the CTU, and

providing back-up peer-to-peer control in the event of a CTU failure. The RTUs shall be a ScadaPack 334 from Control Micro Systems.

2) Program and configuration data shall normally be stored in battery-backed or flash type memory for use by the CPU. In addition, this data shall also be stored in a plug-in operator interchangeable EEPROM memory module. This module shall be fully enclosed with no exposed electrical leads, providing protection against damage due to handling and static electricity. The module shall be programmed via the CPU and without the use of external adapters. The RTUs shall include "watch-dog" circuitry and be "self-initializing" without operator intervention. In the event that the program or configuration data is corrupted, the CPU shall reload the program and configuration data from the EEPROM memory module.

3) The RTUs shall be fully online programmable while the RTU continues to communicate with the rest of the system and performs its assigned control tasks. The RTUs shall support “fill-in-the-blank” type configuration for basic operation and to set-up common features such as COM port set-up, peer-to-peer data collections, local back-up control set points, input and output setup, output on/off time delay settings, front panel display setup, etc. The RTU shall also support a process script language or ladder logic type programming for site-specific customizations including special input and output manipulations, local sequential control, math functions, and PID control as follows:

Relay (Bit) Type	- Examine if ON, Examine if OFF
Timer & Counter	- Timer ON, Timer OFF, Timer DONE
Compare Functions	- Equal, Not Equal, Greater Than, Less Than, etc
Math Functions	- Add, Subtract, Multiply, Divide, Square Root
Scaling Functions	- Scale & Scale with Parameters
Logical Functions	- AND, OR, & NOT
Program Control	- Jump & Skip Next functions
PID	- PID with compound loop input

4) The RTU/PLC programming software shall be written for the 32 bit interface of Win98/NT/2000. The supplier shall provide a licensed copy of the RTU configuration and programming software along with the necessary communications cables to the owner. Training on

the use of the software shall be provided as part of the system training.

B. Construction:

1) The RTU shall use modular construction. The base unit shall be composed of the power supply, CPU, communications modules, and basic inputs and outputs. The unit shall have expandable inputs and outputs via either a card rack design or integrated high-performance serial I/O bus. All terminations on the RTU or expanded I/O shall use removable, NEMA-style "finger-safe" terminal blocks on the controller and I/O.

2) The RTU shall be capable of being powered from AC, DC, or solar sources. DC and solar powered RTUs shall have an integral battery charging circuit that protects the external battery from over and under voltage conditions and provides automatic charging of the battery after power failures. The back-up power supply shall be either 12VDC with 24VDC DC/DC converter or 24VDC with a 12VDC DC/DC converter to run the 12VDC radio and 24VDC to power external sensors from a single battery source. Series tapped 24VDC batteries for 12VDC will not be allowed. Back-up batteries shall be rechargeable sealed lead-acid type batteries as manufactured by PowerSonic or equal. The back-up battery shall provide for 24 hours of back-up operation at water tower remote units and 3 hours at all other sites.

3) The RTU shall have a minimum of two (2) communications ports. The first shall be used primarily for CTU-RTU and RTU-RTU communications. It shall support baud rates of 110-19,200 baud and have a plug-in standard 25pin or 9pin sub-D connector that provides both full RS232 interface and radio modem interface for use with either "data" radios or standard business band type radios (i.e. radios with out internal modems). This port shall also have a 9 pin sub-D connector to allow monitoring of the communications activity. The second communications port shall provide for multi-drop type communications with operator interfaces, external inputs and outputs (I/O), and programming terminals. The port shall provide for both 2 and 4 wire RS485 interface with data rates to 9600 baud. The communications ports shall include LED's to show the status of all control lines.

4) The RTU shall provide for sufficient installed and configured spare inputs and outputs (I/O) to meet the site requirements as detailed and provide for 25% spares of each type. The unit shall have a

minimum of (2) discrete (relay) outputs, (8) discrete inputs (DI), (2) analog outputs (AO), (5) analog inputs (AI), and (1) high speed pulse input (PI). The analog and pulse inputs shall provide for sensor excitation with separate fuses for each input. The fuses may be the self-resetting type. All input and output connections to the RTU shall be via Nema "finger-safe" plug-in terminal blocks. The RTU inputs, outputs, and operator interface shall be as follows:

a) Discrete Outputs - The discrete outputs shall be isolated relay outputs rated at 5.0A continuous @ 240VAC. LEDs on the front of the RTU base unit or expansion module shall indicate the status of each output point. Interposing relays shall be provided if the voltage or current of the external load on a contact exceed the 5.0A 240VAC ratings. Each output shall be provided with operator settable software ON and OFF time delays

b) Discrete Inputs - The discrete inputs shall be optically isolated and provide for 120 VAC excitation to remote sensors and switches. Each input shall be separately fused or current limited such that accidental grounding shall not render the other inputs non-functional. LEDs on the front of the input module shall indicate the status of each input point.

c) Analog Inputs - The analog inputs shall provide filtered and scalable analog to digital conversion of input signals. The analog inputs shall be switch selectable from 0-5VDC to 0-20mADC and provide a minimum of 0.3% resolution and 0.5% accuracy over the temperature range of 0-70degrees C. The RTU shall provide separately fused 24VDC excitations to the remote sensors.

d) Analog Outputs - The analog outputs shall provide a 0-5VDC signal to RTU panel mounted devices or 4-20mA isolated signals if sent to other panels as specified.

e) Pulse Inputs - The high-speed counter/pulse inputs shall provide for pulse rates up to 1KHz direct from flow meter transmitter heads without interposing equipment. The pulse input shall include fused 12VDC excitation to the meter transmitter.

f) Power Supply - Each RTU assembly shall include an integral power supply. Power supplies shall be designed for 12VDC or 24VDC input power and suitable for use in battery back-up operations. DC/DC converters shall be required to insure that

both the 12VDC and 24VDC are regulated separately from the common source.

C. Enclosures:

Remote site installations requiring equipment to be mounted outside shall have a double box enclosure with the remote unit enclosure mounted inside a lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seems free sides front and back, and a stainless steel hinge pin. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

The remote unit enclosures mounted in damp corrosive areas (such as concrete meter vaults) shall be NEMA Type 4X rated enclosures. The enclosures shall be made of molded fiberglass polyester and be furnished with external mounting feet. The door shall have a seamless foam-in-place gasket and corrosion-resistant hinge pin and bails. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be a light gray inside and out. The subpanels shall be finished in white. Nema 4X enclosures shall be Hoffman "Fiberglass Hinged Cover".

D. Front Panel Hardware Displays:

As detailed in the appendix, the RTU units may include front panel displays of the specified inputs and outputs. The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

E. Local Control Functions:

In general the RTU shall be programmed to provide generic control functions as detailed earlier and to work in concert with the CTU. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

PART 3 - EXECUTION

3.01 EQUIPMENT EXAMINATION

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

3.02 SYSTEM START-UP

The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Authority during the warranty period.

3.03 TRAINING

The system manufacturer shall supply "factory" personnel to conduct two separate on-site training sessions, totaling a minimum of one day of training.

The initial training session shall be conducted during start-up as needed until the Authority is satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the Authority's personnel.

3.04 SUBSTANTIAL COMPLETION

The Authority will grant substantial completion only after completion of the start-up and initial training phase of the project. The Authority shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Authority. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

3.05 WARRANTY/SUPPORT PROGRAM

The control system manufacturer shall supply a **one (1)** year parts and labor warranty and comprehensive support program from date of substantial completion for all new items and software supplied under this section (except as noted below). Power surges and lightning damage shall not be included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the Authority. The manufacturer shall provide a 24-hour response to calls from the Authority. The manufacturer, at his discretion, may dispatch replacement parts to the Authority by next-day delivery service for field replacement by the Authority.

The support program shall begin from the time of "substantial completion" as issued by the Authority. The support program shall include free updating of all software as needed and providing free phone support from the integrator throughout the warranty period.

END OF SECTION

SECTION 4.01

WATER LINES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All contractors installing water or sewer infrastructure in any way related to the distribution of collections systems of the Authority, must be a licensed General Contractor in the State of Alabama. This license must also declare a major classification of Municipal and Utility (MU) and/or Municipal and Utility Specialty (MU-S). Work performed by any person or company not possessing the proper license will not be accepted into service for the water distribution and sewer collection system.

B. Contractor shall be responsible for safely storing materials needed for work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

C. Trenching includes excavating, backfilling, compacting, disposing of surplus material, and all other work incidental to the construction of trenches for utilities and buried appurtenances, including additional excavation which may be required for structures forming a part of the pipe line.

D. Excavation includes removal of quicksand, hardpan, boulders, clay, rubbish, unforeseen obstacles, underground conduits, pipe, drain tile, trees, root, timber or masonry structures, pavements, sidewalks, and all other obstacles encountered. No claim for additional payment will be accepted because of the character of the ground in which the excavation is made. Excavation will be classified with separate payment for rock excavation.

E. Reaction blocking is required at all fittings. It shall be considered an integral part of the water line work, and no separate payment shall be made for it.

1.02 RELATED SECTIONS

A. Section 2.14 Trenching, Backfilling and Compaction for Utilities
B. Section 2.15 Unclassified Excavation for Utilities
C. Section 4.02 Valves Hydrants and Blowoffs

PART 2. PRODUCTS

2.01 MATERIALS

A. Bedding and backfill material shall be size No. 67 in accordance with the Alabama Department of Transportation's Standard Specifications for Road and Bridge Construction or satisfactory soil materials of clay, rock or gravel, free of debris, waste, frozen materials, vegetable and other deleterious matter that has a size of no more than 2" as specified herein and/or as shown on the plans.

B. Portland cement, ASTM C150, Type I.

C. Steel bar reinforcing, ASTM A615, Grade 60.

D. Concrete aggregate, ASTM C33.

2.02 DUCTILE IRON PIPE AND FITTINGS

A. **All new pipe in developments shall be ductile iron.**

B. Ductile cast iron pipe shall be made of good quality ductile iron that meets the requirements for modular iron castings of ASTM E8. It shall be plain end ductile iron pipe with push-on, single gasket joints. The design thickness shall be that specified by ANSI A21.50/AWWA C150, except that all pipe with a diameter of 12" or less shall have a wall thickness of class 350.

C. Ductile iron pipe shall be centrifugally cast in metal or sand-lined molds and shall conform to the specifications of ANSI A21.51/AWWA C151. It shall be made and tested in accordance with ASTM A339 and shall be subjected to and able to withstand a hydrostatic pressure of 500 psi. The maximum depth of pits shall be half that allowed in the AWWA specifications.

D. The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

E. The push-on, single gasket joints shall be either Fastite (manufactured by American Cast Iron Pipe Company), Tyton (U. S. Pipe and Foundry Company), Super Bell-Tite (Clow Corporation), or other joints of similar type and equal quality. They shall be able to withstand 200 psi of operating pressure.

F. The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

G. The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquid tight for all pressures from a vacuum to a maximum rating of 350 psi of internal liquid pressure.

H. Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell to the water, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

I. Fittings shall be ductile iron. Use compact mechanical joint fittings (4"-12"). All fittings shall conform to the specifications of either ANSI A21.53/AWWA C153. Tees at fire hydrants shall be anchor-style or hydrant tees. Connections between hydrant valves and the hydrant shall be ductile iron anchor couplings. No PVC pipe will be permitted in fire hydrant assemblies.

J. Where noted on the plans and for restraint purposes, restraint gaskets may be used. Gaskets shall be FieldLok 350® by U.S. Pipe Co.; Fastgrip® by American Cast Iron Pipe Co.; or approved equal.

K. Pipe and fitting shall be lined with enameline or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous

seal coat or asphalt emulsion spray coat approximately one (1) mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

L. The pipe manufacturer shall furnish the Owner a certificate of inspection, sworn to by the factory inspector in the presence of a notary public, stating that the pieces of pipe in the shipment were made and tested in accordance with ANSI A21.51 and that they were subjected to and withstood a hydrostatic pressure of 500 psi. Each statement is to give the number of pieces of pipe in the shipment, the length of each piece of pipe, and the serial number of each piece of pipe making up the shipment. In addition, the weight of each individual piece of pipe making up the shipments to be listed opposite the serial number of each pipe length and attached to the certificate of inspection.

2.03 PVC PIPE

A. **All new pipe in developments shall be ductile iron. PVC pipe shall only be used where approved by the Authority's General Manager.**

B. All plastic pipe shall be made from Class 12454-B polyvinyl chloride (PVC 1120) as defined by ASTM D1784.

C. SDR pipe Class 200 pipe shall have NSF approval and be manufactured in accordance with ASTM D2241. The following tests shall be run for each size and type of piping being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. Acetone Test (Extrusion Quality Test): once per shift in accordance with ASTM D2152. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the test.

3. Quick Burst Test: once per 24 hours in accordance with ASTM D1599.

SDR	Pressure Rating	Minimum Bursting Pressure, psi
21	200	800

4. Impact Tests: For six (6) inches and larger, once per shift in accordance with ASTM D2444; for four (4) inches and smaller, once each two (2) hours in accordance with ASTM D2444.

5. Wall Thickness and Outside Dimensions Tests: once per hour in accordance with ASTM D2122.

6. Bell Dimension Test: once per hour in accordance with ASTM D3139.

D. If any specimen fails to meet any of the above mentioned tests, all pipe of that size and type manufactured between the test periods must be scrapped and a full set of tests rerun.

E. Furnish a certificate from the pipe manufacturer stating that he is fully competent to manufacture PVC pipe of uniform texture and strength and in full compliance with these specifications and further stating that he has manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions. In addition, the manufacturer's equipment and quality control facilities must be adequate to ensure that each extrusion of pipe is uniform in texture, dimension, and strength. Also furnish a certificate from the manufacturer certifying that the pipe furnished for this project meets the requirements of these specifications.

F. All pipe shall be manufactured in the United States of America. All pipe for any one project shall be made by the same manufacturer.

G. All four (4) inch and six (6) inch pipe may be furnished in the manufacturer's standard laying lengths of 20 feet, 38 feet, or 40 feet. Pipe eight (8) inches and larger shall be furnished in 20 feet lengths. The Contractor's methods of storing and handling the pipe shall be approved by the Engineer. All pipe shall be supported within five (5) feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be stored away from heat or direct sunlight.

H. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

1. Nominal size
2. Type of material

3. SDR/DR or class
4. Manufacturer
5. NSF Seal of Approval
6. Pressure Class

I. Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

J. The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. Gasket materials shall meet the requirements of ASTM F477. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

K. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced wit a temperature shift of at least 75 degrees F.

L. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support or promote any bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

M. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell or ring joints with rubber compression gaskets as manufactured by the Vulcan Plastic Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

N. Fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21.53/AWWA

C153. The gaskets shall be ducked tipped transition gaskets for use with PVC pipe.

O. Fittings shall be lined with enameline or a thin cement lining as specified in ANSI A21.4/AWWA C104. In addition, a bituminous seal coat or asphalt emulsion spray coat approximately one (1) mil thick shall be applied to the cement lining in accordance with the pipe manufacturer's standard practices.

P. Fittings shall be in accordance with the compact mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

2.04 COPPER WIRE FOR DETECTION

A. **All** water lines **(DIP or PVC)** shall be installed with a 10 gauge, blue coated copper wire, installed directly above the pipe. Adequate wire shall be terminated inside valve boxes for connection to line detection equipment.

2.05 MECHANICAL JOINT RESTRAINT DEVICES

A. Mechanical Joint Restraint Devices:

1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
2. Devices shall have a working pressure rating of 350 psi for 3 – 16 inch and 250 psi for 18 inch and larger. Ratings are for water pressure and must include a minimum safety factor of 2:1.
3. Restraint devices shall have torque bolts.
4. Megalug Series 1100 produced by EBAA Iron, Inc., TufGrip Series 1000S by Tyler Union, SIGMA One-Lok Series D-SLDE or approved equal for ductile iron pipe lines. Megalug Series 2000PV produced by EBAA Iron Inc., TufGrip Series 2000 by Tyler Union, Sigma One-Lok Series D-SLCE or approved equal for PVC pipe lines.

B. Restraint Devices - General:

1. Gland body, wedges and wedge activating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
2. Installation shall be performed using conventional tools and installation procedures AWWA C600 while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly. Proper activation of the gripping wedges shall be ensured with torque-limiting twist-off nuts.

PART 3. EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. Excavation for pipelines shall consist of the excavation necessary for the construction of water lines and their appurtenances (including valves, fittings, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provision set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Engineer, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the Engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (of, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15", where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Engineer, the banks of trenches from the ground surface down to a depth not closer than 1' above the top of the pipe may be excavated to non-vertical and non-parallel plans, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15" shall be at expense of the Contractor and may

be cause for the Engineer to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For all pipe in non-rock trenches, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

F. Do not excavate pipe trenches more than 200' ahead of the pipe laying, and not more than two hundred (200) feet of open ditch shall be left behind the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Engineer deems necessary to maintain vehicular or pedestrian traffic.

G. In all cases where materials are deposited along open trenches, place then so that in the event of rain no damage will result to the work and/or to adjacent property.

H. Refer to Section 2.15, Unclassified Excavation for Utilities, paragraph 3.06, for sheeting, shoring and bracing requirements.

3.02 INSTALLATION OF WATER LINES

A. Lay water lines to and maintain at the lines and grades required by the drawings. All fittings, valves, and hydrants shall be at the required locations, the spigots centered in the bells, and all valves and hydrant stems plumb.

B. Unless otherwise indicated by the drawings, all water pipes shall have at least 36 inches of cover when located outside the roadway and at least 36 inches of cover when located inside the roadway. Water line shall be installed under sidewalks inside residential areas. Water lines shall be installed on the opposite side of road from underground primary electrical lines. Separation between water lines and electrical, gas and tele-commnication utilities shall be five (5) feet measured edge to edge. Water lines shall not be installed in the bottom of ditches. No departure from this policy shall be made except with the approval of the Authority.

C. Provide and use tools and facilities that are satisfactory to the Owner and that will allow work to be done in a safe and convenient manner. All pipe, fittings, valves, and hydrants are to be unloaded from the trucks using suitable tools and equipment. Use a derrick, ropes, or other suitable tools or equipment to lower all pipe, fittings, valves, and hydrants into the trench one (1) piece at a time. Lower each piece carefully so that neither it nor any protective coating or lining it may have shall be damaged. Under no circumstances drop or dump water line materials into the trench.

D. Any pipes strung out along the route of the proposed lines before the actual installation of those lines is due to take place shall not be lowered into the trench until they have been swabbed to remove any mud, debris , etc., that may have accumulated within them. PVC pipe shall be strung out a maximum of one (1) day ahead of pipe laying. Remove all unnecessary material from the bell and spigot end of each pipe. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell, and leave dry and oil-free.

E. Take every precaution to keep foreign material from getting into the pipe while it is being placed in the line. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside, then place a heavy, tightly woven canvas bag or plug of suitable size over each end of the pipe, and leave in place until it is time to connect that pipe to the adjacent pipe.

F. Place no debris, tools, clothing, or other materials in the pipe during laying operations.

G. After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

H. Bell holes shall be large enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so each pipe barrel rests on a solid foundation for its entire length.

I. Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug or by other means approved by the

Owner. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.

J. Cut pipe so that valves, fittings, or closure pieces can be inserted in a neat workmanlike manner without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

K. Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the Owner.

L. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer, and shall be approved by the Owner.

M. Lay no pipe in water or when it is the Owner's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use unless prior written approval is obtained from Engineer.

N. Where a water line crosses over a sanitary sewer, use a full joint of pipe with a standard mechanical joint, and center over the sewer. Where a water line is to be parallel to a sanitary or storm sewer, lay it at least ten (10) feet from the sewer. If it is not practical for the water and sewer lines to be separated as described above, then lay the water line at least 18 inches above the top of the sewer.

O. Joint all pipe in the exact manner specified by the manufacturer of the pipe and jointing materials.

P. As an attempt to verify quality of the PVC water pipe prior to installation of all pipe, the following procedure will be required. After the Contractor has laid between two to three thousand feet of pipe, said pipe shall be pressure tested in accordance with these specifications. Only upon satisfactory completion of the testing will the Contractor be allowed to continue laying pipe. If the quality of the pipe becomes suspect at any other point in the project, testing will be required prior to continuation of the pipe laying.

Q. Connecting to Existing Lines

1. Connections of new lines to existing lines shall be as shown on the Plans and/or directed by the Owner. This work is the responsibility of the Contractor and is not a separate pay item. Where tees are cut into existing water line and new water valves are added on either side of the run of tee and for new line on the branch line to a new water valve, the pipe shall either include ductile iron anchor couplings (for 6-inch) or runs of ductile iron pipe (8-inch and greater). No PVC line will be permitted between tees and valves.
2. The Contractor shall be completely responsible for determining existing pipeline materials, ordering proper fittings for the connection, and making the connection in an approved manner.

3.03 BEDDING AND BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the Owner. In an earth trench, for PVC or DIP pipe material, on each side of the line, from the bottom of barrel of pipe to 12 inches above the top of the pipe, the backfill material shall be select backfill consisting of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that, before compaction, are no more than 6" deep. Thoroughly and completely tamp each layer into place before placing additional layers.

B. In a rock trench, backfill shall be No. 67 crushed stone to a point 12-inches above the top of PVC or DIP pipe.

C. In all paved areas or roadways, all backfill for PVC or DIP pipe shall be No. 67 crushed stone to a point within 8-inches of paved surface. The final 8-inches shall be crushed roadway base stone.

D. If PVC or DIP pipe is installed in a rock trench or paved area, install a 6" bedding of No. 67 crushed stone below the pipe.

E. From 1' above the pipe upward (if outside paved area or roadway)the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to

fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 6", and the backfill material shall be placed and spread in even layers not more than 12" deep. Tamp and thoroughly compact the backfill in layers that, before compaction, are 6" deep. In other areas, the backfill for the upper portion of the trenches may be place with out tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

F. Copper Wire for Detection: The Contractor shall furnish and install a 10 gauge blue coated copper wire over all **DIP and PVC** pipe. Where two sections of wire connect a 12 inch minimum twisted overlap is required with adequate bare wire connection for continuity. The bare wire connection shall extend up into all valve boxes so it is accessible for connection to locating equipment. At uncased road crossings the Contractor shall install the copper wire onto the top of the water line. Leave at least 36-inches of detector wire coiled in the valve boxes so it can be accessed for location.

G. If earth material for backfill is, in the opinion of the Owner, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material the Owner considers too wet or otherwise unsuitable.

H. Wherever excavation has been made within easements across private property, the top 1' of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

I. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 8" of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner.

J. Wherever pipes have diameter of 15" or less, do not use power operated tampers to tamp that portion of backfill around the pipe with 1' above the pipe.

K. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being place. If any pipe or

structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary.

L. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Owner's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

3.04 PRESSURE TESTS

A. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 150% of normal operating pressure. All pipe shall be tested within two (2) weeks of installation.

B. Conduct a pressure test for at least two (2) hours on uncovered pipe and six (6) hours on covered pipe.

C. Slowly fill each valved section of pipe with water, and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to the Owner. Furnish the pump, pipe, connections, gauges, and all necessary apparatus.

D. Before applying the specified test pressure, expel all air from pipe. If hydrants or blow-offs are not available at high places, make the necessary taps at the points of highest elevation before testing, and close taps after the test has been completed.

E. Carefully examine all exposed pipes, fittings, valves, and hydrants during the test. Remove any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the Owner.

F. Prepare reports of all pressure test activities. Pressure tests shall be conducted utilizing a recording device and paper circular pressure chart. A copy of the pressure chart shall be provided to the Owner upon completion of satisfactory testing.

3.05 LEAKAGE TEST

A. Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.

B. The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 150 psi.

C. Should any test of pipe laid disclose leakage greater than that specified the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of amount of leakage.

D. Leakage defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof in order to maintain pressure within 5psi of the specified test pressure after the pipe has been filled with water and the air expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

E. Allowable Leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

1. Ductile Iron Pipe: $L = \frac{SD\sqrt{P}}{133,200}$

Where: L = allowable leakage, in gallons per day.
S = length of pipe tested, in feet.
D = nominal diameter of the pipe, in inches.
P = average test pressure during the leakage tests, in per square inch (gauge).

Ductile Iron Pipe

Avg. Test Pressure psi	4	6	8	10	12
200	0.43	0.64	0.85	1.06	1.28
175	0.40	0.59	0.80	0.99	1.19
150	0.37	0.55	0.74	0.92	1.10

* If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

2. PVC Pipe: $L = \frac{ND\sqrt{P}}{7,400}$

Where: L = allowable leakage, in gallons per hour
N = number of joints in the length of pipeline tested
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage tests, in pounds per square inch (gauge)

PVC Pipe

Avg. Test Pressure psi	4	6	8	10	12
200	0.38	0.57	0.76	0.96	1.15
175	0.36	0.54	0.72	0.89	1.07
150	0.33	0.50	0.66	0.83	0.99

* If pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

When testing against closed metal-seated valves, an additional leakage enclosed valve of 0.0078 gal/h/in of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made against the closed main valve in the hydrant. All visible leaks are to be repaired regardless of the amount of leakage.

3.06 DISINFECTION

A. During construction, take precautions to protect pipe interiors, fittings, and valves against contamination. When pipe laying is not in progress (e.g., at the end of the day's work), place watertight plugs in the ends of all pipe already in the trench; if water accumulates in the

trench, leave the plugs in place until the trench is dry. Complete the joints of all pipe in the trench before stopping work for any reason.

B. Prior to placing the installed water line in service, the new pipe and all exposed sections and appurtenances of existing pipelines shall be cleaned and disinfected in accordance with ANSI/AWWA C651unless otherwise specified. Pipelines shall be flushed follow completion of disinfecting procedures. Disposal or neutralization of disinfection water shall comply with applicable regulations.

C. Make water flow from the existing distribution system or some other source approved by the Engineer into the newly laid pipeline, and add chlorine to it. Feed water into the pipe, and chlorine into the water, at constant, measured rates so proportioned that the chlorine concentration in the water in the pipe is kept at a minimum of 50 mg/l available chlorine.

D. Table 3 shows how much chlorine is needed for each 100 feet of line for pipes of various diameters. A 1% chlorine solution may be prepared either with one (1) pound of calcium hypochlorite for each 8.5 gallons of water or with sodium hypochlorite.

TABLE 3
CHLORINE REQUIRED TO PRODUCE A 50 MG/L CONCENTRATION IN 100 FEET OF PIPE, BY DIAMETER

Pipe Size (inches)	100% Chlorine (pounds)	1% Chlorine Solutions (gallons)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
16	0320	3.96

E. While the chlorine is being applied, manipulate valves so that the treatment dosage will not flow back into the line that is supplying the water. Continue the application of chlorine until the entire line being treated is filled with the chlorine solution. Then retain the chlorinated water in the line for at least 24 hours, during which time all valves and hydrants in the line being treated shall be operated so that appurtenances can also be disinfected. After 24 hours, the treated

water shall have a chlorine concentration of at least 25 mg/l throughout the line.

F. Final flushing shall be conducted in accordance with AWWA C651. After applicable retention period, flush heavily chlorinated water from line until chlorine concentration in water leaving the main is no higher that that generally prevailing in the system, or less that 1 mg/l. Perform such flushing only at approved sites. If no approved point of discharge is available, neutralizing chemicals must be applied to the water in order to neutralize the chlorine residual. The amount of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water are shown in Table 4.

TABLE 4
Amounts of Chemicals Required to Neutralize Various Residual Chlorine Concentration in 100,000 Gallons of Water

	Chemical Required							
Residual Chlorine Concentration	Sulfur Dioxide (SO_2)		Sodium Bisulifite ($NaHSO_3$)		Sodium Sufate (Na_2HSO_3)		Sodium Thiosufate ($Na_2S_2O_35H_2O$)	
mg/L	*lb.*	*(kg)*	*lb.*	*(kg)*	*lb.*	*(kg)*	*lb.*	*(kg)*
1	0.8	(.36)	1.2	(.54)	1.4	(.64)	1.2	(.54)
2	1.7	(.77)	2.5	(1.13)	2.9	(1.32)	2.4	(1.09)
10	8.3	(3.76)	12.5	(5.67)	14.6	(6.62)	12.0	(5.44)
50	41.7	(18.91)	62.6	(28.39)	73.0	(33.11)	60.0	(27.22)

G. The velocity of the water used to flush a line shall be at least 2.5 fps. The flow rates required to produce this velocity in various sizes of pipe are shown in the following Table 5:

TABLE 5 REQUIRED OPENINGS TO FLUSH PIPELINES (40 PSI RESIDUAL PRESSURE)					
Pipe Size (inches)	Flow Required to Produce 2.5 fps Velocity (gpm)	No. of Taps on Pipe	Size of Tap	Hydrant Outlet Nozzles	
4	100	1	1″	1	2-1/2
6	220	1	1-1/2″	1	2-1/2
8	390	3	2 @ 1-1/2″ 1 @ 2″	1	2-1/2
10	610	5	3 @ 1-1/2″ 2 @ 2″	1	2-1/2
12	880	2	2″	1	2-1/2

H. Once a line has been flushed, test to make certain that the residual chlorine in the water is within acceptable limits.

I. It must be noted that flushing is no substitute for taking preventative measures before and during the laying of water lines. Certain contaminants -- especially those in caked deposits-- are difficult or even impossible to remove by flushing, no matter how high the velocity. Furthermore, in pipes with diameters of 16 inches or more, it can be difficult to achieve even the minimum recommended flushing velocity of 2.5 fps.

3.07 BACTERIOLOGICAL TESTS

A. After a water line has undergone final flushing but before it is placed into service, contractor shall collect a sample for bacteriological testing from the end of that line. In the case of extremely long lines, take additional samples if the Authority so directs. A bacteriological sample shall be taken from each dead-end line or at least 1,200 feet whichever is greater. Tests shall be in accordance with AWWA C651.

B. Contractor shall collect these samples in sterile bottles treated with sodium thiosulfate. Do not use a hose or fire hydrant to collect samples. One suggested sampling method is to install a standard corporation cock in the line with a copper tube gooseneck assembly; after the samples have been taken, the gooseneck assembly can be

removed and retained for later use. Authority will provide the sample bottles. Authority representative must be present during sample collection.

C. The Authority representative will take the samples collected to the their laboratory to be tested for bacteriological quality in order to determine if they contain any coliform organisms. If the initial disinfection fails to produce satisfactory samples, repeat disinfection until satisfactory samples are obtained.

D. When the samples tested are found to be satisfactory, the water line may be placed in service. Provide the Authority with copies of the final bacteriological tests.

3.08 DISINFECTION PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING LINES.

A. The procedures outlined above apply primarily to cases in which the lines are wholly or partially dewatered.

B. However, leaks or breaks that are repaired with clamping devices while the lines remain full of water under pressure present little danger of contamination and require no disinfection.

C. When an existing line is opened, whether by accident or design, the excavated area could be wet and contaminated because of the presence of sewers nearby. The danger of contamination from such pollution can be lessened if liberal quantities of hypochlorite are applied to the open trenches. It is better to use tablets for disinfection in such cases because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation site.

D. Where practical, treat the lines by the slug method in accordance with AWWA C651.

E. The following disinfection procedure is considered the minimum that may be used when existing lines are repaired:

1. Swab the interior of all pipes and fittings (particularly couplings and tapping sleeves) that are to be used in repairing an existing line with a solution of 5% hypochlorite before installing them.

2. The most practical means of removing contamination introduced into a line during repairs is to give the line a thorough flushing. If the locations of valves and hydrants make it possible, flushing in both directions is recommended. Start flushing as soon as repairs are completed, and continue until all discolored water is eliminated.

3.09 FINAL WATER LINE ACCEPTANCE

A. After completing each section of water line, remove all debris and all construction materials from the work site. Then grade and smooth over the surface of both sides of the line. Leave the entire area clean and in a condition satisfactory to the Owner.

END OF SECTION

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SECTION 4.02

WATER VALVES, HYDRANTS, AND APPURTENANCES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Installation of fire hydrants, valves, and related accessories as specified below.

B. Refer to other sections for work related to that specified under this heading.

PART 2 - PRODUCTS

2.01 GATE VALVES

A. Valves on water lines 12 inches and smaller shall be of the resilient seat, iron body, bronze mounted type designed to work equally well with pressure on either side of the gate. All gate valves shall be in accordance with or exceed AWWA C515. Working pressure shall be 200 psi.

B. Valves shall be supplied with O-ring seal stuffing boxes and shall open to the left. Valves shall be Mueller, M&H, America Darling, Clow, or equal, with mechanical joints.

2.02 TAPPING VALVES AND TAPPING SLEEVES

A. Tapping valves shall meet all the requirements of 2.01 above.

B. Stainless steel tapping sleeves shall be two-piece, Mueller H-304, Ford FTSS, JCM 432 or approved equal. Outlet flange dimensions shall comply with AWWA C207, ANSI Class D 150# drilling. Stainless steel tapping sleeves shall be rated for 250 psi working pressure (4”-12”) and comply with NSF 61. Internal gasket shall be SBR or Buna-N providing 360^0 pipe coverage.

C. Ductile iron body tapping sleeves shall be two-piece, Mueller H-615 or equal and have outlet flange dimensions complying with ANSI B16.1, Class 125 and certified for NSF 61. Ductile body tapping sleeves shall be rated for 20 psi working pressure.

D. All tapping sleeves shall include a ¾" NPT test plug.

2.03 VALVE BOXES

A. All valve box castings shall be made accurately to the required dimensions, and shall be sound, smooth, clean, and free from blisters and other defects. Defective castings which have been plugged or otherwise treated to remedy defects shall be rejected. Contact surfaces of frames and covers shall be machined so that the covers rest securely in the frames with no rocking and with the cover in contact with the frames for the entire perimeter of the contact surface. All castings shall be thoroughly cleaned subsequent to machining and before rusting begins, painted with a bituminous coating so as to present a smooth finish, tough and tenacious when cold, but not tacky with no tendency to scale. Install valve boxes on each proposed valve in accordance with the details shown on the standard drawings.

2.04 FIRE HYDRANTS

A. Fire hydrants shall comply in all respects with AWWA C502 and shall be of the compression type, with the main valve opening against the pressure and closing with the pressure. The main valve opening shall be not less than 5-1/4 inches in diameter. The main valve facing of the hydrant shall be made of balata or similar material especially suited and proven for the services intended. The bottom stem threads of the main valve rod shall be fitted with an acorn nut or suitable means for sealing the threads away from the water. Hydrants shall be connected to the main by a 6 inch mechanical joint shoe, unless otherwise shown on the drawings, and fitted with strapping lugs. For full service fire hydrants, two 2-1/2 inch hose nozzles and one 4-1/2 inch steamer nozzle shall be threaded and screwed into the nozzle section and then pinned to prevent turning.

B. Operating nut shall be provided with convenient means to afford lubrication to ensure ease of operation and the prevention of wear and corrosion.

C. Hydrant shall be the dry barrel type, and hydrant shoe shall have two positive acting non-corrodible drain valves that drain the hydrant completely by opening as soon as the main valve is closed and by closing tightly when the main valve is open. Drain valves operated by springs or gravity will not be acceptable.

D. The packing gland located in the bonnet shall be solid bronze, and gland bolts shall steel with bronze nuts. A double O-ring seal may be used in lieu of conventional stuffing box.

E. The hydrant shall open by being turned to the left and be so marked on the bonnet in cast letters with an arrow.

F. Threads on hose and steamer nipples, operating nut, and cap nuts shall conform to local Water Department standards.

G. Bury depth shall be 48 inches so that a 36 inch minimum cover is maintained above water line. All hydrants shall stand plumb. Install the hydrant so that the bottom flange is a minimum of 4 inches above finished grade.

H. Hydrants shall be M&H, Model 129 or American-Darling Model B84-B. Color shall be red.

2.05 AIR RELEASE VALVES

A. Air release vales shall be manual type and as set forth in the Limestone County Water and Sewer Authority Standard Specifications and Details.

2.06 BLOW-OFF ASSEMBLIES

A. Blow-off assemblies shall be complete assembly and as set forth in the Limestone County Water and Sewer Authority Standard Specifications and Details.

2.07 DUAL CHECK VALVE ASSEMBLY

A. A 1-inch dual check valve assembly shall be installed in the meter box on the discharge side of the water meter assembly. Dual check valve assembly shall be A.Y. McDonald, Model 7311-3JM or Apollo Model DUCLF4N-MRF (no lead). Device shall be certified to NSF 61 and NSF 372 Standards. Brass components in contact with portable water shall conform to ASTM B584 and identified with "NL". Device shall be rated for 175 psi water pressure.

B. Dual check valve assembly shall be provided at each new residential service connection.

2.08 YARD HYDRANT

A. A 1-inch frost-proof yard hydrant shall be installed at each pump station site or at locations otherwise shown on the plans. Hydrant shall be Model YH-3 lead free with a bury depth of 36 inches, as manufactured by Campbell Manufacturing, Inc. Hydrant shall include a locking hasp to prevent unauthorized usage.

PART 3 - EXECUTION

3.01 SETTING VALVES AND APPURTENANCES

A. General: Set valves, fittings, plugs, and caps and joint to pipe in the manner heretofore specified for cleaning, laying, and jointing pipe.

B. Tapping sleeves shall be separately pressure tested before connection to the new water line. The Authority must witness the tapping saddle pressure test. The tapping sleeves must be rated for the anticipated working pressure. Care must be used to assure that all bolts are equally tightened. The tapping valve is to be solidly supported with brick or block and carefully bedded to prevent shifting due to settling back fill.

C. The Authority will perform taps for water lines for all water lines up to 8-inches in size. The cost of the Authority performing the water line tap is $100/in-dia. The Contractor will be required to excavate for installation of the tapping saddle and tapping valve and install both devices in preparation for the Authority to tap. The aforementioned pressure test shall already be completed. Taps on lines above 8-inches in diameter shall be performed by the Contractor at their own expense by a tapping sub-contractor approved by the Authority. The coupon from large taps shall be provided to the Authority.

D. Location of Valves: Valves in water mains shall, where possible, be located on the street property lines extended unless otherwise shown on the drawings. Valves shall not be located in paved areas without prior approval of the Authority.

E. Valve Boxes: Provide a valve box for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed by the Owner. No PVC pipe will be allowed as a valve box.

F. Provide a concrete collar around each valve located in unpaved areas.

G. Provide a 4-inch thick, wire reinforced concrete slab beneath backflow preventer enclosures.

H. All gate valves shall include a restraint device (Mega-Lug or equal) on each side of the valve.

3.02 SETTING HYDRANTS

A. Location: Locate hydrants as shown on the drawings or as directed by the OWNER and in a manner that will provide complete accessibility and also minimize the possibility of damage from vehicles or injury to pedestrians.

B. Position: All hydrants shall stand plumb. Install hydrants so that bottom flange is 4 inches minimum above finished grade and 36 inch minimum cover is maintained above water line. Minimum hydrant bury length shall be 48-inches.

C. Connection to Main: Connect each hydrant to the main with a ductile iron hydrant anchor tee and 6 inch gate valve. Pipe between valve and hydrant shoe shall be ductile iron anchor couplings or ductile iron pipe with pipe restraint devices (Mega-lug or equal). No PVC pipe will be permitted on hydrant connections.

D. Hydrant Drainage: Provide drainage at the base of the hydrant by placing coarse gravel or crushed stone from the bottom of the trench to at least 6 inches above the waste opening in the hydrant to a distance of 1 foot around the elbow. Connect no drainage system to a sewer.

E. Anchorage for Hydrants: Brace the shoe of each hydrant against undisturbed earth at the end of the trench with stone slabs or concrete blocking. Insure that the drain in the hydrant shoe is not blocked to allow for the hydrant to drain upon closure.

END OF SECTION

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SECTION 4.03

1-INCH WATER SERVICE ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All new residential service assemblies shall be 1-inch unless otherwise approved by the Authority.

B. Service assembly requirements for 1 inch service connections size of service shall be directed by the Authority.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All service assembly components in contact with potable water shall be certified No Lead or Lead Free.

B. The service assembly shall include a corporation cock, copper service pipe gooseneck, meter, meter box, and tapping saddle as required.

C. CORPORATION COCK: The corporation cock shall be of solid bronze suitable for a compression flange on the service pipe and for tapping into the water main at a vertical angle. This cock shall be similar to Ford F-1000. The threads on the corporation cock shall be Ford.

D. SERVICE PIPE: Service pipe shall be 1 inch HDPE DR 9 service line.

E. METER VALVES: Meter valves shall be Ford, straight ball with CTS joints.

F. WATER METERS:

1. 1-inch water meters shall be Mueller Systems™ Series 420 Composite body, positive displacement meters.
2. Each meter shall meet or exceed the latest revision of AWWA C710 and shall be compliant with no-lead requirements. Maximum working pressure shall be 150 psi.
3. Each meter shall be equipped with a solid state absolute encoder register meeting the requirements of AWWA C707 and compatible

with Mueller Systems AMI system technology. Display shall be a 10 digit LCD visual resolution. Battery shall be lithium thionyl chloride. When the SSR is interrogated by the AMI device, the SSR register shall communicate the unique 10 digit serial number and up to a 9 digit electronic reading and all tamper codes in ACSII format where it can be recorded and maintained within the reporting structure of the AMU system. The SSR encoder shall have a 20 year life.

4. Each meter shall also be provided with a MegaNet™ meter transmission unit (MTU) used to transmit meter reading to the head end receiver and MCM software. The MTU shall utilize a high powered 2 watt transmission and operate at FCC licensed frequency. (VHF 136-174 MHz or UHF 450-470 MHz bands. The MTU shall be capable of operating in either indoor, outdoor or pit type installations. When attached to the meter, the MTU shall monitor, identify and immediately notify the utility of alarms such as continuous flows, no flow, leaks, tampering or reverse flows. The MTU shall be compatible with the encoder register.

G. METER BOXES: Meter boxes for 1-inch assemblies shall be by NDS Technical Services, Lindsay, CA. Boxes shall be jumbo sized 13" by 20". Meter box and cover shall be injection molded of structural foam polyolefin material with coloring and UV stabilizers added. Box design shall be tapered and have a minimum wall thickness of 0.25" and include one pipe slot. The body shall have a double wall at the top cover seat area with a minimum thickness of 0.187". The cover seat area shall have 16 structural support ribs on the underside of the seat, each with a minimum thickness of 3/16". The bottom of the body shall have a 1" flange. The cover shall have an average thickness of 0.25". The cover shall be drop-in with cast iron meter read inner lid.

H. TAPPING SADDLES: Tapping saddles shall be used for tapping all PVC pipe and shall be Ford S70 series, and shall be AWWA threaded to accept the corporation cock specified above. Tapping saddle body and strap shall be made of brass alloy and shall be joined together with stainless steel pin. No taps larger than 1 inch shall be made in any size pipe without approval by the Owner.

I. DUAL CHECK VALVES: Each residential water service shall include a dual check valve. The dual check backflow preventer shall meet the domestic requirements of NSF 61 and be lead free. It shall be bronze-bodied. A brass identification tag indicating direction of flow shall be securely attached to the body by corrosion-resistant mechanical fasteners.

The dual check shall be A.Y. McDonald, Model 7311-3JM or Apollo Model DUCLF4N-FMRF1.

PART 3 – EXECUTION

3.01 PREPARATION

A. Make no taps on dry lines without approval from the Owner. Taps in newly installed water line shall be made by the Contractor. Taps on existing water lines shall be made by the Authority.

B. Contractor shall make all service taps on new lines.

C. The service line shall have a minimum of 18 inches cover. Prior to connecting meter, blow any accumulated trash out of the pipe.

3.02 INSTALLATION

A. All service lines to be installed under paved county or state roads will be bored and jacked. A 2-inch schedule 40 PVC casing pipe shall be provided for bored 1" services or new 1" services under roadways. Service line casing shall extend to a point 2 feet behind the sidewalk on each side of the roadway. No couplings shall be used on new service lines.

B. In general, install the meter box as near the property lines as possible in the street right-of-way. Set plumb approximately 1 inch above the existing of proposed grade and so that surface drainage will not enter it. Fill from the existing or proposed grade to the top of the meter box at a slope of 1 inch in 12 inches. When the cut or fill slopes on streets extend beyond the street right-of-way, install the meter box at the top or toe of slope, as applicable, or as directed by the Owner. Meter boxes damaged by home builder will be responsibility of the home builder to reset or replace.

C. The service main shall not be taut from stop to cock. A gooseneck shall be left at the connection to the water main.

D. The dual zone backflow preventer shall be mounted directly behind the meter on the house side of the service line.

END OF SECTION

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SECTION 4.04

2 - INCH WATER METERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Installation of 2-inch water meters.

PART 2 - PRODUCTS

2.01 2 - INCH WATER METERS

A. Meter shall be a magnetic drive, positive displacement, Mueller 500 Series DI. **No meter substitutions are allowed.**

B. Meter shall meet the requirements of AWWA C700 and NSF Standard 61, Annex G.

C. Measuring element shall be a nutating disk.

D. Maximum working pressure shall be 150 psi.

E. Meter end connections shall be flanged.

F. Materials:

1. Main case: Nylon coated ductile iron.
2. Measuring chamber and strainer: Thermoplastic.
3. Casing bolts: ANSI B18 stainless steel.
4. Register box & lid: Bronze UNSC85700

G. Each meter shall be equipped with a solid state absolute encoder register meeting the requirements of AWWA C707 and compatible with Mueller Systems AMI system technology. Display shall be a 10 digit LCD visual resolution. Battery shall be lithium thionyl chloride. When the SSR is interrogated by the AMI device, the SSR register shall communicate the unique 10 digit serial number and up to a 9 digit electronic reading and all tamper codes in ACSII format where it can be recorded and maintained within the reporting structure of the AMU system. The SSR encoder shall have a 20 year life.

H. Each meter shall also be provided with a MegaNet™ meter transmission unit (MTU) used to transmit meter reading to the head end receiver and MCM software. The MTU shall utilize a high powered 2 watt transmission and operate at FCC licensed frequency. (VHF 136-174 MHz or UHF 450-470 MHz bands. The MTU shall be capable of operating in either indoor, outdoor or pit type installations. When attached to the meter, the MTU shall monitor, identify and immediately notify the utility of alarms such as continuous flows, no flow, leaks, tampering or reverse flows. The MTU shall be compatible with the encoder register.

I. Meter shall read in gallons.

J. Meter accuracy shall be as follows:

1. Typical Low Flow (95% Minimum) - 2.0 GPM
2. Typical Operating Range (100% ±1.5%) - 8 to 160 GPM
3. Maximum Continuous Operation – 80 GPM

PART 3 - EXECUTION

3.01 SETTING METERS

A. Meters shall be installed in precast concrete meter boxes as shown on the Standard Details. Meter boxes shall be set level with top of meter box a flush to grade. Meter boxes shall be set atop a minimum of 8-inches of crushed stone and include a drain hole in the bottom of the meter box. Care shall be taken in the backfilling around the meter box to prevent damage to the meter box. Backfill around meter boxes shall be select backfill with no stone or rock greater than 2-inches.

B. Rubber gaskets shall be used at each flange during installation. Bolts on flanges shall be torqued to the manufacturer's recommended requirements. Do not over-tighten bolts.

C. Meter appurtenances shall be provided in accordance with the Standard Details.

END OF SECTION

SECTION 4.05

LARGE WATER METERS – 3-INCH AND GREATER

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Installation of large water meters greater than 2-inch diameter.

PART 2 - PRODUCTS

2.01 LARGE WATER METERS – 3-INCH AND GREATER

A. Water meters shall be Hersey HbMAG as supplied by Mueller Systems. **No substitutions are allowed.**

B. The Hersey HbMAG is a micro-processor based water meter with graphical display and key for optimum customer operation and information both on site and remotely. The transmitter shall drive the magnetic field in the sensor, evaluating the flow signal from the sensor and calculating the vvolume passing through. It shall deliver the information via the integrated Hersey encoder output as part of Mueller Systems AMR/AMI solutions.

C. Meter Size and Flow Range

NORMAL FLOW RANGES				
Size	Low Flow, GPM	Mid Flow, GPM	High Flow, GPM	Intermittent High Flow, GPM
3″	0.5	2.75	550	825
4″	.75	4.5	880	1320
6″	1.5	11.25	2200	3300
8″	2	17.5	3465	5200
10″	8.75	28	5500	8250
12″	15	44	8800	13200

D. Meter Requirements

1. Meter shall meeting IP68/NEMA 6P and NSF-61 standards.

2. Meter shall measure flow in both forward and reverse directions.

3. Meter shall be capable of installation in either the horizontal or vertical direction with 5-times pipe diameter of straight pipe.

4. Maximum working pressure shall be 175 psi.

5. Measuring principle shall be electromagnetic induction.

6. Meter accuracy: Low Flow - ±5%; Normal Flow - ±0.4%.

7. Meter Temperature Range: 33^0F to 140^0F.

8. Meter Construction:

   a. ANSI Class 150 standard end flanges.
   b. Epoxy coated steel main case.
   c. Hastelloy C276 electrodes.
   d. EPDM liner.
   e. Hastelloy C276 grounding electrodes with one on each side of the sensor.

9. Meter Register: Permanently sealed LCD register with heat-treated glass lens. Register shall display volume of water measured, flow rate, reverse flow and low battery alarm. Register shall include standard integrated infrared communication interface with encoder interface.

E. Transmitter Requirements

1. Integral mount with AISI 316 stainless steel top housing and coated brass bottom.
2. Cable entries: 2 x M20.

3. Display: 8 digits for visual meter reading information and index, menu and status symbols for dedicated information.

4. Standard flow unit to be in gallons and flow rate to be in gallons/minute.

5. Outputs: 2 passive outputs (MOS), individually galvanically isolated; maximum load ± 35V DC, 50 mA short circuit protected. Output Maximum pulse rate of 50 hz.

6. Power Supply: Auto-detection of power source with display symbol for operation power. Internal batter pack with 2 D0Cell 3.6Volt. Mains power supply to be 12-24V AC/DC.

F. Meter Features

1. A real time clock with time and date.

2. Two totalizer with forward, reverse, bi-directional net flow calculation and free selectable start value. One customer totalize, following totalizer 1 setting and resettable via display key or software with logging of date and time.

3. Measurement:
   a. Low flow cut-off: 0.05% of high flow or free adjustable.
   b. Empty pipe detection symbolized in display.
   c. Data Logger: logging of 26 records selectable as daily, weekly or monthly logging.

4. Alarms:
   a. Active alarm to be indicated on the display.
   b. Monitoring
      1)Total hours an alarm has been active
      2)number of times the alarm has been activated
      3)first time and last time the alarm appears

5. Fatal Faults:
   a. Coil current – fault in driving magnetic sensor field
   b. Amplifier – fault in signal circuit
   c. Check sum – fault I calculation or handling of data

6. Warning Faults:
   a. Low Power
   b. Flow overflow
   c. Pulse overflow on outputs A and B
   d. Consumption
   e. Empty pipe
   f. Low impedance
   g. Flow limit

7. Data Protection: All data stored in EEPROM. Totalizers 1 and 2 to be backed up every 10 minutes; statistics every hour; power consumption and temperature measurement every 4 hours.

8. Battery Power Management:
   a. Optimal battery information on remaining capacity.
   b. Calculated capacity.
   c. Number of power-ups.
   d. Date and time registered for first and last time power alarm.

9. Diagnostics:
    a. Continuous self-testing including:
        1)coil current to drive the magnetic field
        2)Signal input circuit
        3)Data calculation, handling and storage
    b. Alarm Statistics and logging for fault analysis:
        1)Electrode impedance
        2)Flow simulation
        3)Number of sensor measurements
        4)Transmitter temperature
        5)Low impedance alarm
        6)Flow alarm
        7)Verification mode

G. Each meter shall also be provided with a MegaNet™ meter transmission unit (MTU) used to transmit meter reading to the head end receiver and MCM software. The MTU shall utilize a high powered 2 watt transmission and operate at FCC licensed frequency. (VHF 136-174 MHz or UHF 450-470 MHz bands. The MTU shall be capable of operating in either indoor, outdoor or pit type installations. When attached to the meter, the MTU shall monitor, identify and immediately notify the utility of alarms such as continuous flows, no flow, leaks, tampering or reverse flows. The MTU shall be compatible with the meter transmitter.

PART 3 - EXECUTION

3.01 SETTING METERS

A. Meters shall be installed in precast concrete meter boxes as shown on the Standard Details. Meter boxes shall be set level with top of meter box a minimum of 4-inches above grade. Meter boxes shall be set atop a minimum of 8-inches of crushed stone and include a drain hole in the bottom of the meter box. Care shall be taken in the backfilling around the meter box to prevent damage to the meter box. Backfill around meter boxes shall be select backfill with no stone or rock greater than 2-inches.

B. Meter must be set so as to remain completely full of liquid.

C. Sensor shall be mounted at 45^0 angle on top side of pipe to allow for empty pipe detection sensing.

D. Rubber gaskets shall be used at each flange during installation. Bolts on flanges shall be torqued to the manufacturer's recommended requirements. Do not over-tighten bolts.

E. No valves or other flow obstructions shall be mounted within 5 pipe diameters on the upstream side and 3 pipe diameters on the downstream side.

F. Meters shall be properly grounded. For metal pipe, connect the meter ground connections directly to the adjoin metal pipe. For plastic pipe, a grounding ring must be provided at each end flange of the meter.

END OF SECTION

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SECTION 4.06

BACKFLOW PREVENTION DEVICES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Requirements for new reduced pressure zone assemblies and double detector check valve assemblies.

B. Refer to the *"Backflow Prevention and Cross-Connection Control Guidelines"* for Limestone County Water & Sewer Authority for determination of applications and usage for reduced pressure zone assemblies and double detector check valve assemblies.

PART 2 - PRODUCTS

2.01 REDUCED PRESSURE ZONE ASSEMBLY (3/4" – 2")

A. The reduced pressure zone assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check valves with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check valves and the relief valve without use of special tools. Service of all internal check valve components shall be through top mounted access covers threaded to the main valve body. The check valve poppet assembly shall be guided via the use of a corrosion resistant plastic guide. The check valve and relief valve seats shall be push-in type. The relief valve cover shall be secured with stainless steel bolts and shall utilize a quarter turn locking joint to capture the spring load of the relief valve. The relief valve shall have an internal sensing line to sense the inlet water supply. All rubber elastomers shall be of chloramine resistant material.

B. The assembly shall include a strainer, two resilient seated isolation valves, four top-mounted resilient seated test cocks and an air gap drain fitting.

C. The assembly shall meet the requirements of: ASSE Standard 1013; NSF; CSA B64.4 and be UL classified.

D. Device shall be Watts Series LF919 or Owner approved equal.

2.02 REDUCED PRESSURE ZONE ASSEMBLY (3" AND GREATER)

A. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves. The main body valve shall be manufactured from 300 Series stainless steel for corrosion resistance. The check valves shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The check valve shall utilize a single torsion spring design to minimize pressure drop through the assembly. The check valves shall be modular and shall seal to the main valve body by the use of an O-ring. There shall be no brass or bronze parts used within the check assembly or relief valve. The use of seat screws to retain the check valve seat is prohibited. All internal parts shall be accessible through a single cover on the valve assembly securely held in place by a two-bolt grooved coupling. The differential relief valve shall be bottom mounted and supplied with a steel reinforced sensing hose. The assembly shall include two NRS resilient seated shutoff valves and four ball type test cocks.

B. The assembly shall include a drain line. Where drain line is used, an air gap is required.

C. The assembly shall meet the requirements of: ASSE Standard 1013; AWWA Standard C511; and CSA B64.5 and be UL/FM approved.

D. Device shall be Watts Series LF994 or Owner approved equal.

2.03 REDUCED PRESSURE DETECTOR ASSEMBLIES (6" & 8")

A. A Reduced Pressure Detector Assembly shall be installed on fire protection systems when connected to a public water supply. The unit shall be complete assembly including UL listed and FM approved OS&Y shutoff valves and including an auxiliary line consisting of an approved backflow preventer and water meter. The body construction shall be fused epoxy coated cast iron. All trim shall be stainless steel and the test costs shall be bronze. The valves shall include replaceable bronze seats. Detector meter shall be 5/8" x ¾" and read in gallons per minute.

B. The assembly shall meet the requirements of: ASSE Standard 1047; AWWA Standard C511; and CSA B64 and be UL/FM approved.

D. Device shall be Watts Series 909RDPA or Owner approved equal.

2.04 DOUBLE CHECK VALVE ASSEMBLY (3" AND GREATER)

A. The Double Check Valve Assembly shall consist of two independent tri-link check modules within a single housing, sleeve access port, four test cocks and two drip-tight shutoff NRS valves. Tri-link checks shall be removable and serviceable without the use of special tools. The housing shall be constructed of 304 Schedule 40 stainless steel pipe with grooved end connections. Tri-link checks shall be stainless steel and have reversible elastomer EPDM discs and in operation shall produce drip-tight closure against reverse flow caused by back-pressure or back-siphonage. Test cocks shall be bronze body nickel plated. All springs shall be stainless steel.

B. The assembly shall meet the requirements of: ASSE 1015; AWWA C510; CSA B64.5; and be UL/FM approved.

D. Device shall be Watts Series LF757 or Owner approved equal.

2.05 DOUBLE DETECTOR CHECK ASSEMBLIES (6" & 8")

A. The Double Check Detector Assembly shall consist of two independent tri-link check modules within a single housing, sleeve access port, four test cocks and two drip tight shutoff OSY valves. Tri-link checks shall be removable and serviceable, without the use of special tools. The housing shall be constructed of 304 Schedule 40 stainless steel pipe with groove end connections. Tri-link checks shall be reversible elastomer EPDM discs and in operation shall produce drip-tight closure against reverse flow caused by back-pressure or back-siphonage. The bypass assembly shall consist of a meter, which registers in gallons, a double check backflow assembly and required test cocks. Test cocks shall be bronze body nickel plated. All springs shall be stainless steel. Pins and fasteners shall be 300 Series stainless steel.

B. The assembly shall meet the requirements of: ASSE 1048; CSA B64.5; and be UL/FM approved.

D. Device shall be Watts Series LF757DCDA or Owner approved equal.

2.06 INSULATED ENCLOSURES

A. Backflow prevention devices shall be mounted in a heated enclosure to prevent freezing.

B. The enclosure shall be or fiberglass (sizes ¾" – 3") or reinforced aluminum construction (4" and larger) providing access through doors for testing purposes. Enclosure shall also be removable for maintenance purposes. The enclosure shall be structurally lined with a unicellular, non-wicking insulation consisting of a sandwich laminate or applied by spray. It shall contain a thermostatically controlled heat source mounted to the interior wall to provide protection to -30^{0}F. No wood or particle board shall be allowed. Power source will be protected with a ground fault circuit interrupted receptacle, NEMA 3R installed in the enclosure.

C. The enclosure shall contain drain openings sized to accommodate the maximum discharge of the reduce pressure zone assembly. Drain openings shall open to discharge under the most sever conditions. These openings are to be protected against intrusion of either wind, debris or animals. The enclosure shall be furnished with means of permanent anchor and lockable access doors and/or lid to protect from vandalism.

D. The enclosure shall be factory assembled and delivered to the site ready to install with no drilling, screwing or riveting of enclosure required on site.

E. The enclosure shall be WattsBox Insulated Enclosure Model WB or Owner approved equal.

PART 3 - EXECUTION

3.01 SETTING BACKFLOW DEVICES

A. Refer to the *"Backflow Prevention and Cross-Connection Control Guidelines"* for Limestone County Water & Sewer Authority for installation and enclosure device requirements for reduced pressure zone assemblies and double detector check valve assemblies.

B. Reduced pressure zone assemblies shall be mounted above ground on a 4-inch thick, reinforced concrete pad and include covers suitable to protect the device and all wetted piping from freezing. Freeze protection shall be accomplished with electric heater mounted integrally in the structure.

C. Double Check and Double Detector Check Assemblies shall be mounted in a precast, belowground vault with full coverage aluminum access hatch as reflected on the standard details.

END OF SECTION

SECTION 5.01

CONCRETE FOR UTILITY LINES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations directed by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete work shall conform to ACI 301, latest revision, as modified by the supplemental requirements below:

1. Strength: The strength of concrete shall be 4,000 psi unless otherwise shown on the drawings.

2. Durability: All concrete exposed to weather shall be air entrained.

3. Slump: Concrete shall be proportional and produced to have a slump of three (3) inches with a one (1) inch tolerance.

4. Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Owner.

5. Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Perform concrete work in accordance with recommendations of ACI-301.

END OF SECTION

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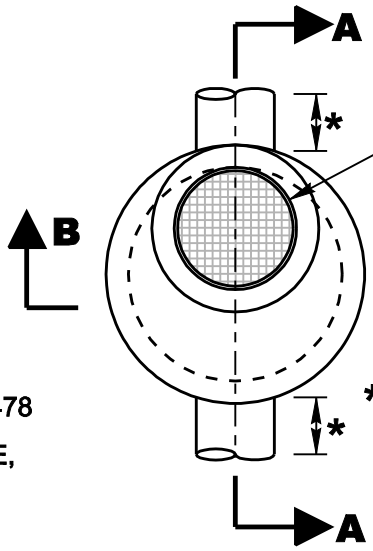
6.0

STANDARD CONSTRUCTION DETAILS

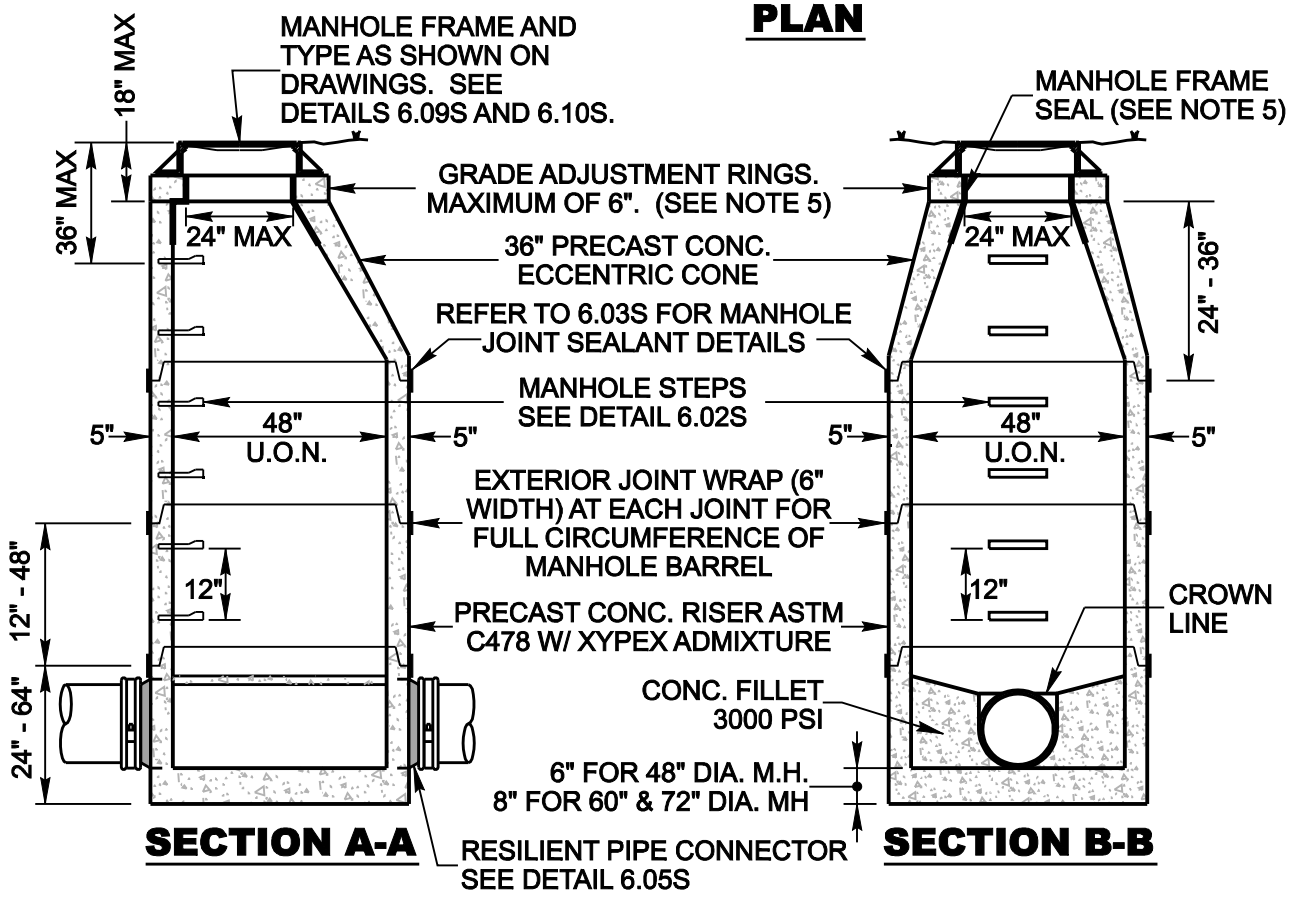
Sanitary Sewer Details
Water Details
Miscellaneous Details

NOTES:

1. DO NOT USE GRADE RINGS WHERE MH EXTENDS ABOVE GRADE.
2. PLACE 2 STRIPS OF BUTYL RUBBER SEALANT BETWEEN TOP OF CONCRETE AND BOTTOM OF MANHOLE FRAME. GROUT FRAME AND COVER TO MANHOLE.
3. MONOLITHIC MANHOLE SIDEWALL TO BE 5" THICK
4. ALL PRECAST MANHOLE SEGMENTS TO MEET REQUIREMENTS OF ASTMC478
5. WHERE GRADE ADJUSTMENT IS DONE, A MANHOLE FRAME SEAL SHALL BE PROVIDED.



PLAN



REV.: 01/2015
REV.: 02/2012
DATE: 08/2010

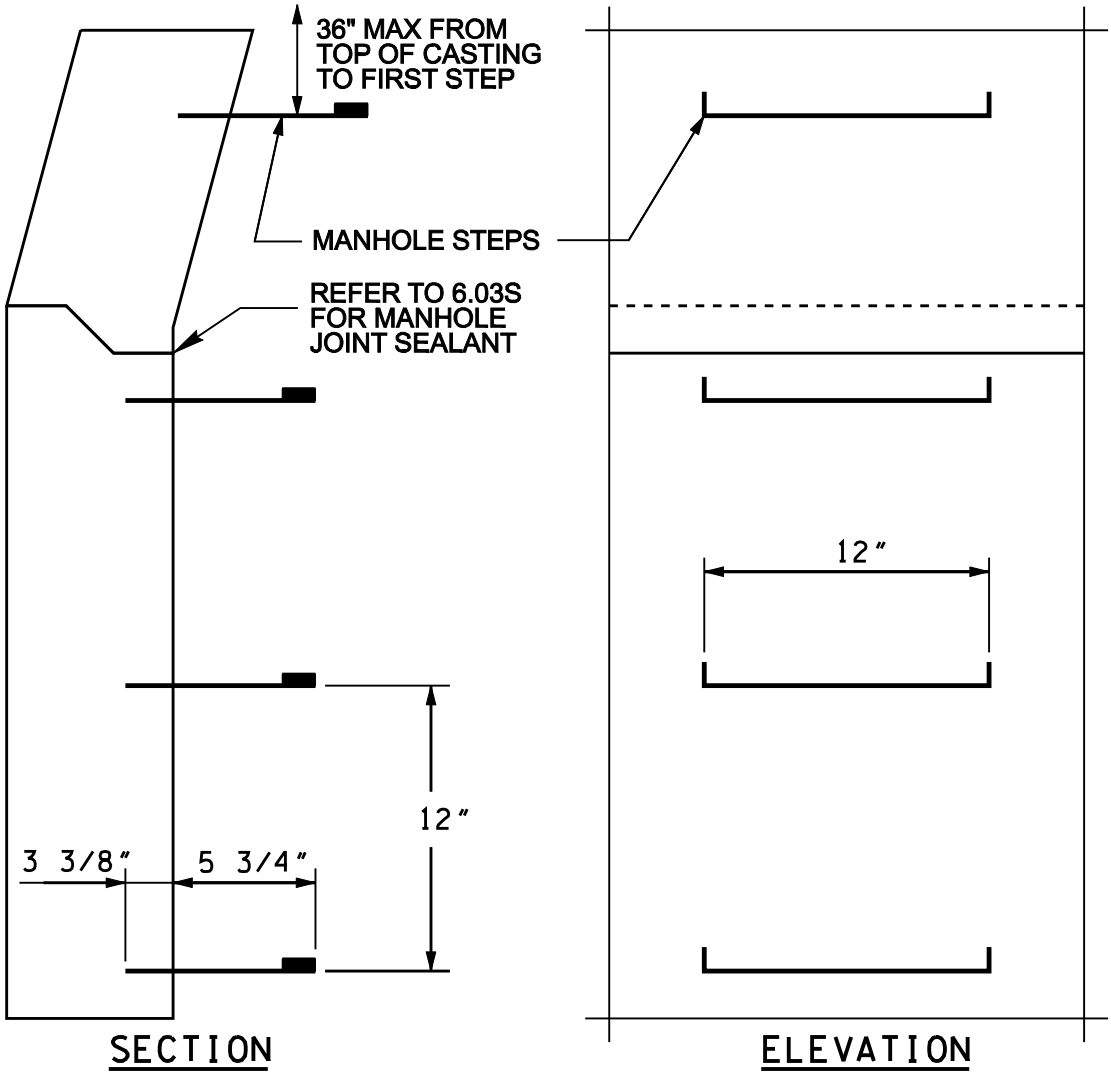
NOT TO SCALE

TYPICAL SANITARY SEWER MANHOLE

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NOTE:
3/8" STEEL REINFORCED ROD ENCAPSULATED
IN POLYPROPYLENE PLASTIC



1. STEPS TO BE INTEGRALLY CAST INTO MANHOLE SECTION.
2. STEPS TO BE ALIGNED VERTICALLY THROUGHOUT EACH MANHOLE SECTION
3. STEPS TO BE ALIGNED WITH OUTLET PIPE DIRECTION
4. LAST STEP TO BE 12" ABOVE PIPE

REV. 01/2015
DATE: 08/2010

NOT TO SCALE

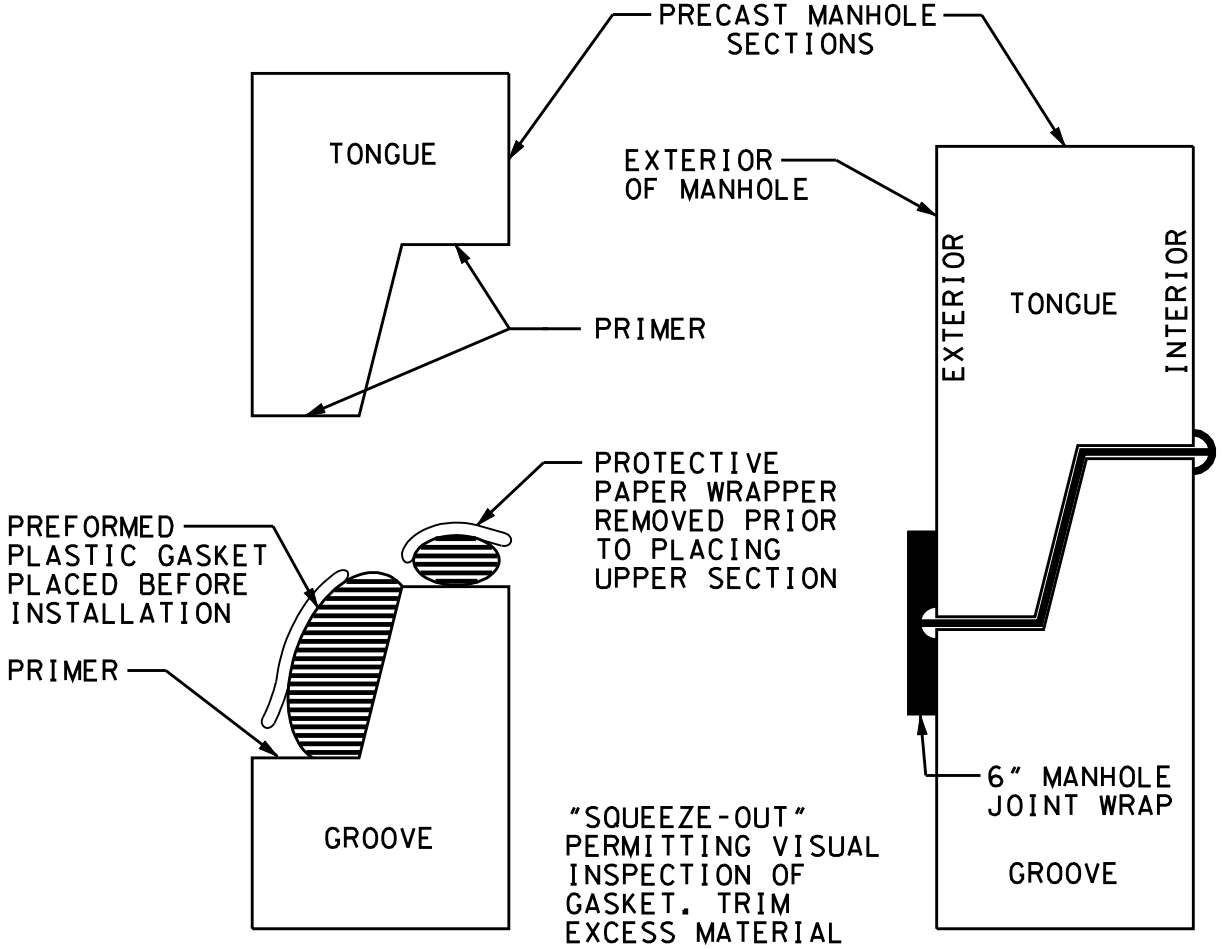
MANHOLE STEPS DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NOTE:

WHERE MASTIC DOES NOT PROTRUDE, EITHER INSIDE OR OUTSIDE, POINT UP JOINT WITH GROUT



OPEN JOINT

CLOSED JOINT

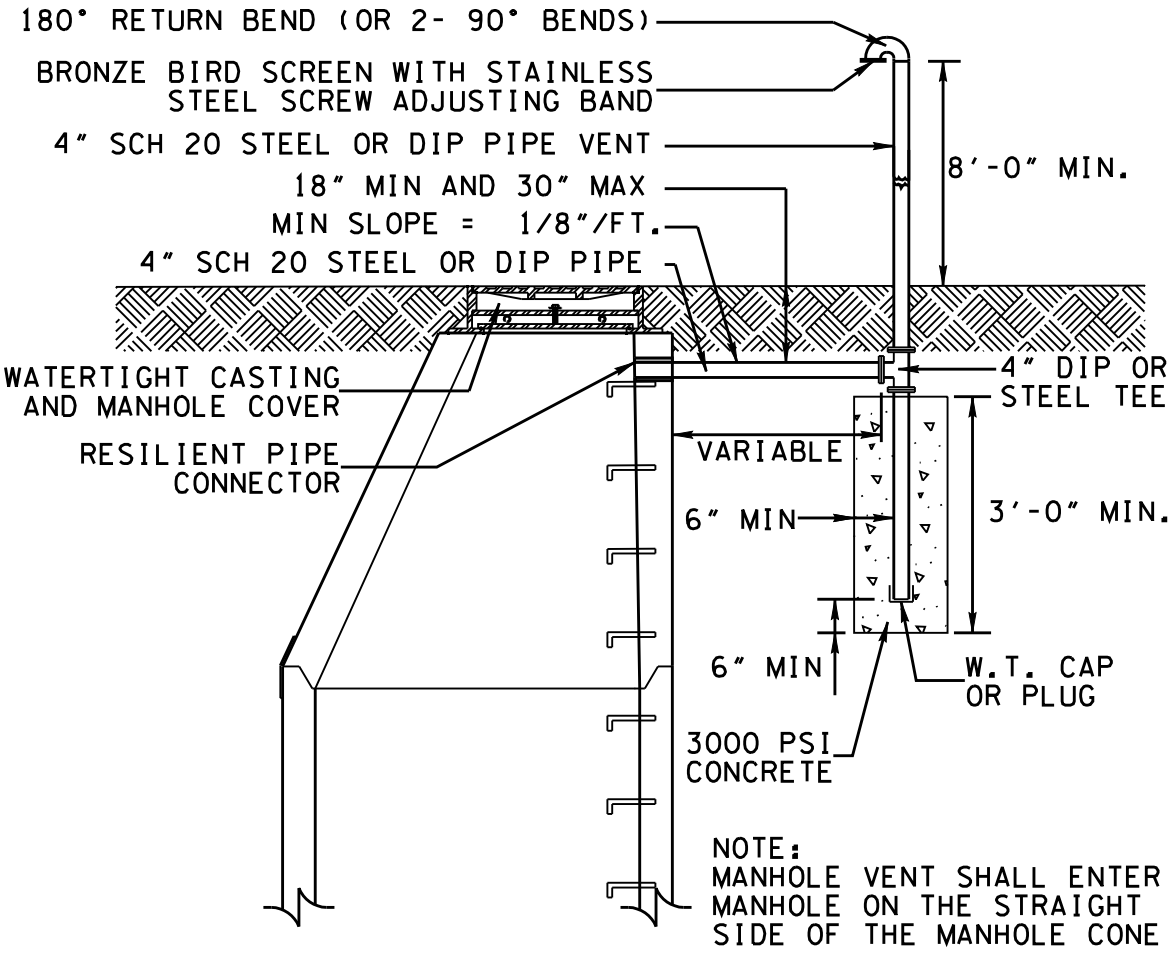
DATE: 08/2010

NOT TO SCALE

MANHOLE JOINT SEALANT DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. PIPE TO BE PAINTED WITH ONE COAT OF PRIMER, AND TWO COATS OF SAFETY GREEN ENAMEL.
2. TOP OF VENT TO BE MINIMUM OF 8'-0" ABOVE GRADE OR HIGHER IF ELEVATION IS SHOWN ON PLANS.

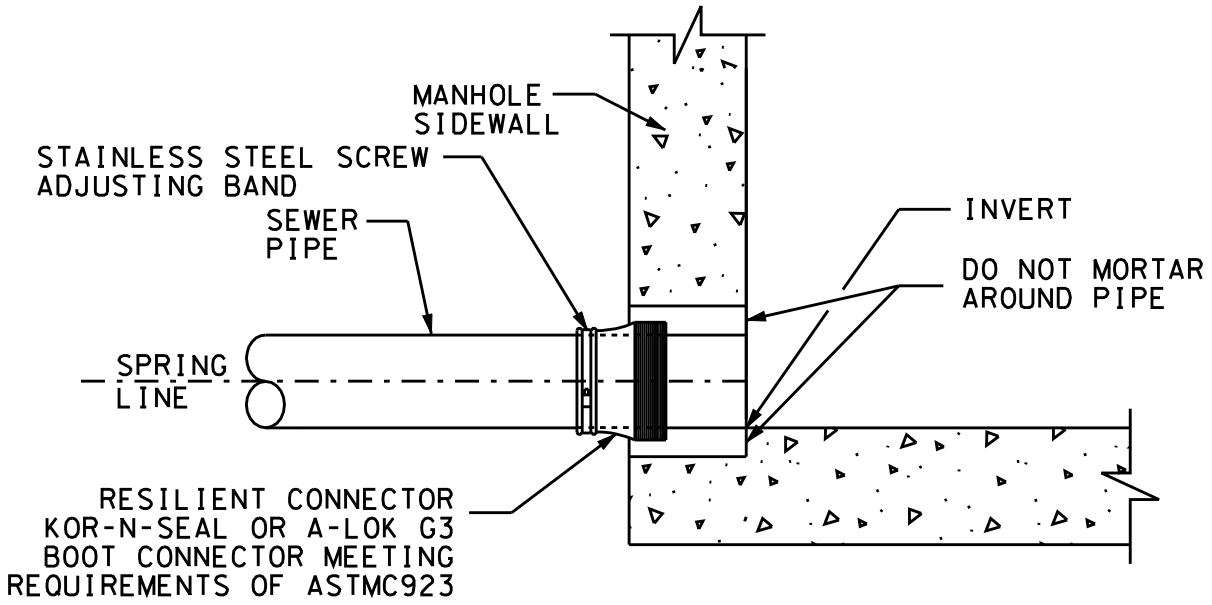
DATE: 08/2010

NOT TO SCALE

MANHOLE VENT DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE:

1. PIPES ENTERING/EXITING MANHOLES SHALL BE A MINIMUM OF 6 FT IN LENGTH

REV.: 02/2012
DATE: 08/2010

NOT TO SCALE

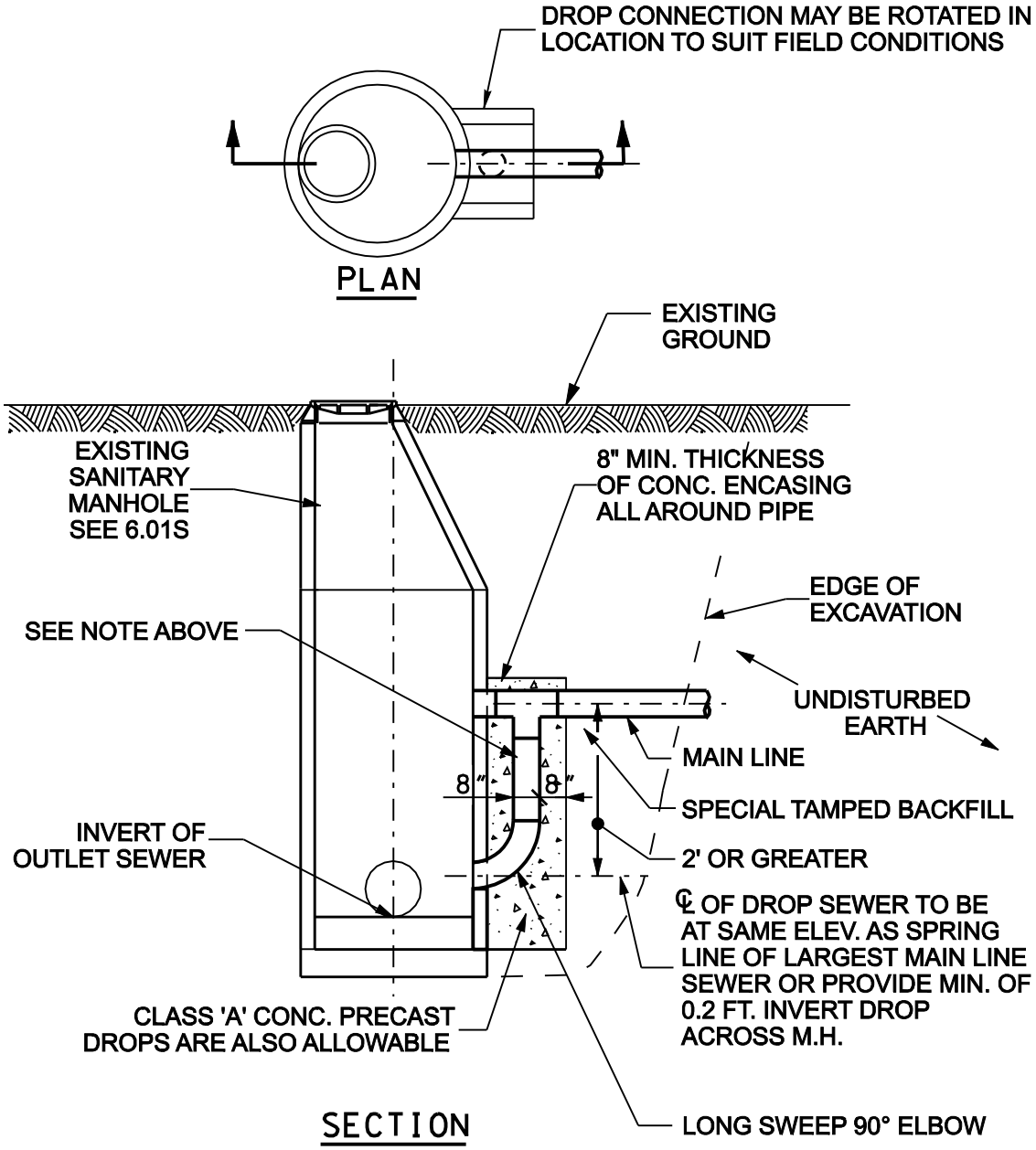
FLEXIBLE MANHOLE PIPE CONNECTION DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

DROP SIZE NOTE:

FOR GRAVITY SEWERS, DROP SIZES SHALL BE 8" FOR MAIN LINE UP THROUGH 12"; 10" FOR MAIN LINE 15" AND LARGER. FOR FORCE MAINS, DROP SIZES SHALL BE MINIMUM OF 6". FOR FORCE MAIN LARGER THAN 6", MATCH REQUIREMENTS FOR GRAVITY SEWERS.



REV. 01/2015

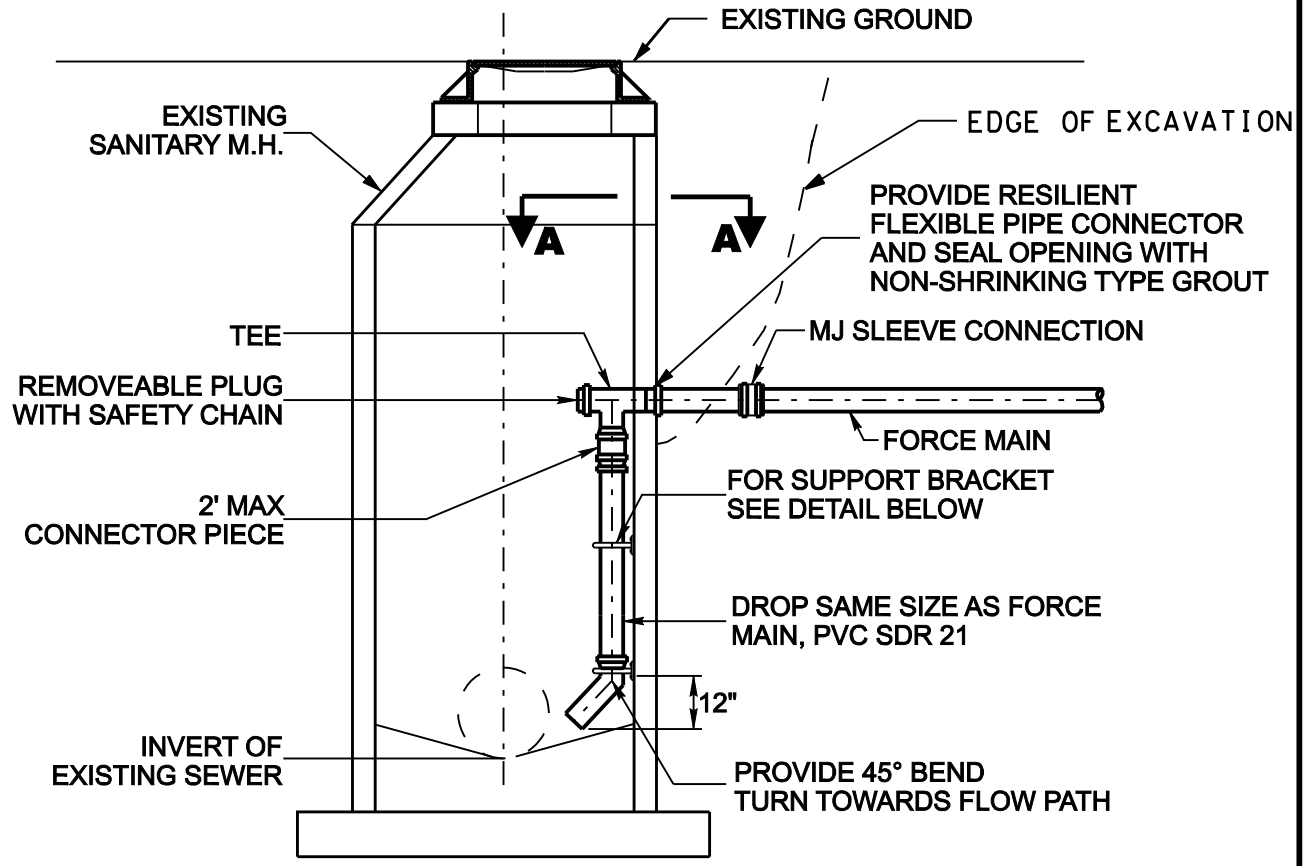
DATE: 08/2010

NOT TO SCALE

EXTERIOR DROP MANHOLE DETAIL (GRAVITY LINE ONLY)

STANDARD DETAILS

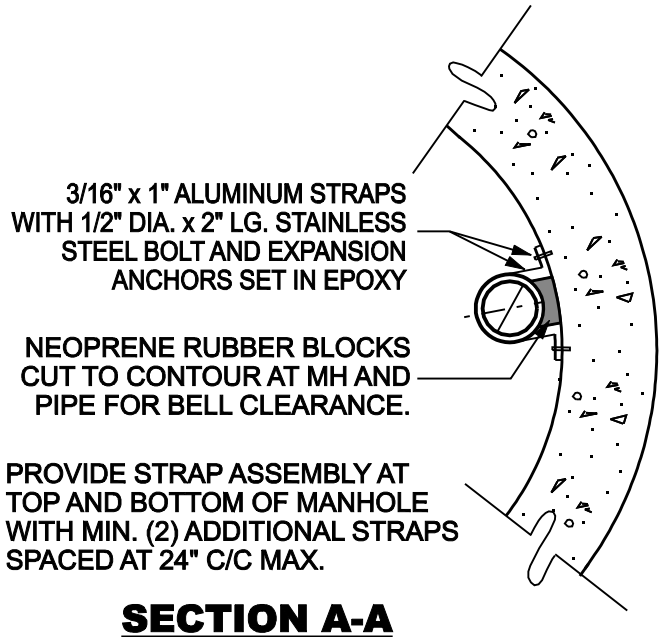
LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



SECTION

NOTES:

1. THIS DETAIL TO BE USED ONLY WITH PERMISSION OF LCWSA GENERAL MANAGER AND LCWSA BOARD ENGINEER.
2. STRONG-SEAL HIGH PERFORMANCE MIX MS2C SHALL BE APPLIED TO EXISTING MANHOLE. REFER TO SPECIFICATION 3.04
3. INTERIOR PIPING TO BE SAME SIZE AS FORCE MAIN PIPING.



SECTION A-A

REV. 01/2015
DATE: 08/2010

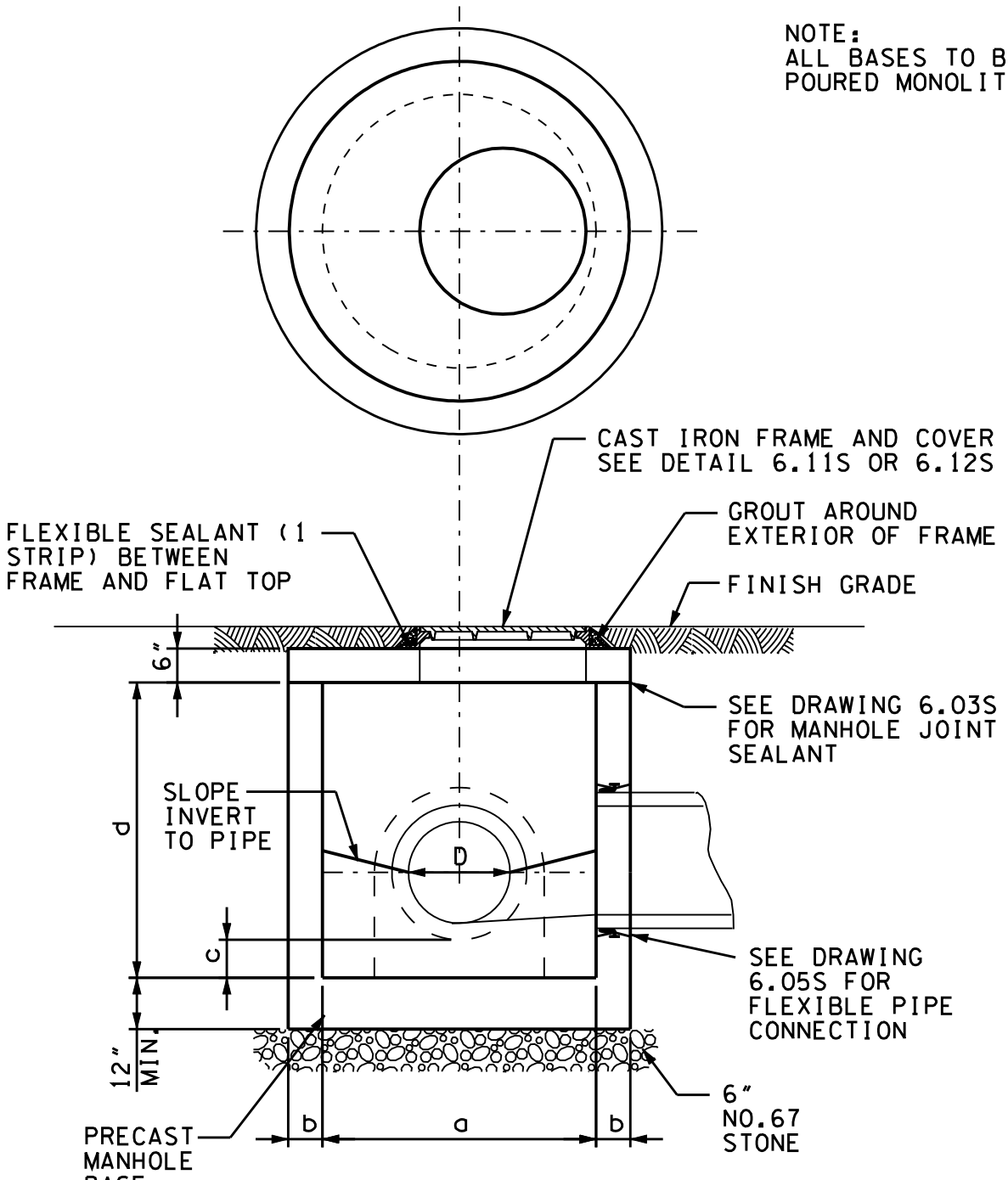
NOT TO SCALE

INTERIOR DROP MANHOLE DETAIL (FORCE MAIN CONNECTION ONLY)

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NOTE:
ALL BASES TO BE
POURED MONOLITHIC.



PIPE DIAMATER	MANHOLE DIAMATER	WALL THICKNESS	BASE THICKNESS	MIN. RISER HEIGHT	MAX. RISER HEIGHT
D	a	b	c	d	d
< 24"	4'-0"	5"	8"	2'-6"	5'-8"

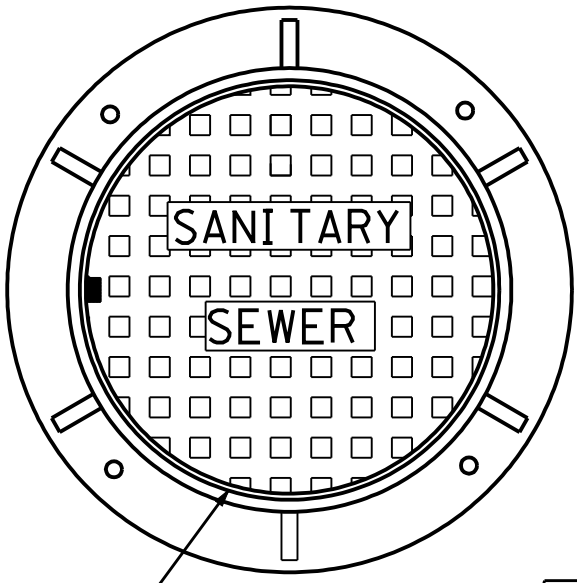
DATE: 08/2010

NOT TO SCALE

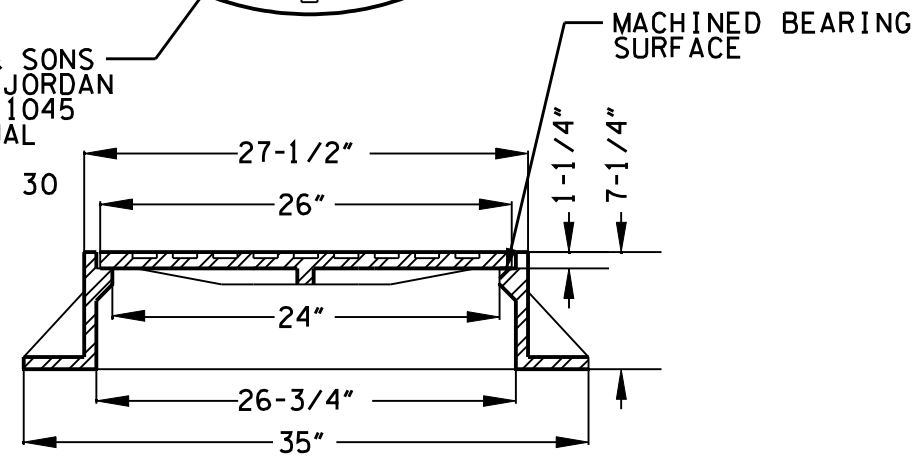
SHALLOW MANHOLE DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



JOHN BOUCHARD & SONS
NO. 1150, EAST JORDAN
IRON WORKS NO. 1045
OR APPROVED EQUAL
TRAFFIC DUTY
ASTM A48, CLASS 30



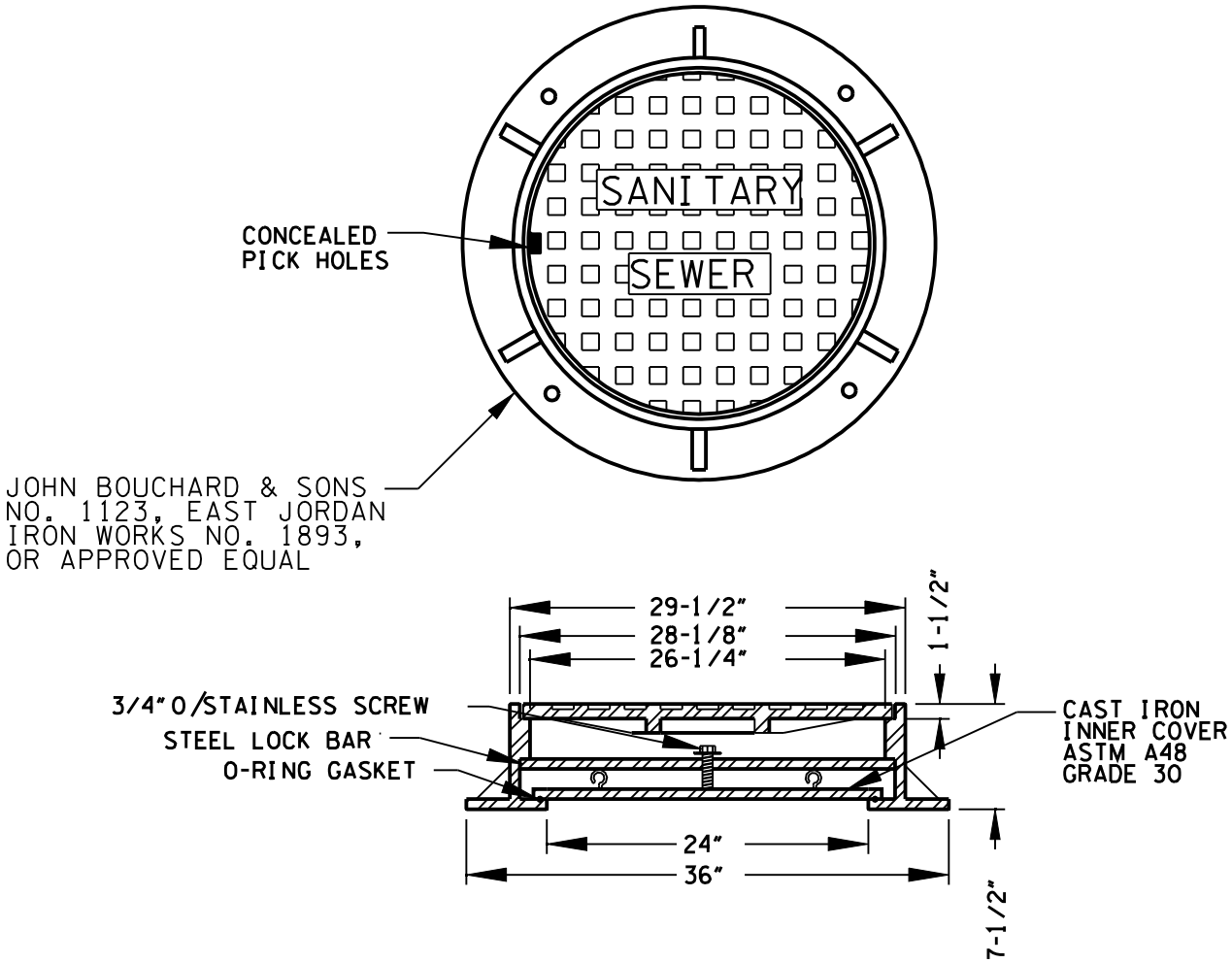
DATE: 08/2010

NOT TO SCALE

TRAFFIC TYPE MANHOLE FRAME AND COVER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



DATE: 08/2010

NOT TO SCALE

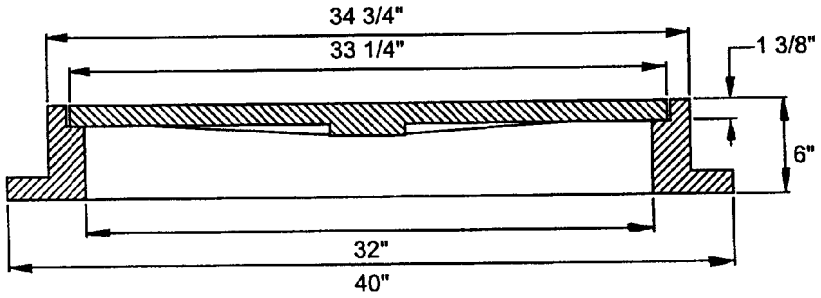
WATERTIGHT MANHOLE FRAME AND COVER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

JOHN BOUCHARD & SONS
NO. 1312, EAST JORDAN
IRON WORKS NO. 1320
OR APPROVED EQUAL
ASTM A48, GRADE 30

CONCEALED PICK HOLE



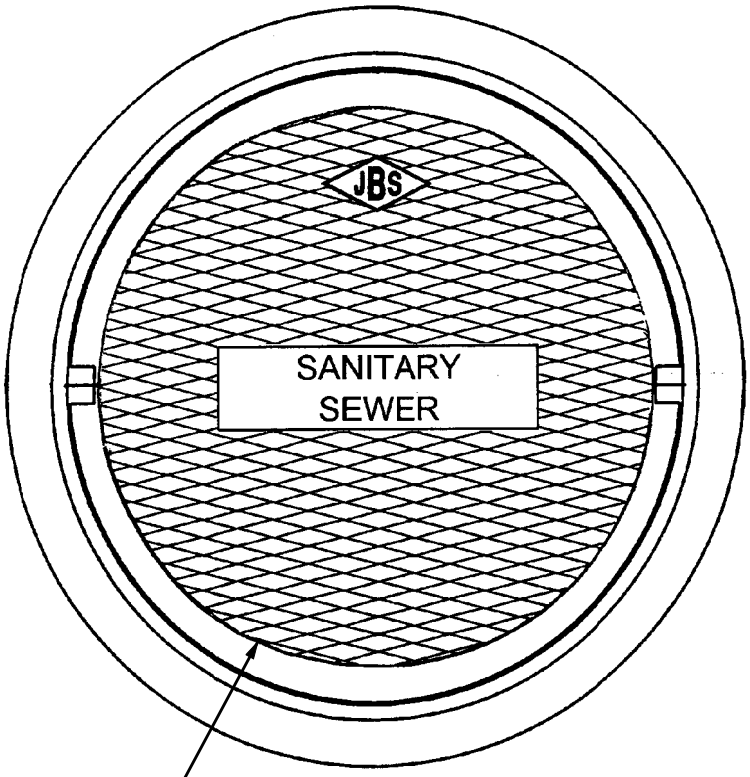
DATE: 08/2010

NOT TO SCALE

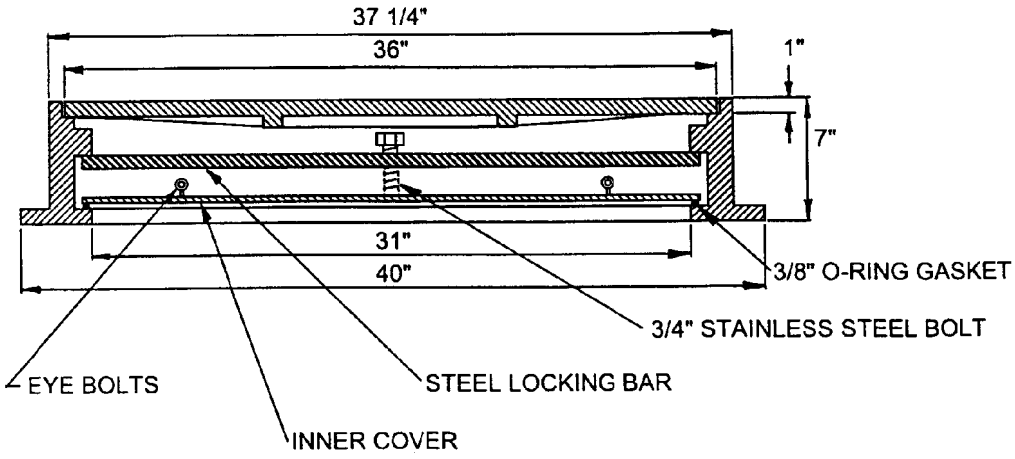
SHALLOW MANHOLE FRAME AND COVER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



JOHN BOUCHARD & SONS
NO. 1125 OR APPROVED
EQUAL



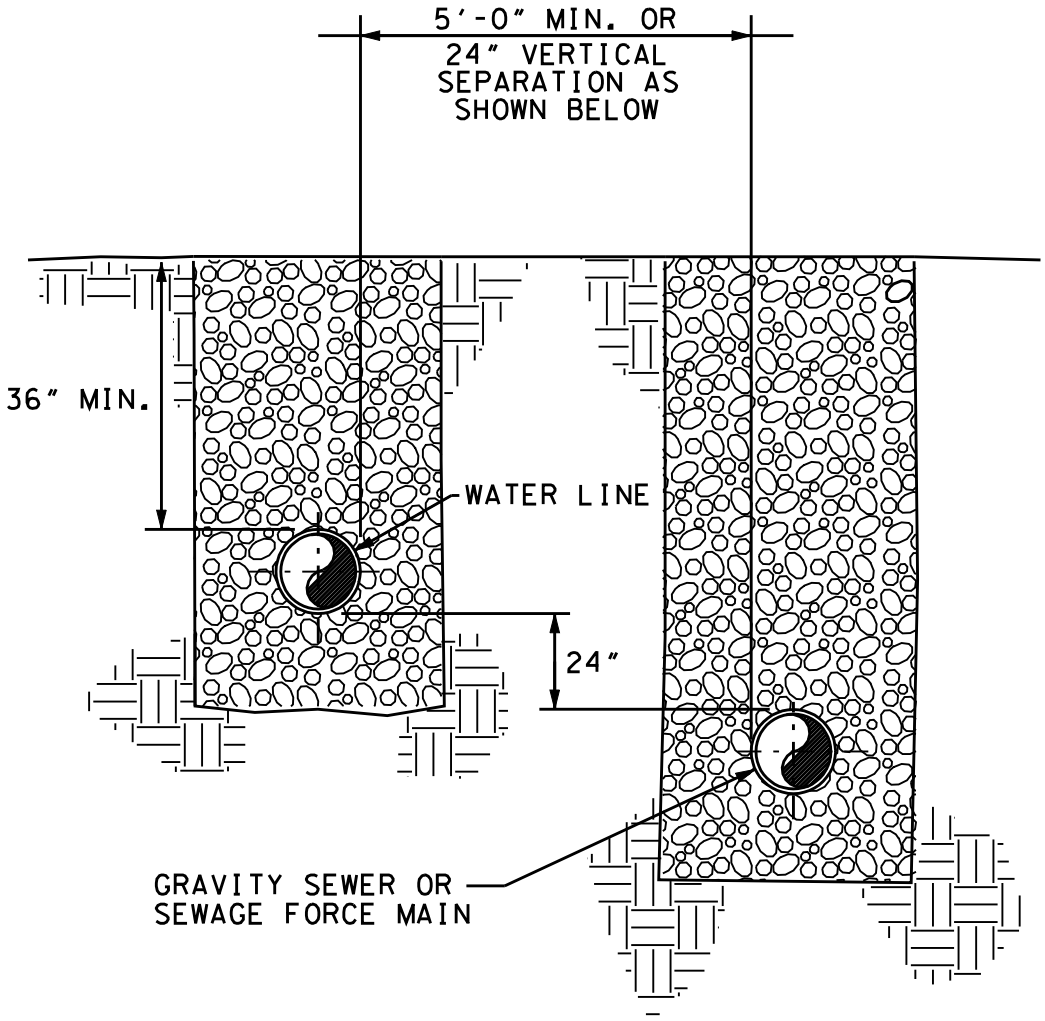
DATE: 08/2010

NOT TO SCALE

SHALLOW WATERTIGHT MANHOLE FRAME AND COVER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE: IF SEPARATION CANNOT BE MAINTAINED, THE SEWER PIPE SHALL BE ENCASED A DISTANCE OF 5 FEET EITHER SIDE OF THE POINT OF CROSSING

DATE: 08/2010

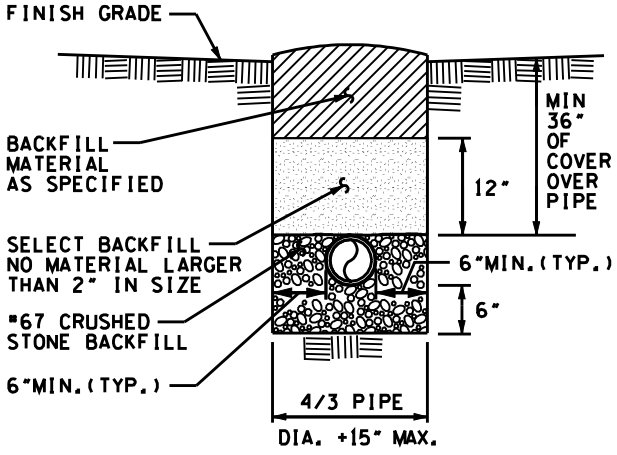
NOT TO SCALE

TYPICAL WATER AND SANITARY SEWER SEPARATION

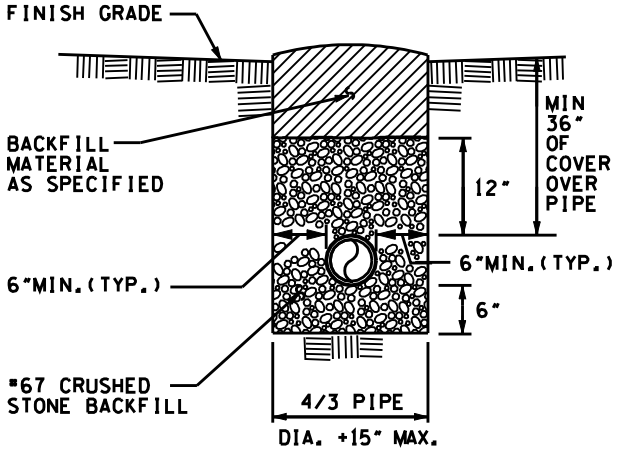
STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NOTE:
SEE SPECIFICATIONS FOR
DEPTH REQUIREMENT
OF SEWER PIPE

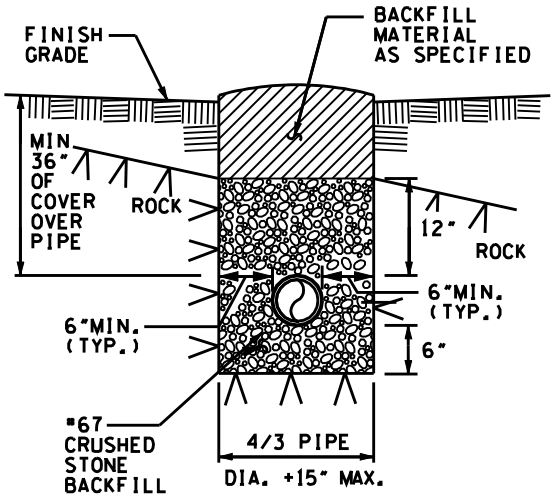


DUCTILE IRON PIPE IN EARTH



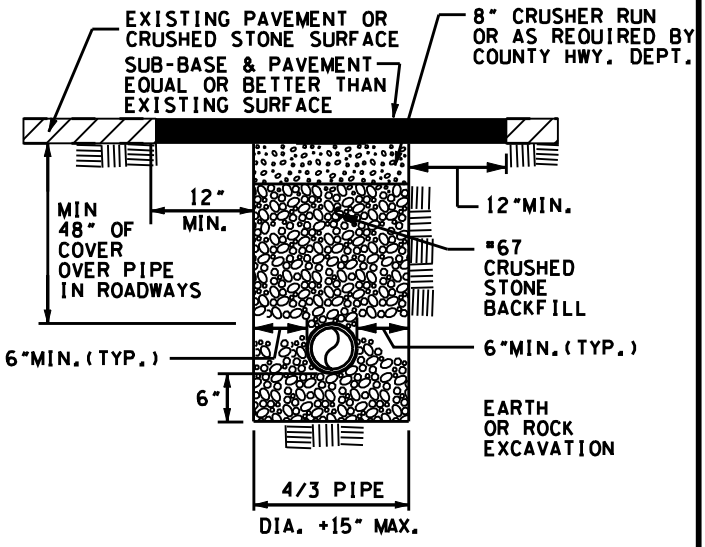
PVC PIPE IN EARTH

NOTE:
UNTIL REPAVING IS COMPLETED, USE A DENSE GRADED STONE FOR THE TOP 6" FOR TEMPORARY SURFACE



ALL PIPE IN ROCK

CRUSHED STONE SURFACE
EQUAL TO EXISTING SURFACE
OR 6" MIN.



ALL PIPE IN TRAFFIC AREAS

DATE: 08/2010

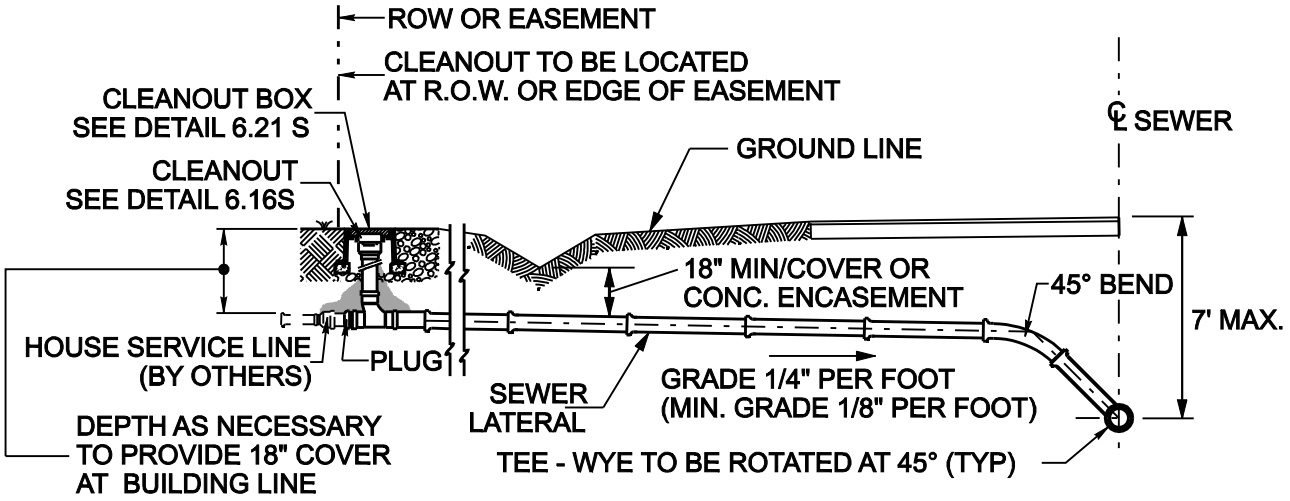
REFER TO DETAIL 6.08W FOR SEWER FORCE MAIN BEDDING AND BACKFILLING DETAILS

NOT TO SCALE

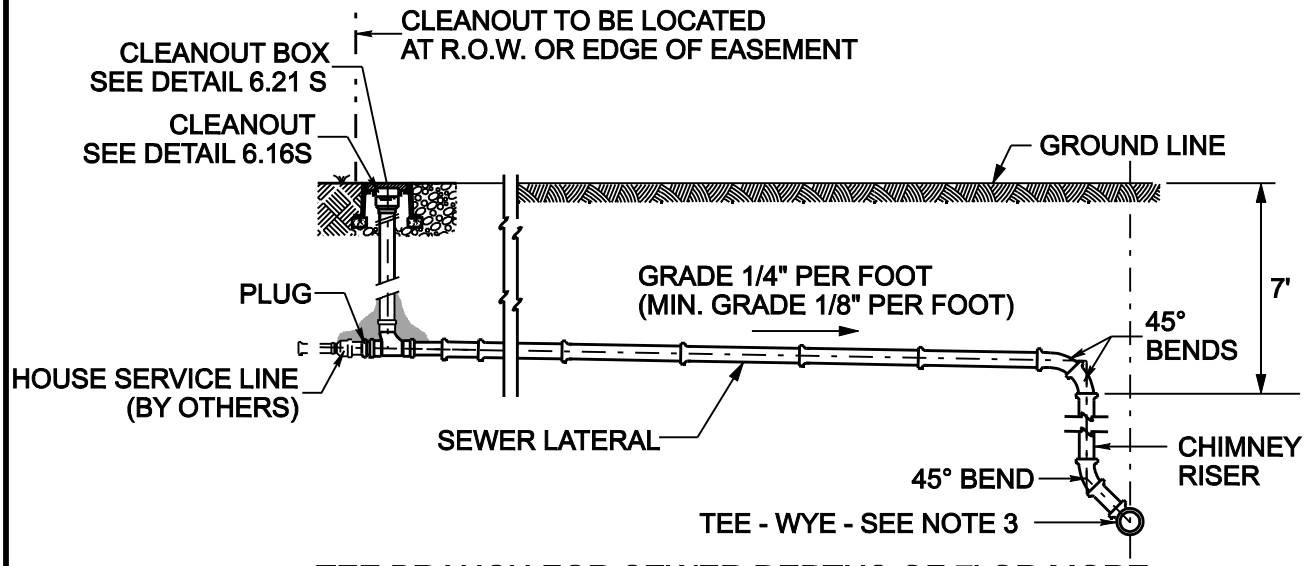
GRAVITY SANITARY SEWER BEDDING AND BACKFILL DETAILS

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



TEE BRANCH FOR SEWER DEPTHS LESS THAN 7'



TEE BRANCH FOR SEWER DEPTHS OF 7' OR MORE

NOTES:

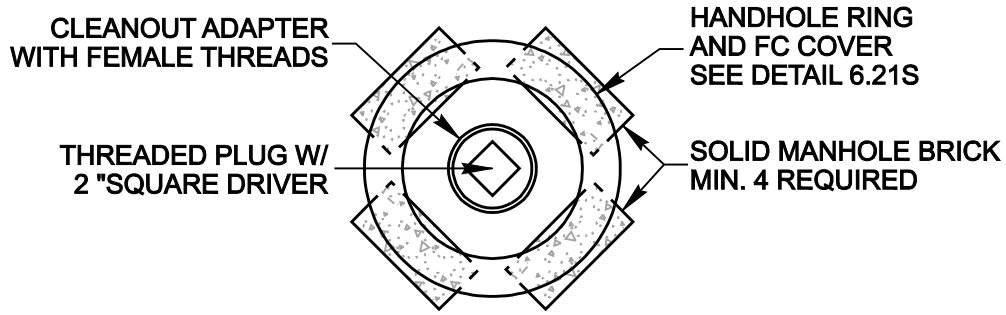
1. SERVICE MATERIAL TO BE SCH. 40 PVC. BACKFILL FOR SERVICE LINE TO BE SAME AS FOR SEWER LINE.
2. LATERAL SIZE TO BE 4" FOR RESIDENTIAL SERVICES; 6" FOR COMMERCIAL OR INDUSTRIAL SERVICES UNLESS OTHERWISE NOTED.
3. TEES SHALL BE SDR 26 WITH GASKETED BRANCHES. 8" x 4" SERVICES SHALL TRANSITION TO SCH. 40 PVC AT THE TEE. 8" x 6" TEE WILL REQUIRE A SECTION OF SDR 26 PIPE AND SLEEVE TO TRANSITION TO SCH. 40 PVC.
4. ALL FITTINGS PAST THE TEE SHALL BE SOLVENT WELD GLUE JOINT FITTINGS.
5. TEES SHALL NOT BE ORIENTED IN THE 12 O'CLOCK (STRAIGHT UP) POSITION.
6. TEES SHALL NOT BE PLACED BACK-TO-BACK. CONSECUTIVE TEES MUST BE SEPARATED BY AT LEAST 6 FT OF MAIN LINE PIPE.

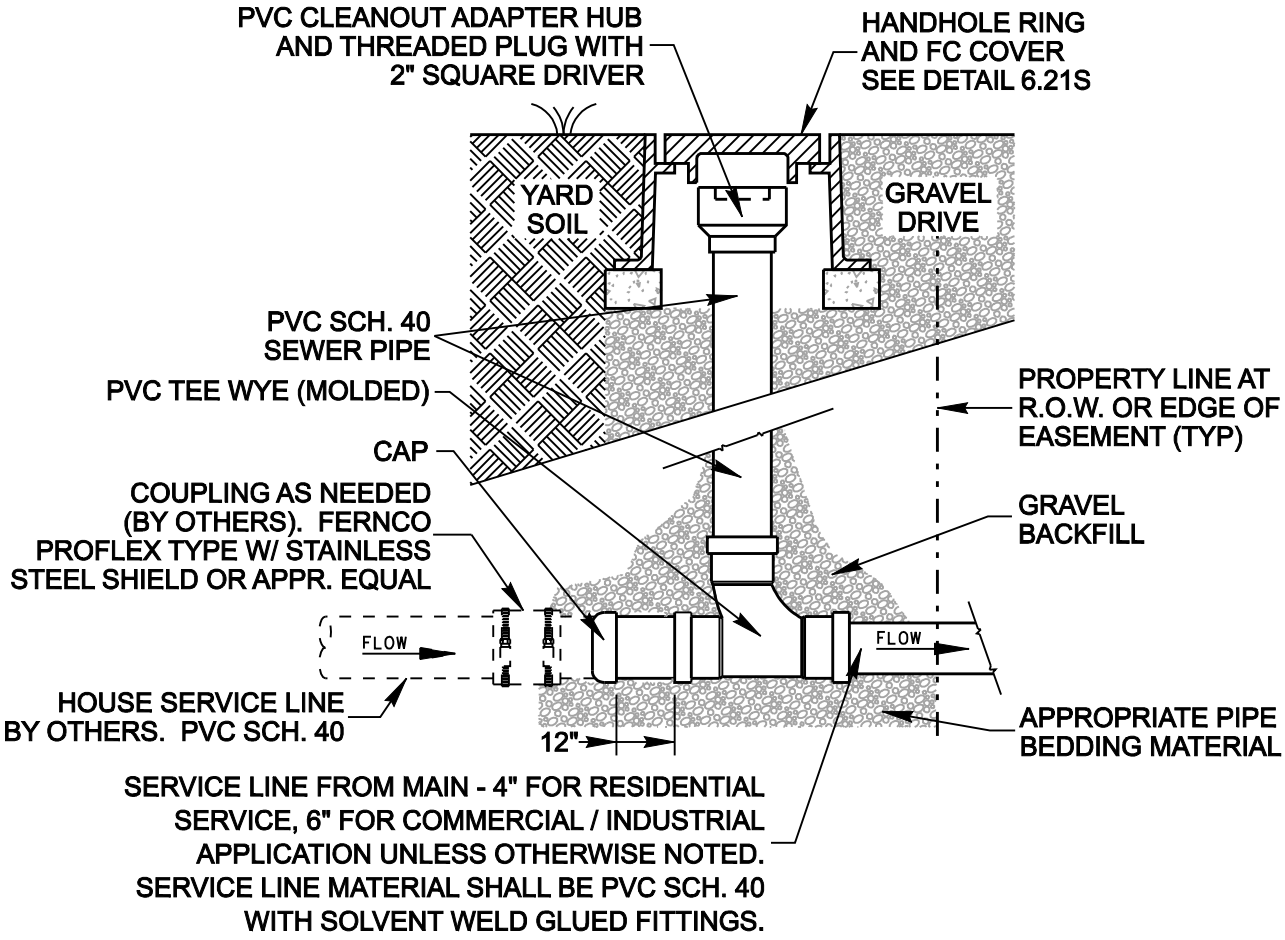
DATE: 08/2010	REVISED 11/2010	REVISED 02/2012	NOT TO SCALE

SANITARY SEWER LATERALS

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA





REVISED: 11/2010

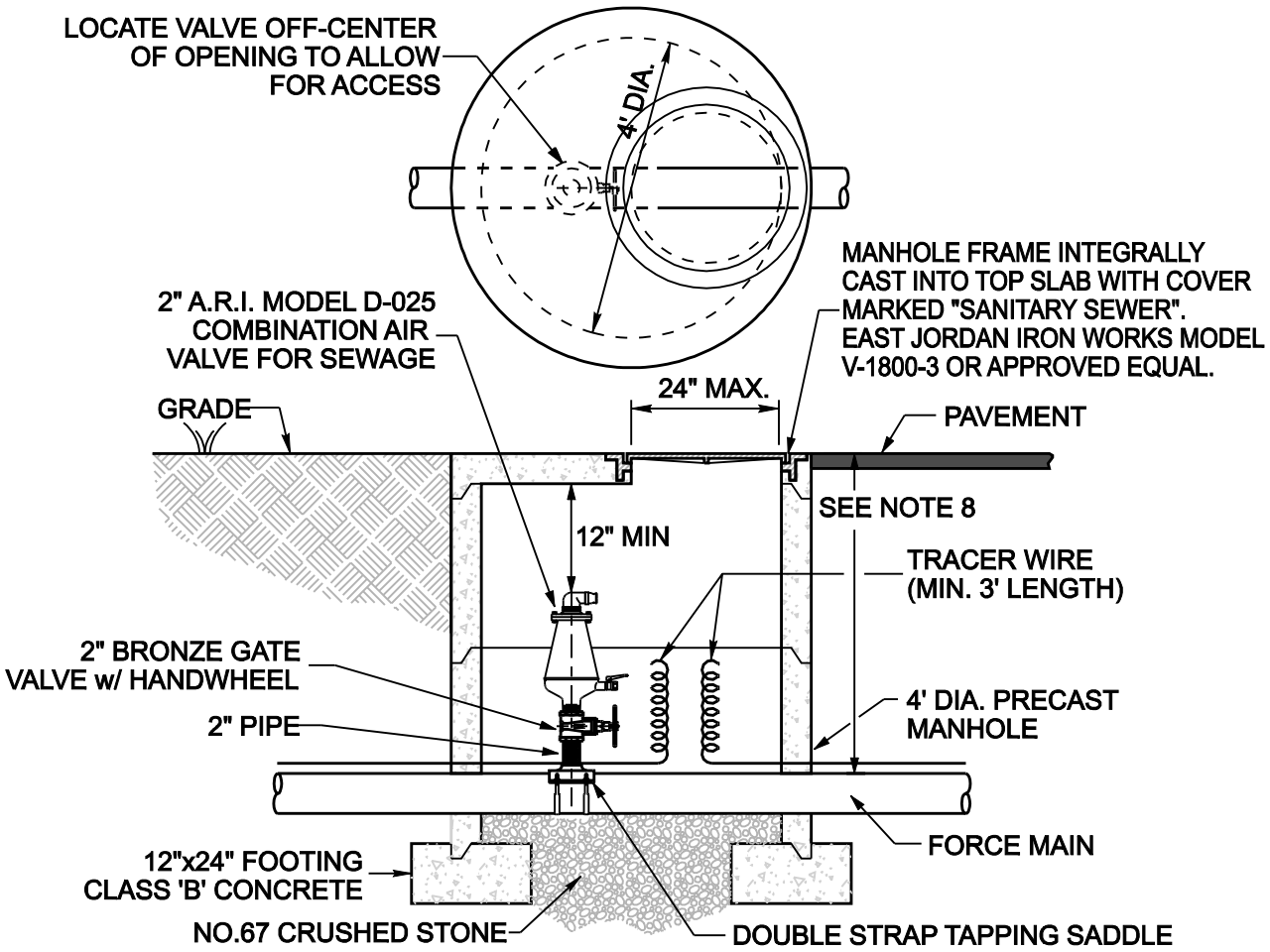
DATE: 08/2010

NOT TO SCALE

SANITARY SEWER SERVICE CLEANOUT ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. COMBINATION AIR VALVE TO BE INSTALLED AT ACTUAL HIGH POINT OF LINE. CONTRACTOR SHALL COORDINATE LOCATION WITH INSPECTOR
2. ALL PIPING FOR COMBINATION AIR VALVE SHALL BE BRASS OR STAINLESS STEEL.
3. CONTRACTOR SHALL ADJUST THE DEPTH OF THE FORCE MAIN AT ALL HIGH POINTS TO ACCOMMODATE THE INSTALLATION OF THE COMBINATION AIR VALVE.
4. VALVE BODY SHALL BE RESTRAINED AND SUPPORTED BY BRACING TO INTERIOR WALL OF MH.
5. TERMINATE TRACER WIRE INSIDE VALVE VAULT.
6. APPLY GROUT AS NEEDED AT PIPE-TO-MANHOLE CONNECTION TO PREVENT SEDIMENTATION INSIDE MANHOLE.
7. DEPTH OF ARV MANHOLE SHALL BE OF SUFFICIENT DEPTH SO THAT FLAT-TOP SECTION AND CASTING ARE FLUSH WITH GRADE. CONTRACTOR SHALL MODIFY PIPE DEPTH AS NEEDED DURING INSTALLATION TO ACCOMODATE DEPTH OF STRUCTURE.

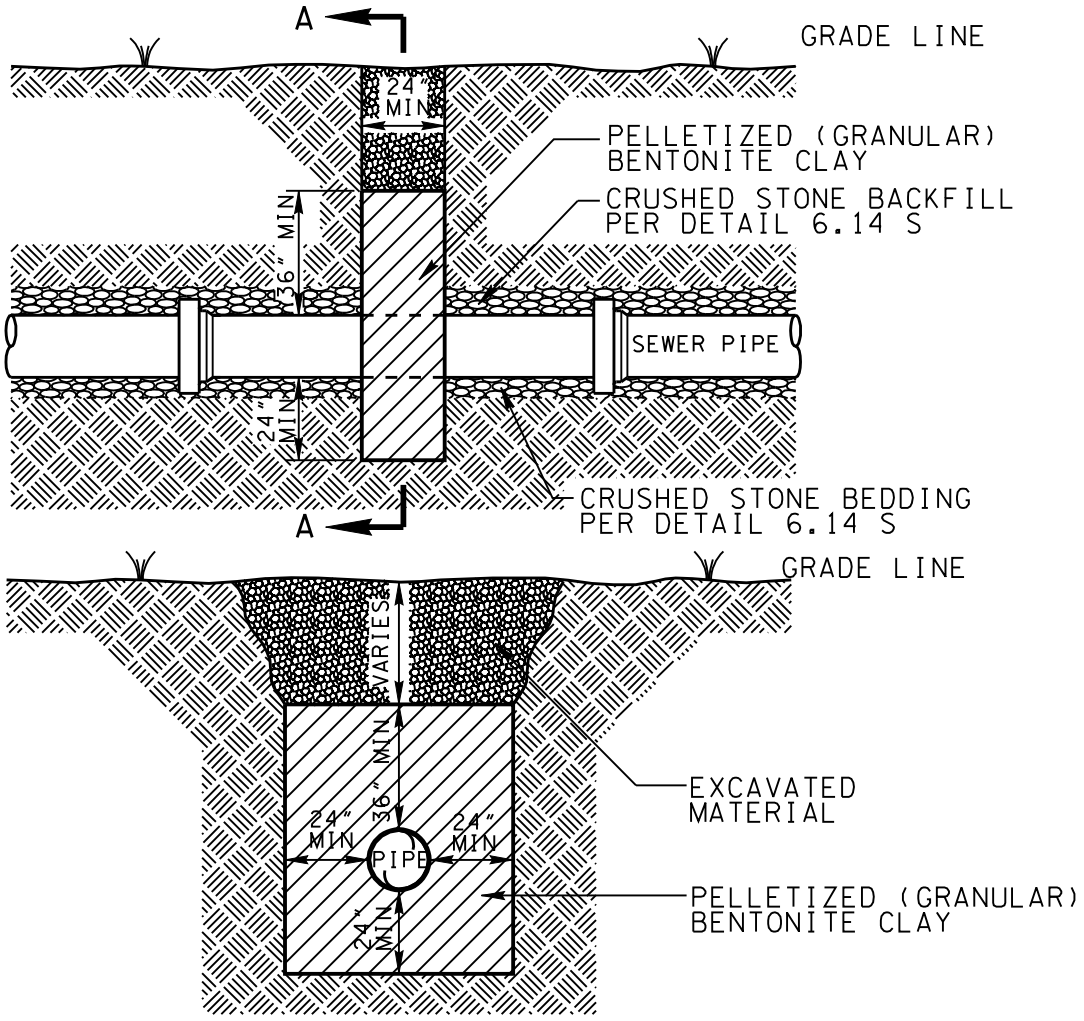
REV. 01/2015
DATE: 08/2010

NOT TO SCALE

TYPICAL SEWAGE AIR/ VACUUM RELEASE VALVE

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



SECTION A-A

NOTE:
A 24" KEYWAY SHALL BE CUT IN DIRT EXCAVATION. FRACTURED AND SHOT ROCK SHALL BE REMOVED TO CLEAN SOLID ROCK IN ROCK TRENCHES. THIS IS REQUIRED ON SIDES IN ADDITION TO BOTTOM. IF BOTTOM IS OVERSHOT, IT MUST BE CLEANED TO SOLID UNFRACTURED ROCK.

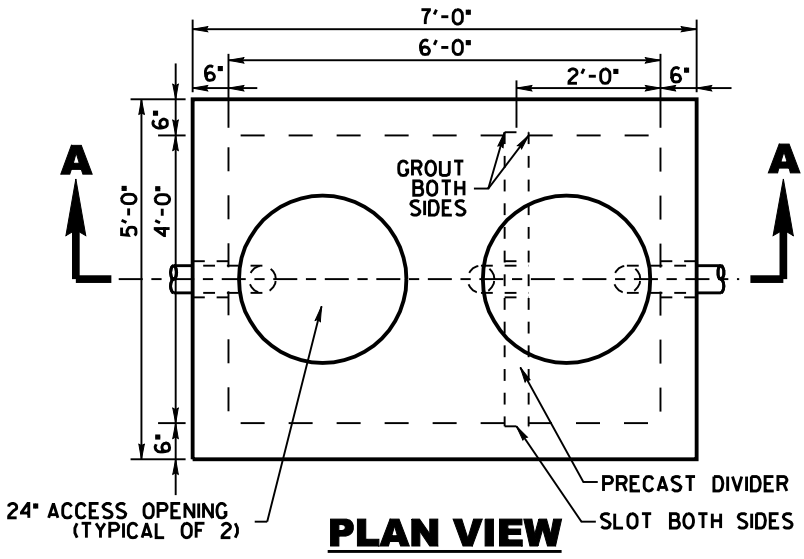
DATE: 08/2010

NOT TO SCALE

CHECK DAMS FOR SANITARY SEWER LINES

STANDARD DETAILS

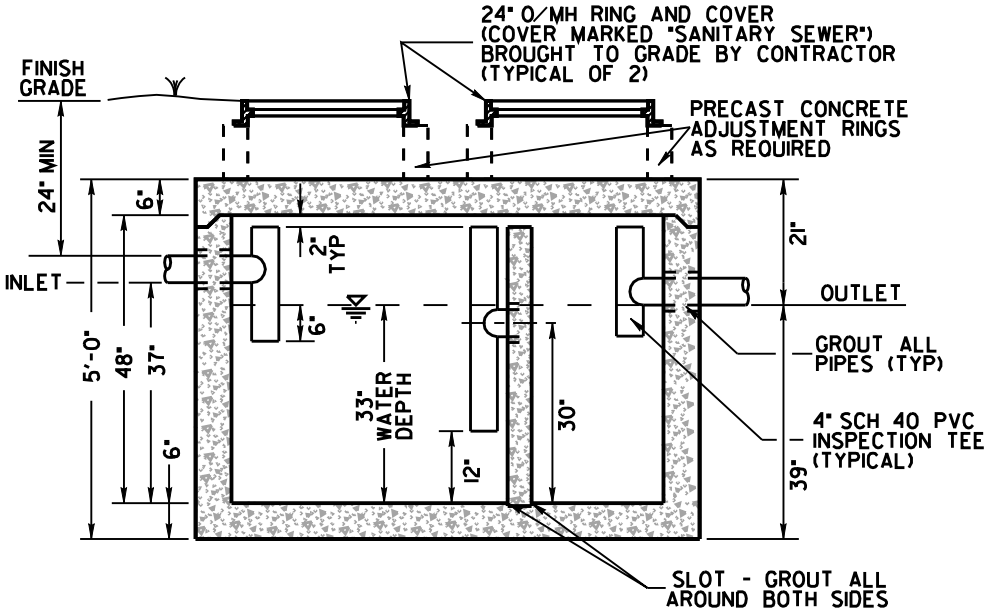
LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



PLAN VIEW

GENERAL NOTES

1) CONCRETE: 28 DAY COMPRESSIVE STRENGTH f'c = 4,500 PSI
2) REINFORCEMENT: ASTM A-615 GRADE 60
3) LOADS: H-20 TRUCK WHEEL WITH 30% IMPACT PER AASHTO
4) BUTYL RUBBER JOINT SEALANT SS-S-00210
5) CONTRACTOR TO:
   -- SUPPLY AND INSTALL ALL PIPING AND SAMPLING TEES
   -- GROUT ALL PIPES AND WEIRS
   -- FILL WITH CLEAN WATER PRIOR TO "START-UP" OF SYSTEM



SECTION A-A

NOTE:

A 500 GALLON GREASE TRAP IS SHOWN HERE, HOWEVER THE SIZE NECESSARY IS TO BE DETERMINED BASED ON DESIGN CRITERIA AND THE FOLLOWING FORUMLA:

NUMBER OF MEALS PER PEAK HOUR **X** WASTE FLOW RATE **X** RETENTION TIME **X** STORAGE FACTOR **=** CAPACITY IN GALLONS

SIZES LARGER THAN SHOWN HERE ARE AVAILABLE AND MAY BE REQUIRED. CONFIRM SIZING WITH LCWSA FOG POLICIES.

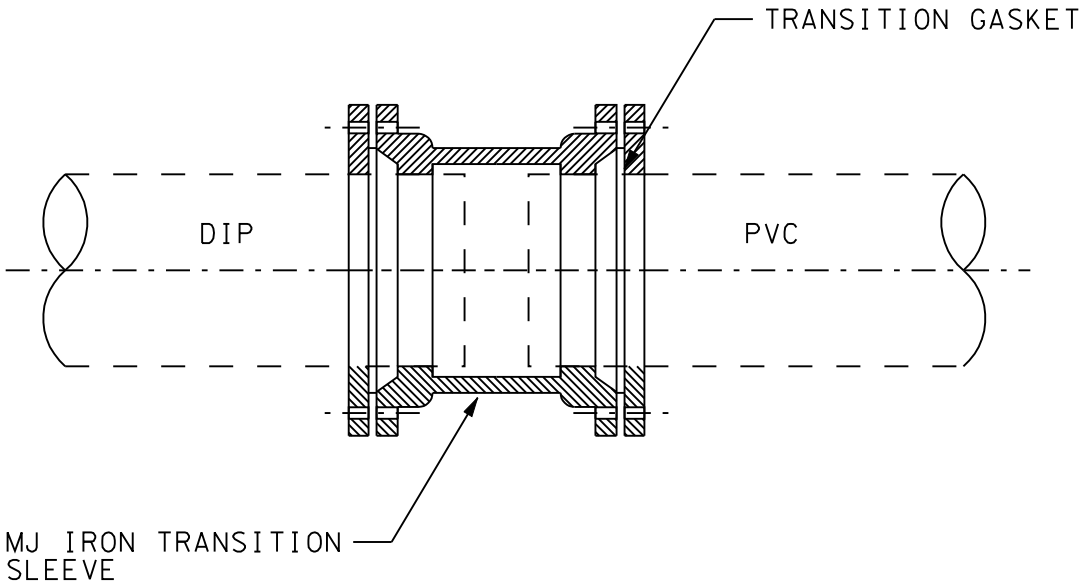
REV. 01/2015
DATE: 06/2011

NOT TO SCALE

500 GALLON GREASE TRAP

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. TRANSITION SLEEVES SHALL BE SOLID, MECHANICAL JOINT, LONG PATTERN FITTINGS. AWWA C153
2. LCWSA SHALL APPROVE ALTERNATE TRANSITION METHODS.

SOLID SLEEVE TRANSITION

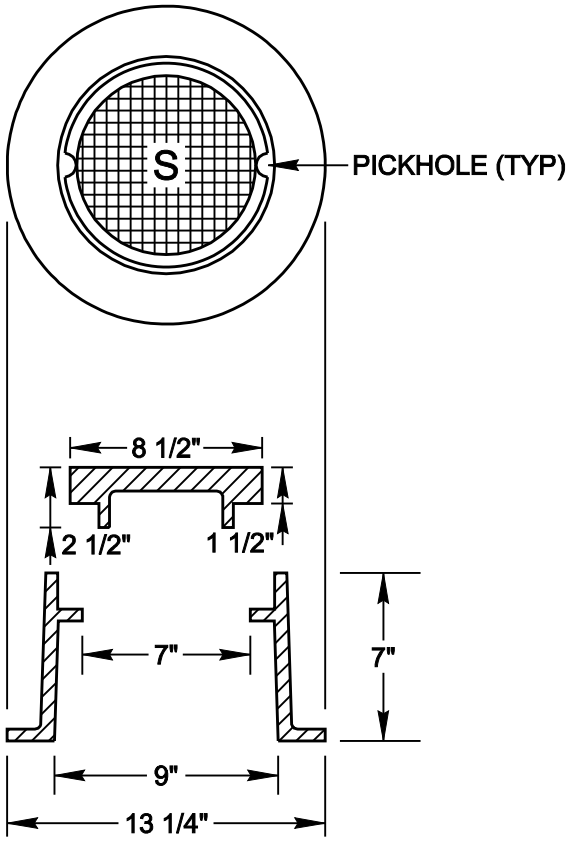
DATE: 08/2010

NOT TO SCALE

TYPICAL SEWER LINE REPAIR TRANSITION

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:
1. CASTING TO BE U.S. FOUNDARY, NO. 7610 OR EQUAL
2. COVER TO BE MARKED WITH LETTER "S"

REVISED: 11/2010

DATE: 08/2010

NOT TO SCALE

SMALL CAST IRON CLEANOUT BOX FRAME AND COVER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

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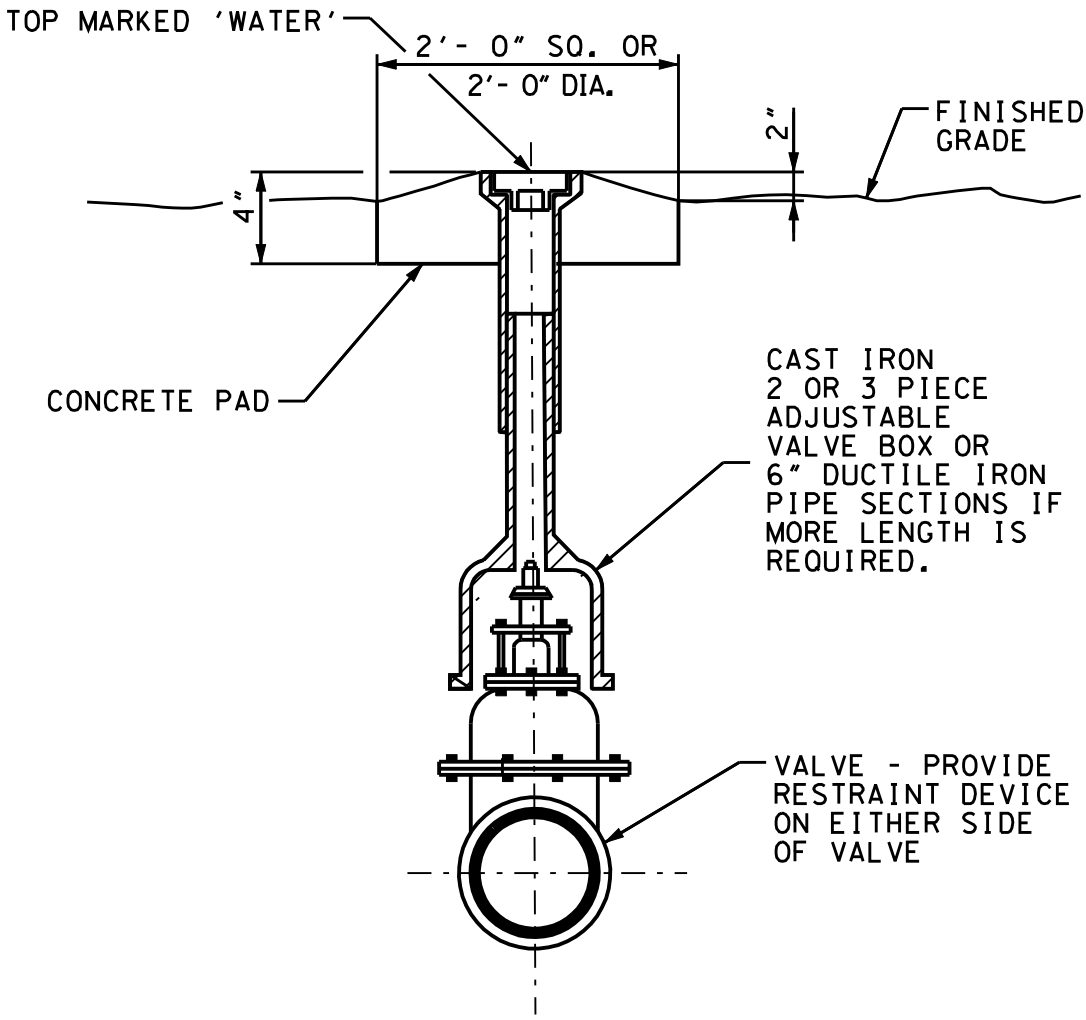


NOTE:

CAST AROUND THE TOP OF EACH VALVE BOX A CONCRETE DISK 2'-0" IN DIAMETER OR 2'-0" SQUARE AND 4" THICK WHEN VAVLES ARE LOCATED IN UNPAVED AREAS. NOT REQUIRED IN PAVED AREAS. PAD MAY BE PRECAST.

REVISED: 01/2015

DATE: 08/2010

NOT TO SCALE

TYPICAL VALVE BOX SETTING

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

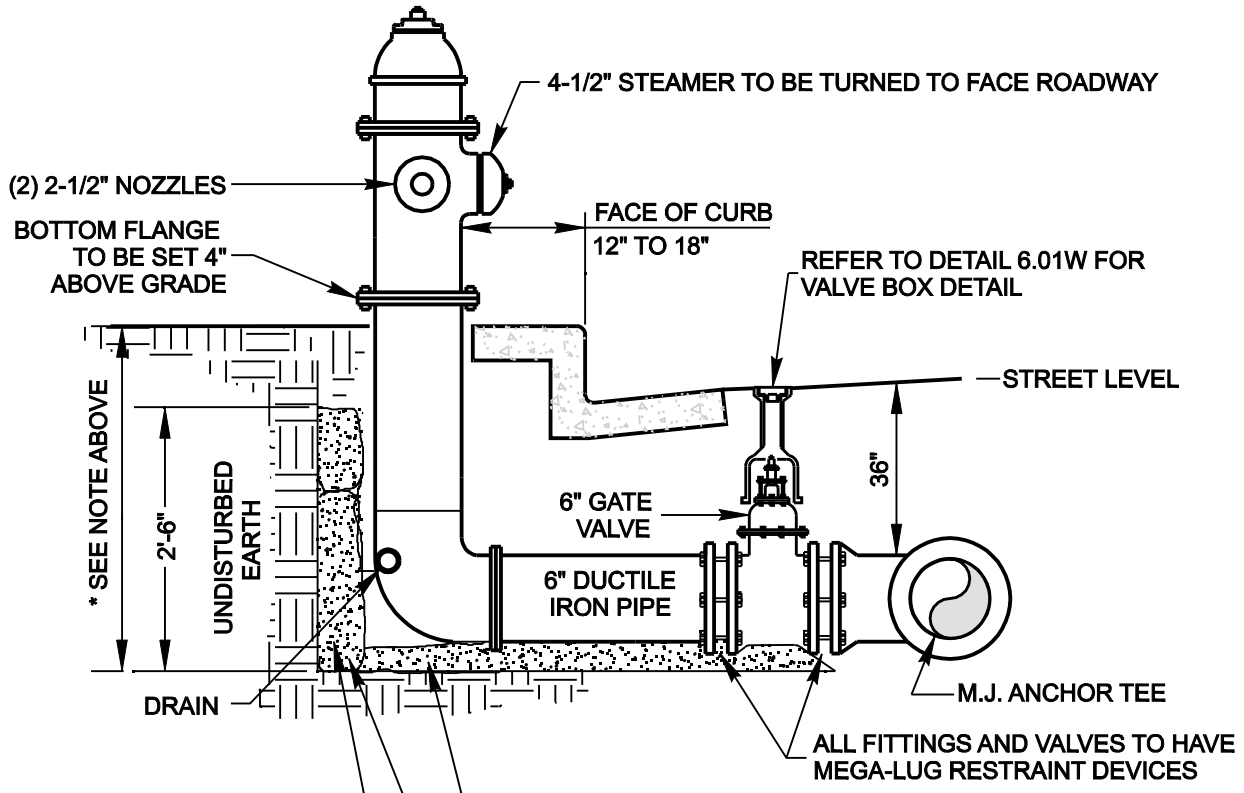
* HYDRANT BURY SHALL BE 48" MINIMUM WITH 36" COVER ABOVE WATER LINE AND BOTTOM FLANGE OF HYDRANT SET 4" ABOVE GRADE.

NOTE:
FIRE HYDRANT SHALL NOT SIT CLOSER THAN 5' FROM EDGE OF ANY POWER AND/OR LIGHT POLE.

HYDRANT SHALL BE SET ON CONCRETE VALVE BOX FOOTING BLOCK. CONCRETE BLOCK OR POURED CONCRETE (CLASS A) SHALL BE WEDGED FIRMLY BEHIND AND EXTENDING AROUND HYDRANT TO UNDISTURBED EARTH.

CARE SHALL BE USED TO SET HYDRANT PLUMB. THE FIRE HYDRANT SHALL BE LOCATED NOT LESS THAN 12 INCHES OR MORE THAN 18 INCHES FROM FACE OF CURB TO FRONT OF HYDRANT PROTECTION CASE.

A MINIMUM OF 2 CU. FT. OF CRUSHED STONE SHALL BE PLACED AROUND LEAD ADJOINING BLOCKING FOR DRAINAGE FROM WASTE OPENING.



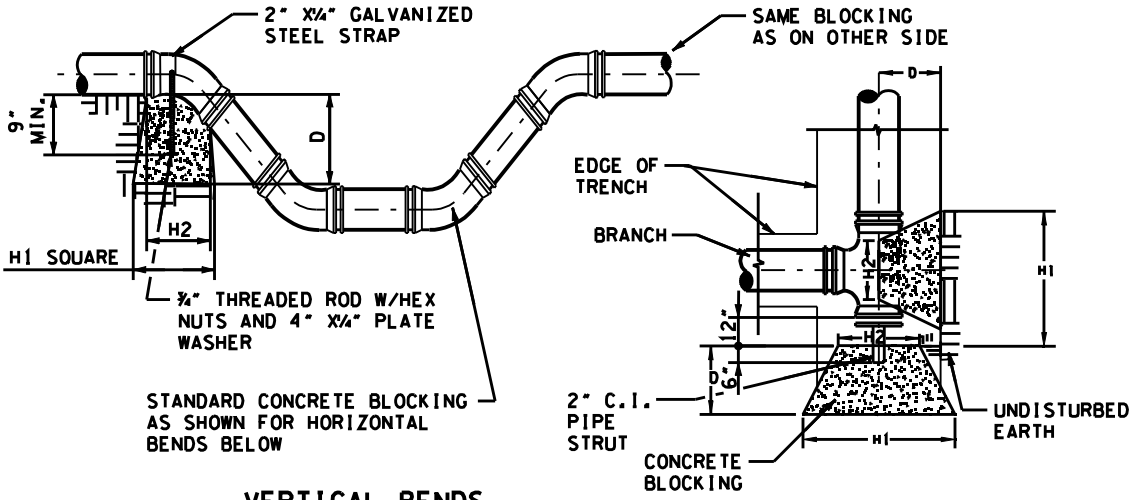
REV.: 01/2015
REV.: 02/2012
DATE: 08/2010

NOT TO SCALE

TYPICAL FULL SERVICE FIRE HYDRANT SETTING

STANDARD DETAILS

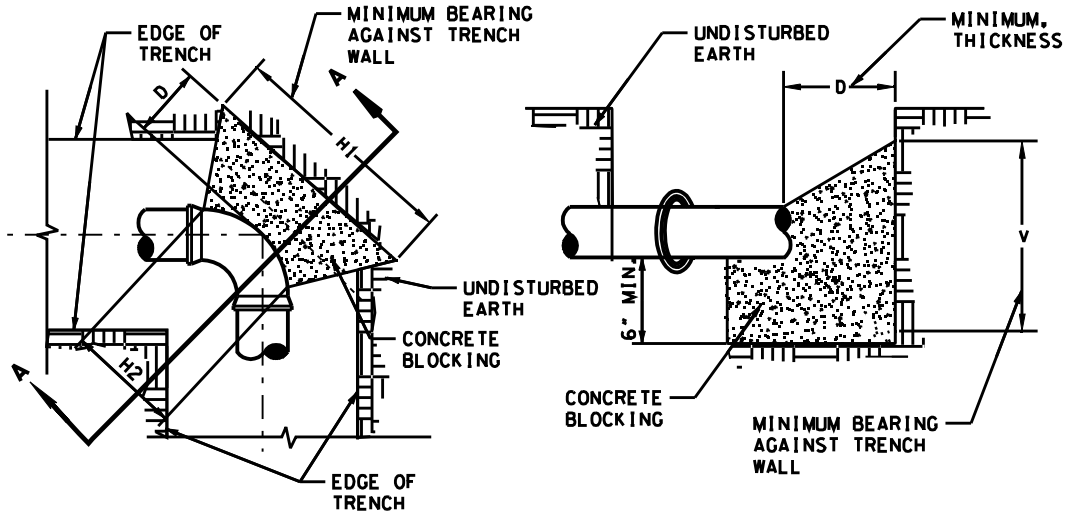
LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



VERTICAL BENDS

TEES, CROSSES AND PLUGS

NOTE: DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.



HORIZONTAL BENDS

SECTION A-A

NOTES:
MEG-A-LUG RESTRAINING DEVICES MAY BE INSTALLED IF DIRECTED BY THE OWNER. IF RESTRAINING DEVICES ARE INSTALLED, CONCRETE THRUST BLOCKS ARE NOT REQUIRED. CONCRETE USED FOR BLOCKING SHALL BE 3,500 PSI. EARTH PRESSURES ARE CALCULATED FOR 4,000 PSF SOIL. BEARING AREAS OF THRUST BLOCKS SHALL BE INCREASED WHEN POURED IN SAND, LOOSE FILL OR WET EARTH. TABLE IS BASED ON 225 PSI OR 150 PSI WORKING PRESSURE PLUS 50% WATER HAMMER

TEES, CROSSES & PLUGS					90° BENDS					45° BENDS					22½° BENDS					11¼° BENDS					PIPE SIZE
H1	H2	V	D	C.F.	H1	H2	V	D	C.F.	H1	H2	V	D	C.F.	H1	H2	V	D	C.F.	H1	H2	V	D	C.F.	
24"	12"	12"	18"	2.25	24"	12"	12"	18"	2.25	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	3"&4"
24"	16"	18"	18"	3.50	30"	16"	18"	18"	4.05	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	6"
36"	18"	18"	18"	5.05	39"	18"	24"	18"	7.30	30"	11"	18"	18"	3.95	30"	11"	18"	18"	3.95	24"	11"	16"	18"	3.40	8"
48"	24"	18"	24"	7.15	54"	32"	24"	18"	10.25	24"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	10"
54"	30"	24"	24"	13.4	54"	32"	36"	24"	18.15	42"	18"	24"	24"	9.60	24"	18"	24"	24"	6.60	24"	18"	21"	24"	6.10	12"

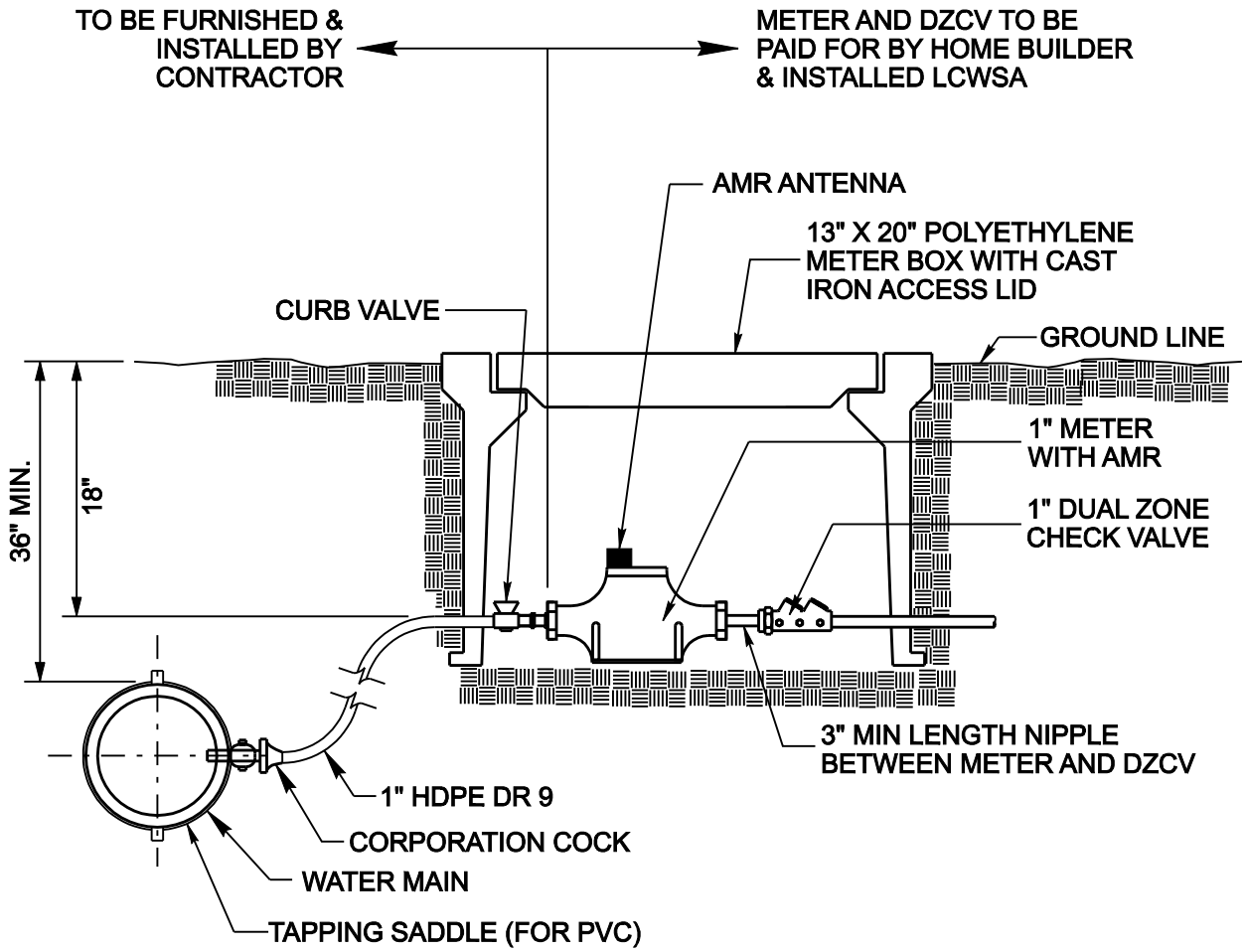
DATE: 08/2010

NOT TO SCALE

TYPICAL CONCRETE THRUST BLOCKING

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. FOR TAPS IN PVC PIPE USE TAPPING SADDLE. NO SADDLE REQUIRED FOR DUCTILE IRON PIPE.
2. SERVICES UNDER ROADWAYS (NEW OR EXISTING) ARE TO BE INSTALLED INSIDE 2" SCH 40 PVC CARRIER PIPE TO A POINT 2' BEHIND SIDEWALK ON EACH SIDE OF ROADWAY. SERVICES UNDER EXISTING ROADWAYS TO BE BORED AND JACKED.
3. REFER TO STANDARD SPECIFICATIONS FOR TECHNICAL REQUIREMENTS OF EACH ITEM.
4. WATER TAPS ON NEW WATER MAINS TO BE MADE BY CONTRACTOR. WATER TAPS ON EXISTING WATER MAINS WILL BE MADE BY LCWSA.

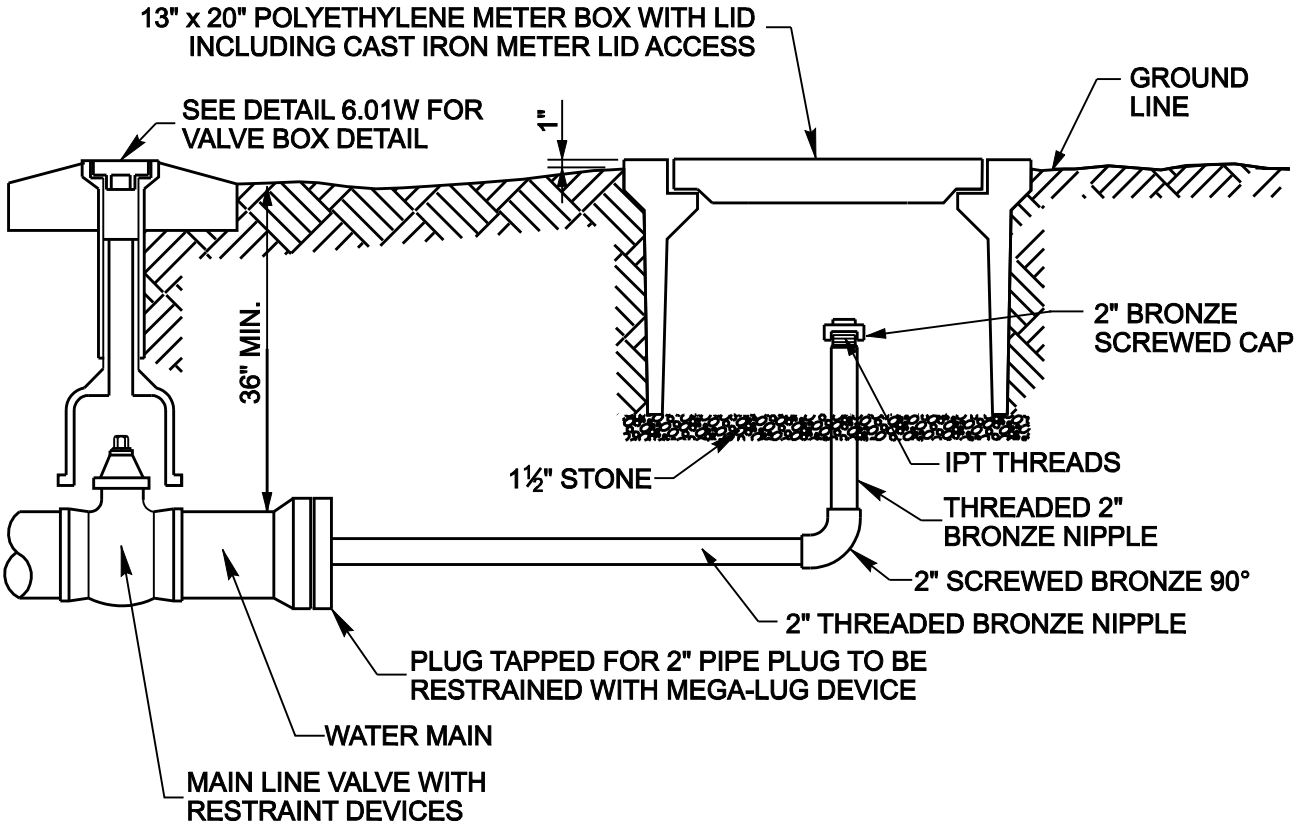
REVISED: 01/2015
DATE: 08/2010

NOT TO SCALE

1" SERVICE ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



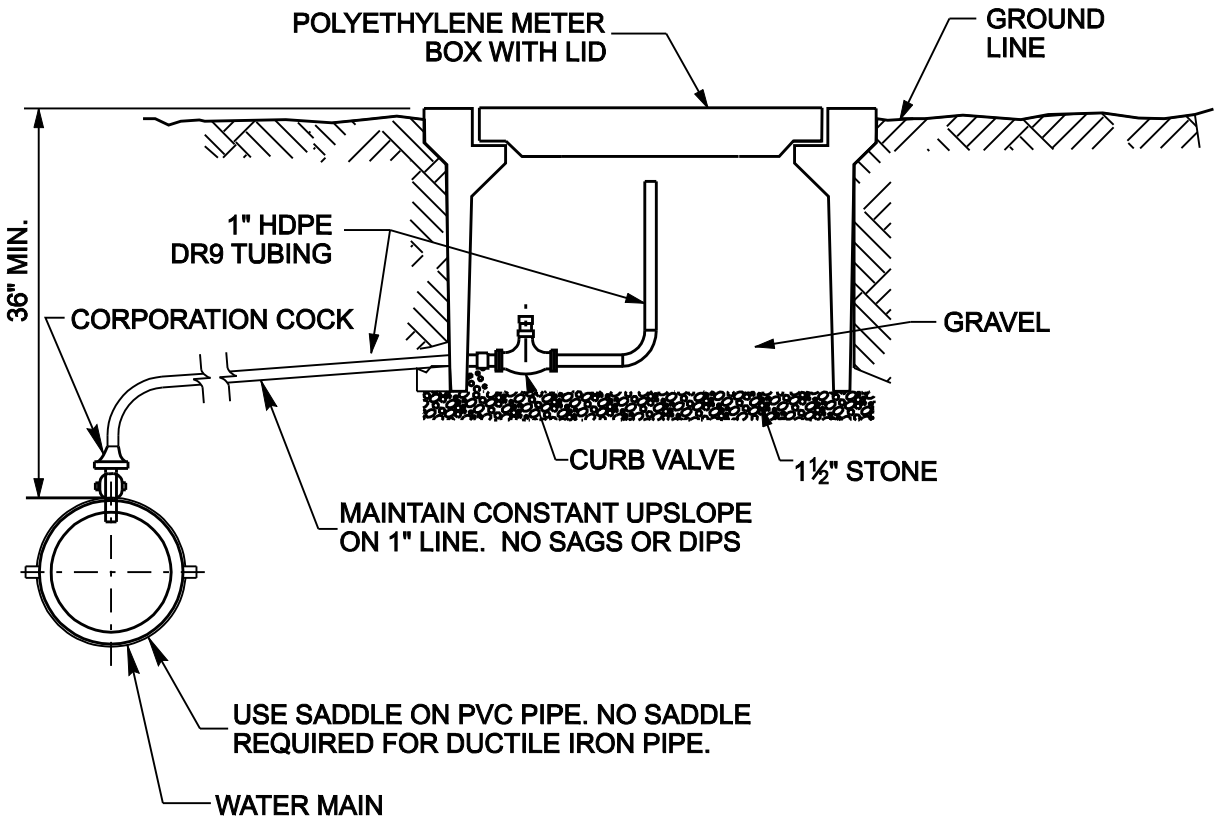
REVISED: 01/2015
REVISED: 09/2010
DATE: 09/2010

NOT TO SCALE

2" BLOWOFF DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. IF PIPE IS IN ROADWAY, AIR RELEASE ASSEMBLY SHALL BE LOCATED OUTSIDE ROADWAY.
2. ASSEMBLY SHALL BE LOCATED AT HIGH POINT OF WATER MAIN AS DIRECTED BY LCWSA.
3. AIR RELEASE ASSEMBLIES SHALL ONLY BE USED WHERE FIRE HYDRANT SPACING DOES NOT PROVIDE FOR AIR RELEASE AT HIGH POINT.

REV. 01/2015
DATE: 08/2010

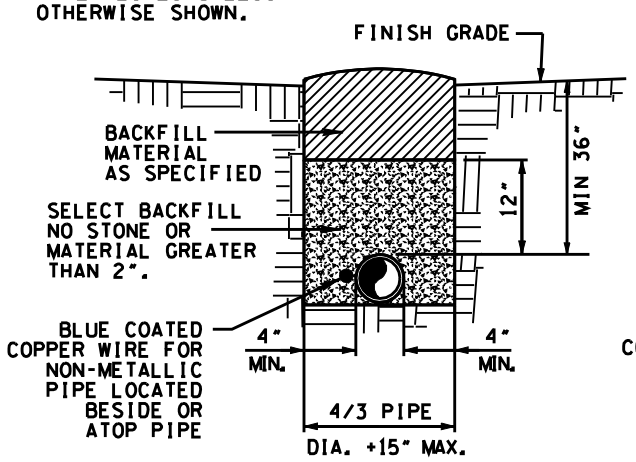
NOT TO SCALE

1" MANUAL AIR RELEASE ASSEMBLY

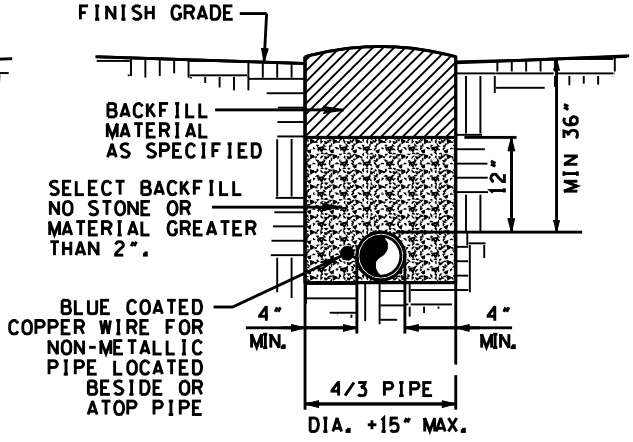
STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NOTE:
36" MIN. COVER FOR ALL
WATER LINES UNLESS
OTHERWISE SHOWN.



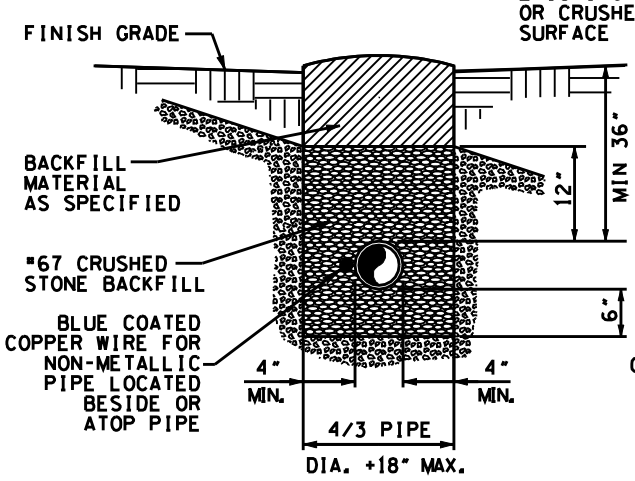
DUCTILE IRON PIPE
IN EARTH



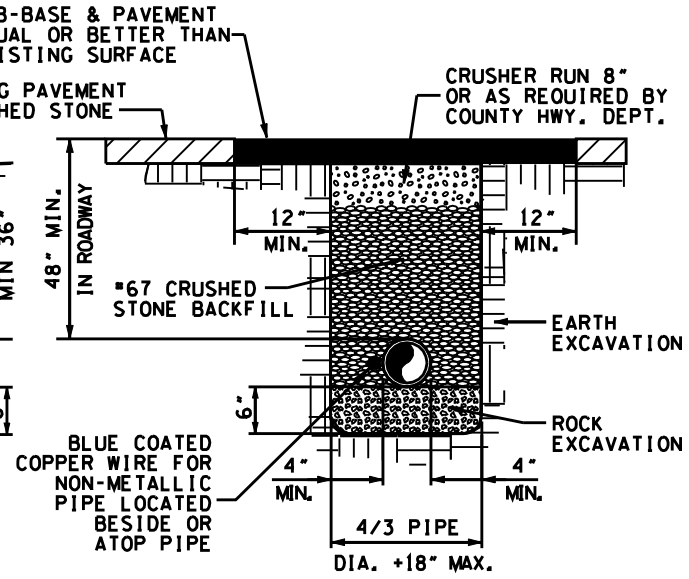
PVC PIPE
IN EARTH

NOTE:
UNTIL REPAVING IS COMPLETED USE
A DENSE GRADED STONE FOR THE
TOP 6" FOR TEMPORARY SURFACE

CRUSHED STONE SURFACE
EQUAL TO EXISTING SURFACE
OR 6" MIN.



ALL PIPE
(DUCTILE IRON OR PVC)
IN ROCK



ALL PIPE
IN TRAFFIC AREAS

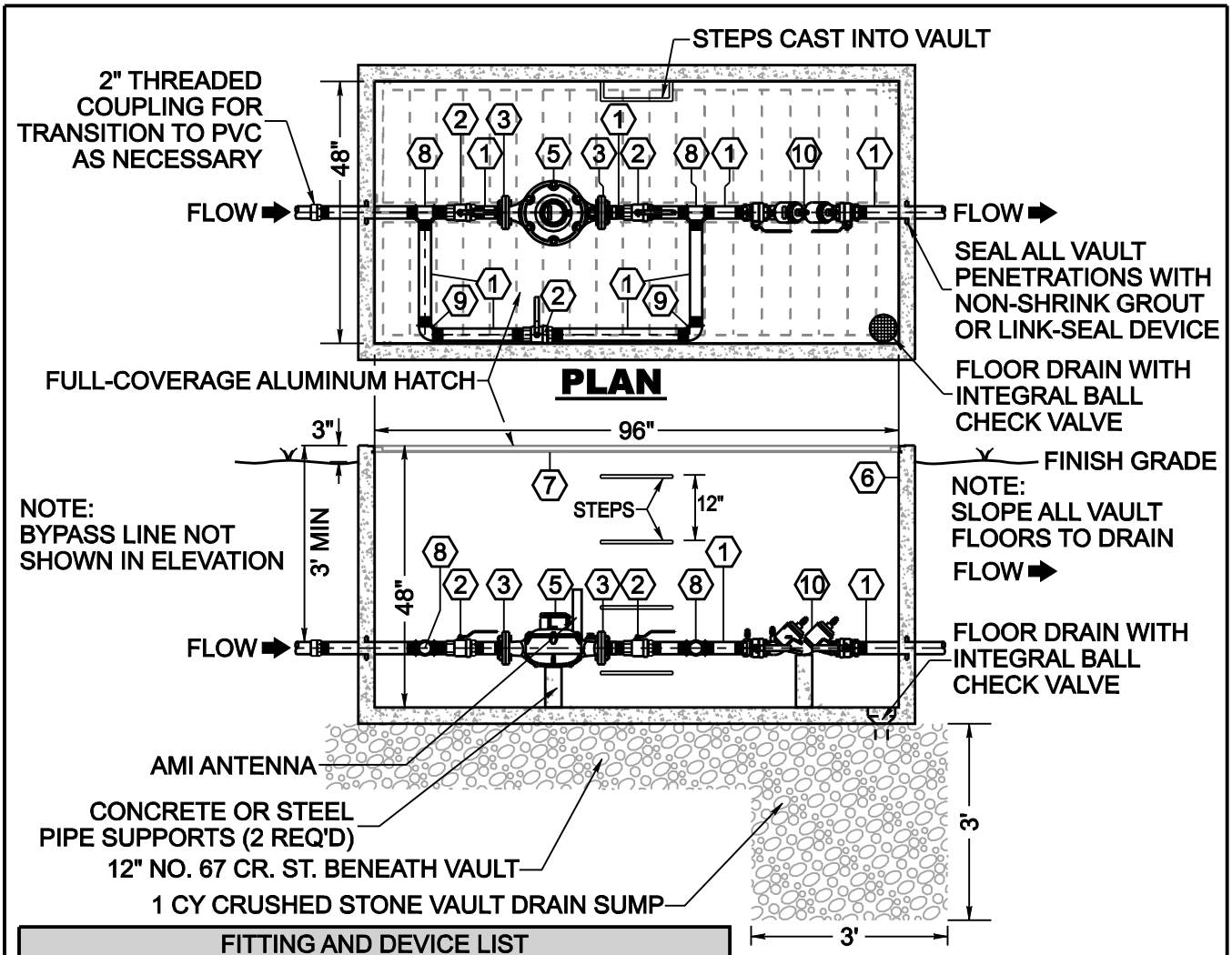
DATE: 08/2010	REV. 01/2015

NOT TO SCALE

STANDARD WATER MAIN & FORCE MAIN BEDDING AND BACKFILLING

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



FITTING AND DEVICE LIST	
1	2" THREADED HARD DRAWN COPPER PIPE
2	2" BRASS BALL VALVE
3	2" BLIND FLANGE THREADED 2" NPT
4	NO LONGER USED
5	2" MUELLER POSITIVE DISPLACEMENT METER (FLANGED)
6	96" x 48" x 48" DEEP PRECAST CONCRETE VAULT
7	96" x 48" FULL COVERAGE ALUMINUM HATCH**
8	2" x 2" THREADED STEEL TEE
9	2" THREADED 90° ELBOW
10	WATTS MODEL 719 DOUBLE CHECK VALVE ASSEMBLY

NOTES:

BALL VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.

BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.

MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
DESCRIPTION	NUMBER
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	A&L9648CV
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L9648ALM**

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

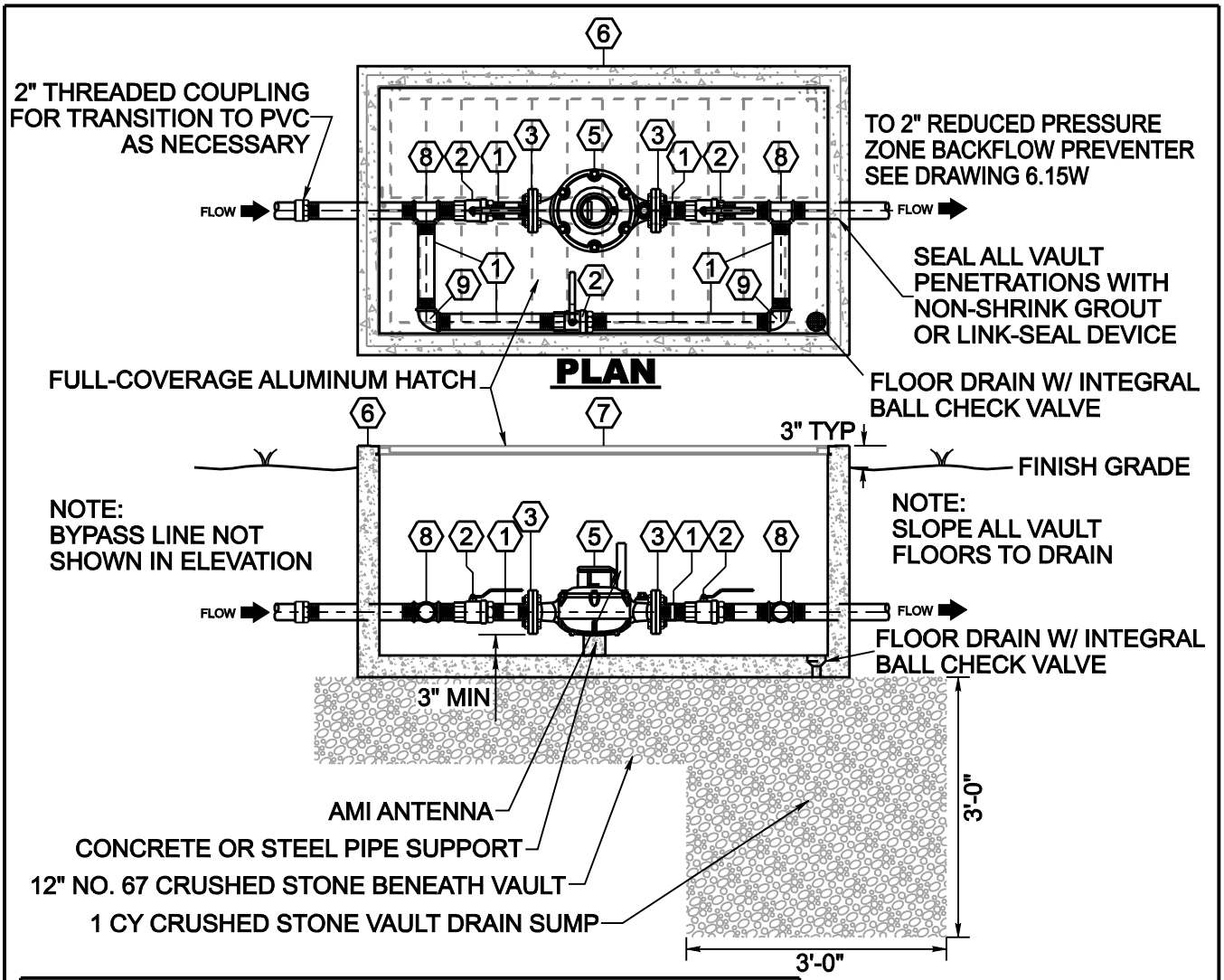
NOT TO SCALE

DATE: 12/2010	REV. 02/2012	REV. 02/2015

2" WATER METER VAULT ASSEMBLY WITH DOUBLE CHECK VALVE BACKFLOW PREVENTER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



ELEVATION

FITTING AND DEVICE LIST	
1	2" THREADED HARD DRAWN COPPER PIPE
2	2" BRASS BALL VALVE
3	2" BLIND FLANGE THREADED 2" NPT
4	NO LONGER USED
5	2" MUELLER POSITIVE DISPLACEMENT METER (FLANGED)
6	MIN. 55" x 34" x 29" DEEP PRECAST CONCRETE VAULT
7	55" x 34" FULL COVERAGE ALUMINUM HATCH**
8	2" x 2" THREADED STEEL TEE
9	2" THREADED 90° ELBOW

NOTES:
BALL VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

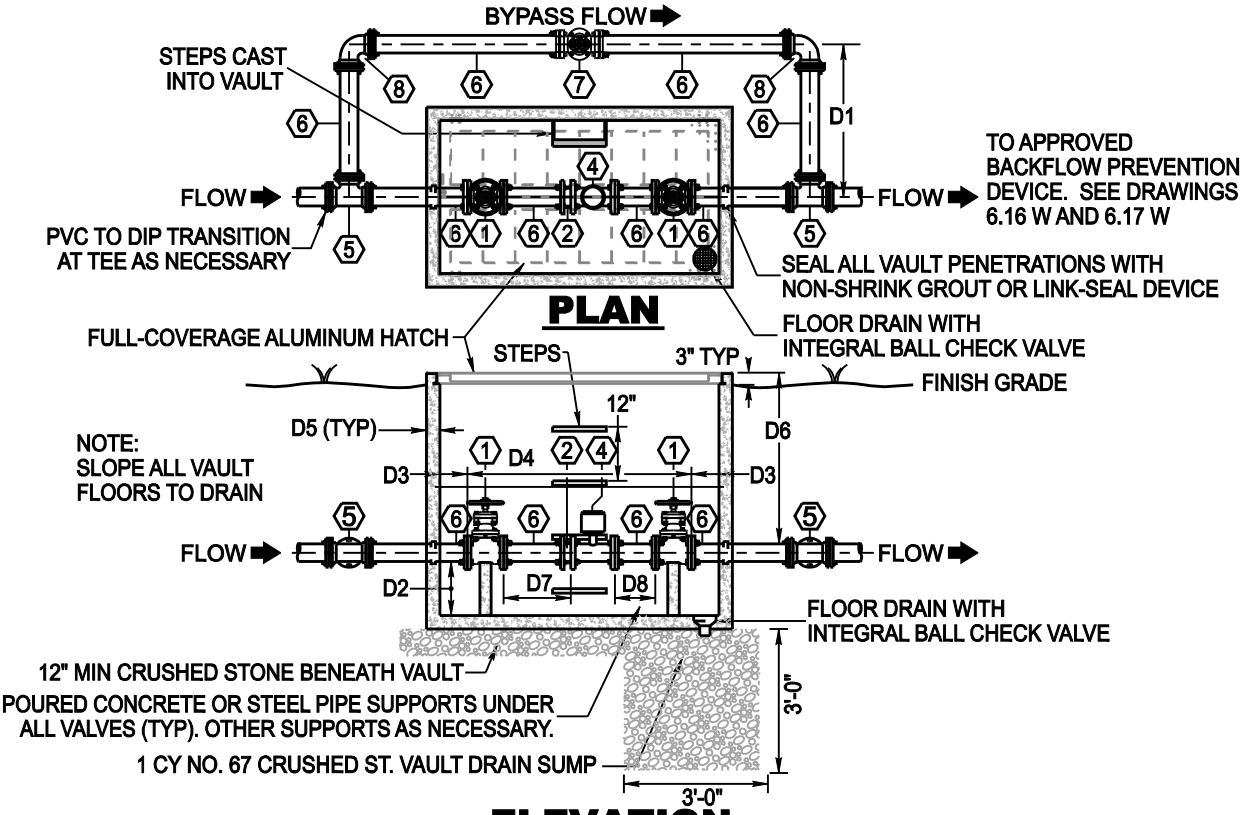
MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
DESCRIPTION	NUMBER
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	A&L6234CV
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L6234ALM**

DATE: 12/2010	REV. 02/2012	REV. 02/2015	NOT TO SCALE

2" WATER METER VAULT ASSEMBLY FOR USE WITH RPZ BACKFLOW PREVENTER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BYPASS LINE MAY BE PLACED ON OPPOSITE SIDE AS NECESSARY TO ACCOMODATE SITE CONDITIONS.
2. ALL EXTERNAL MJ FITTINGS TO BE RESTRAINED WITH MECHANICAL RESTRAINT DEVICES.
3. GATE VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.
4. UNIFLANGE DEVICES AND PLAIN-END PIPE MAY BE USED AS NECESSARY IN LIEU OF FLANGED PIPE.
5. ROMAC #501 COUPLING ADAPTER MAY BE USED IN LIEU OF SMITH-BLAIR #912
6. RAMNECK BUTYL SEALANT (2 ROLLS) REQUIRED BETWEEN VAULT AND RISER
7. MOUNT AMI MTU PER MANUFACTURER RECOMMENDATIONS.

DIMENSIONS	
DIM.	3" LINE
D1	3'-0"
D2	1'-0"
D3	6" +/-
D4	4'-2" *
D5	3"
D6	3'-0"
D7	15" MIN
D8	9" MIN

FITTING AND DEVICE LIST	
1	3" GATE VALVE WITH HANDWHEEL (NRS SHOWN) FL x FL
2	3" SMITH-BLAIR MODEL 912 FLANGED COUPLING ADAPTER
3	NO LONGER USED
4	3" MUELLER ELECTROMAG FLOW METER (FLANGED)
5	3" DI MJ TEE
6	3" DIP MIN CL 52
7	3" MJ GATE VALVE WITH VALVE BOX
8	3" DI MJ 90° BEND

* = VARIES DEPENDING ON SPOOL

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

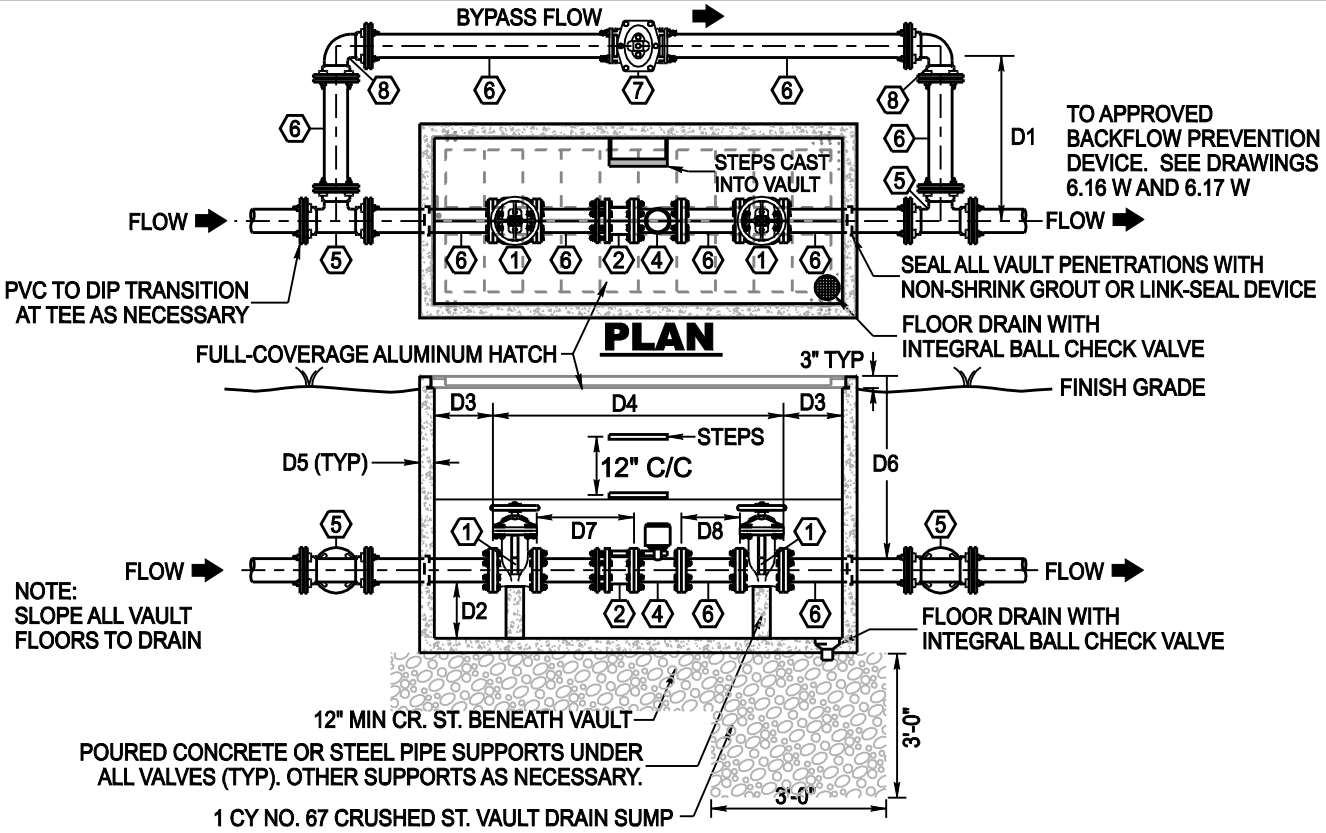
MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
DESCRIPTION	3" LINE
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	62"L x 34"W x 29"H W/ 25" RISER
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L6234ALM**

DATE: 12/2010	REV. 01/2015	NOT TO SCALE

3" WATER METER VAULT ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BYPASS LINE MAY BE PLACED ON OPPOSITE SIDE AS NECESSARY TO ACCOMODATE SITE CONDITIONS.
2. ALL EXTERNAL MJ FITTINGS TO BE RESTRAINED WITH MECHANICAL RESTRAINT DEVICES.
3. GATE VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.
4. UNIFLANGE DEVICES AND PLAIN-END PIPE MAY BE USED AS NECESSARY IN LIEU OF FLANGED PIPE.
5. ROMAC #501 COUPLING ADAPTER MAY BE USED IN LIEU OF SMITH-BLAIR #912
6. RAMNECK BUTYL SEALANT (2 ROLLS) REQUIRED BETWEEN VAULT AND RISERS IF RISERS ARE USED.
7. MOUNT AMI MTU PER MANUFACTURER RECOMMENDATIONS.

DIMENSIONS	
DIM.	4" LINE
D1	3'-0"
D2	1'-0"
D3	12" +/-
D4	5'-0" *
D5	3"
D6	3'-0"
D7	20" MIN
D8	12" MIN

FITTING AND DEVICE LIST	
1	4" GATE VALVE WITH HANDWHEEL (NRS SHOWN) FL x FL
2	4" SMITH-BLAIR MODEL 912 FLANGED COUPLING ADAPTER
3	NO LONGER USED
4	4" MUELLER ELECTROMAG FLOW METER (FLANGED)
5	4" DI MJ TEE
6	4" DIP MIN CL 52
7	4" MJ GATE VALVE WITH VALVE BOX
8	4" DI MJ 90° BEND

* = VARIES DEPENDING ON SPOOLS

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

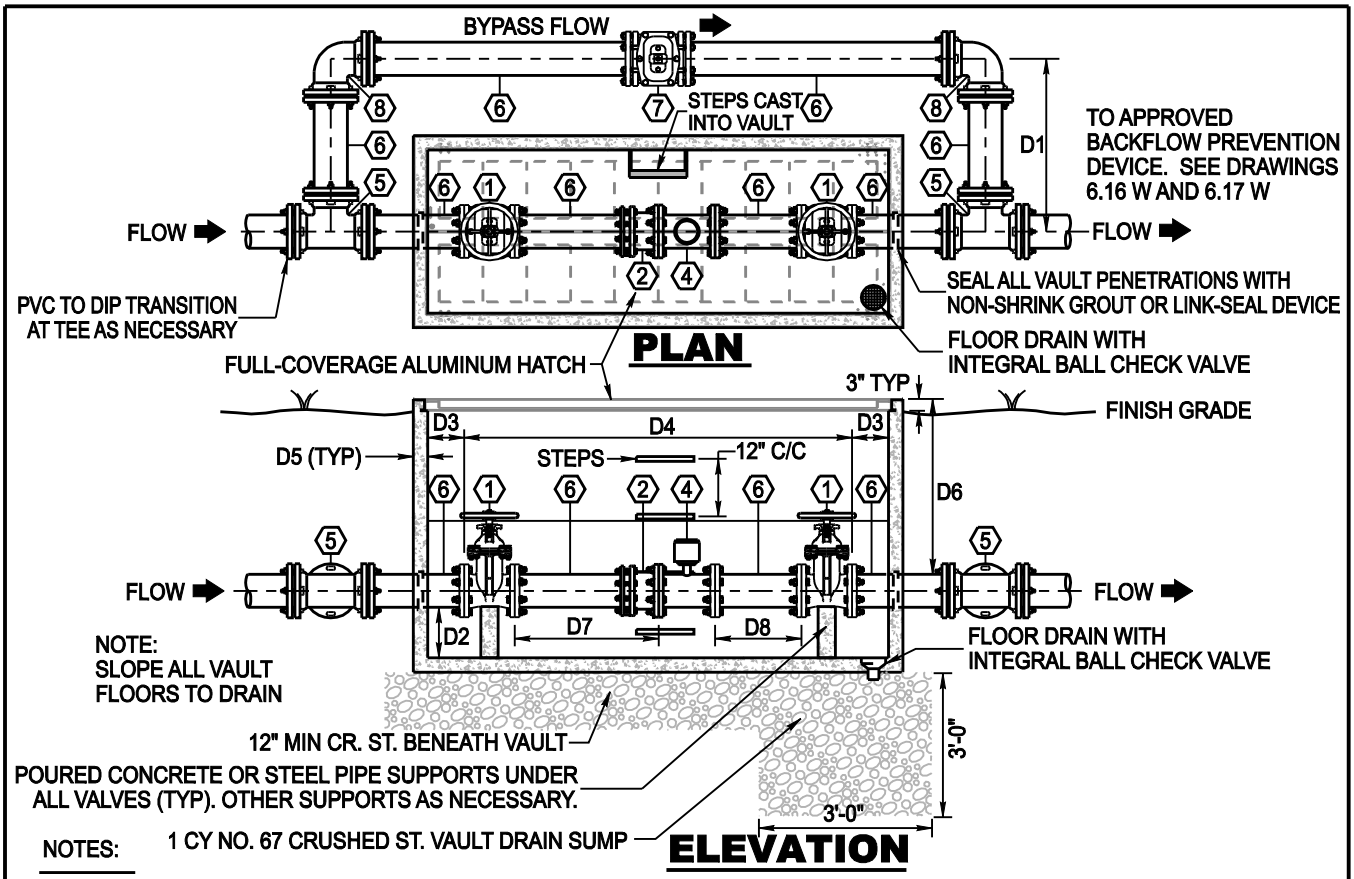
MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
DESCRIPTION	4" LINE
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	84"L x 34"W x 29"H W/ 25" RISER
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L8434ALM**

DATE: 12/2010 | REV. 01/2015 | NOT TO SCALE

4" DOMESTIC WATER METER VAULT ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BYPASS LINE MAY BE PLACED ON OPPOSITE SIDE AS NECESSARY TO ACCOMODATE SITE CONDITIONS.
2. ALL EXTERNAL MJ FITTINGS TO BE RESTRAINED WITH MECHANICAL RESTRAINT DEVICES.
3. GATE VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.
4. UNIFLANGE DEVICES AND PLAIN-END PIPE MAY BE USED AS NECESSARY IN LIEU OF FLANGED PIPE.
5. ROMAC #501 COUPLING ADAPTER MAY BE USED IN LIEU OF SMITH-BLAIR #912
6. RAMNECK BUTYL SEALANT (2 ROLLS) REQUIRED BETWEEN VAULT AND RISERS IF RISERS ARE USED.
7. MOUNT AMI MTU PER MANUFACTURER RECOMMENDATIONS.

DIMENSIONS	
DIM.	6" LINE
D1	3'-6"
D2	1'-0" +/-
D3	7" +/-
D4	5'-0" *
D5	3"
D6	3'-0"
D7	30" MIN
D8	18" MIN

FITTING AND DEVICE LIST	
1	6" GATE VALVE WITH HANDWHEEL (NRS SHOWN) FL x FL
2	6" SMITH-BLAIR MODEL 912 FLANGED COUPLING ADAPTER
3	NO LONGER USED
4	6" MUELLER ELECTROMAG FLOW METER (FLANGED)
5	6" DI MJ TEE
6	6" DIP MIN CL 52
7	6" MJ GATE VALVE WITH VALVE BOX
8	6" DI MJ 90° BEND

* = VARIES DEPENDING ON SPOOL

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

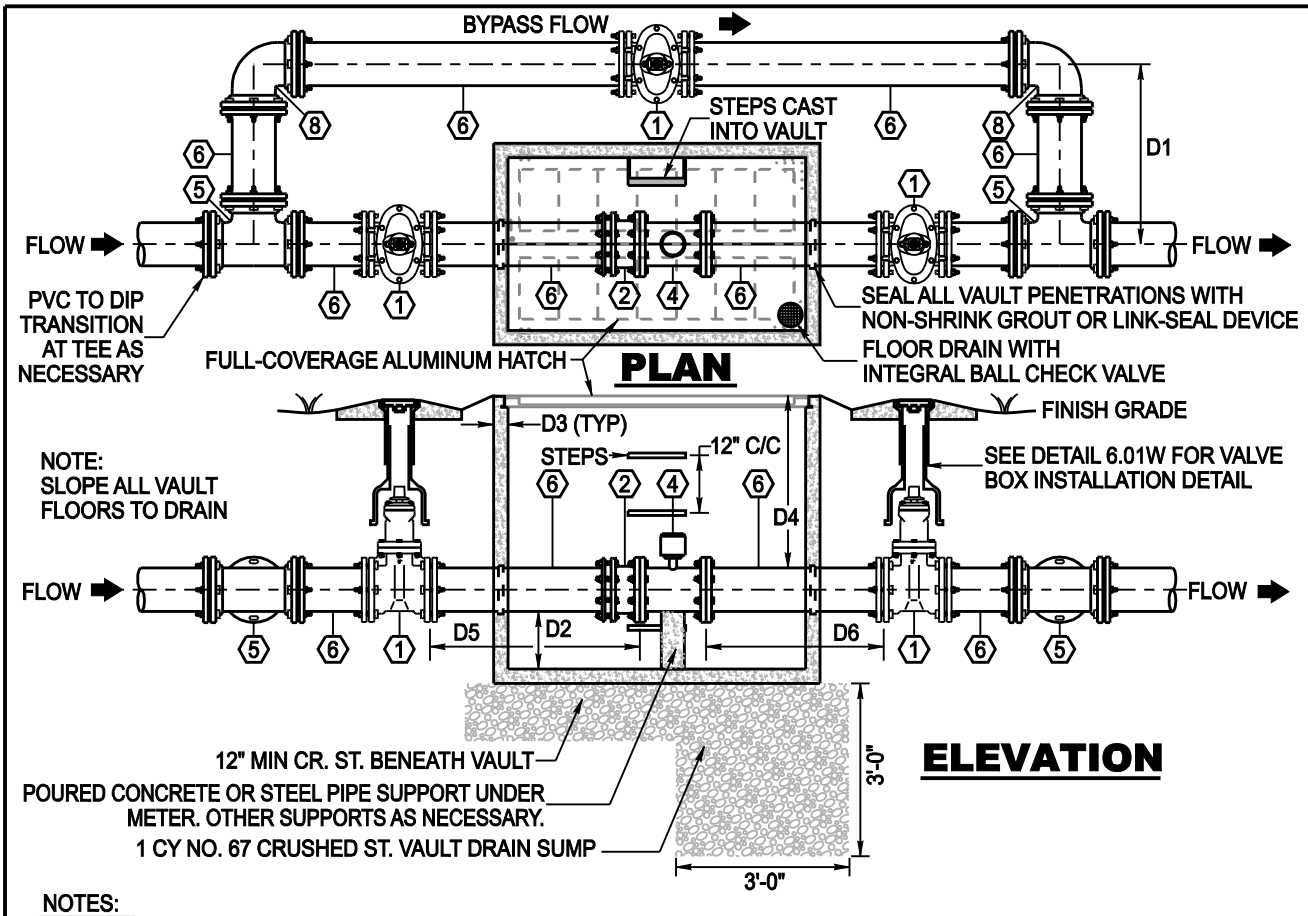
MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
DESCRIPTION	6" LINE
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	96"L x 48"W x 48"H W/ 6" RISER
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L9660ALM**

DATE: 12/2010 | REV. 01/2015 | NOT TO SCALE

6" DOMESTIC WATER METER VAULT ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BYPASS LINE MAY BE PLACED ON OPPOSITE SIDE AS NECESSARY TO ACCOMODATE SITE CONDITIONS.
2. ALL EXTERNAL MJ FITTINGS TO BE RESTRAINED WITH MECHANICAL RESTRAINT DEVICES.
3. GATE VALVES ON EACH SIDE OF METER MUST REMAIN IN FULLY OPEN POSITION DURING NORMAL OPERATION TO INSURE ACCURACY OF METER.
4. UNIFLANGE DEVICES AND PLAIN-END PIPE MAY BE USED AS NECESSARY IN LIEU OF FLANGED PIPE.
5. ROMAC #501 COUPLING ADAPTER MAY BE USED IN LIEU OF SMITH-BLAIR #912
6. RAMNECK BUTYL SEALANT (2 ROLLS) REQUIRED BETWEEN VAULT AND RISERS IF RISERS ARE USED.
7. MOUNT AMI MTU PER MANUFACTURER RECOMMENDATIONS.

DIMENSIONS	
DIM.	8" LINE
D1	3'-6"
D2	1'-0" +/-
D3	3"
D4	3'-0"
D5	40" MIN
D6	24" MIN

* = VARIES DEPENDING ON SPOOL

FITTING AND DEVICE LIST	
1	8" MJ GATE VALVE WITH VALVE BOX
2	8" SMITH-BLAIR MODEL 912 FLANGED COUPLING ADAPTER
3	NO LONGER USED
4	8" MUELLER ELECTROMAG FLOW METER (FLANGED)
5	8" x 8" DI MJ TEE
6	8" DIP MIN. CL 52
7	8" GATE VALVE WITH VALVE BOX
8	8" DI 90° MJ BEND

MINIMUM INSIDE HATCH AND VAULT DIMENSIONS	
PRECAST CONCRETE VAULT (A&L VAULT PRODUCTS)	62"L x 34"W x 29"H W/ 25" RISER
ALUMINUM HATCH (A&L VAULT PRODUCTS)	A&L6234ALM**

** - HATCHES ARE FOOT TRAFFIC RATED ONLY

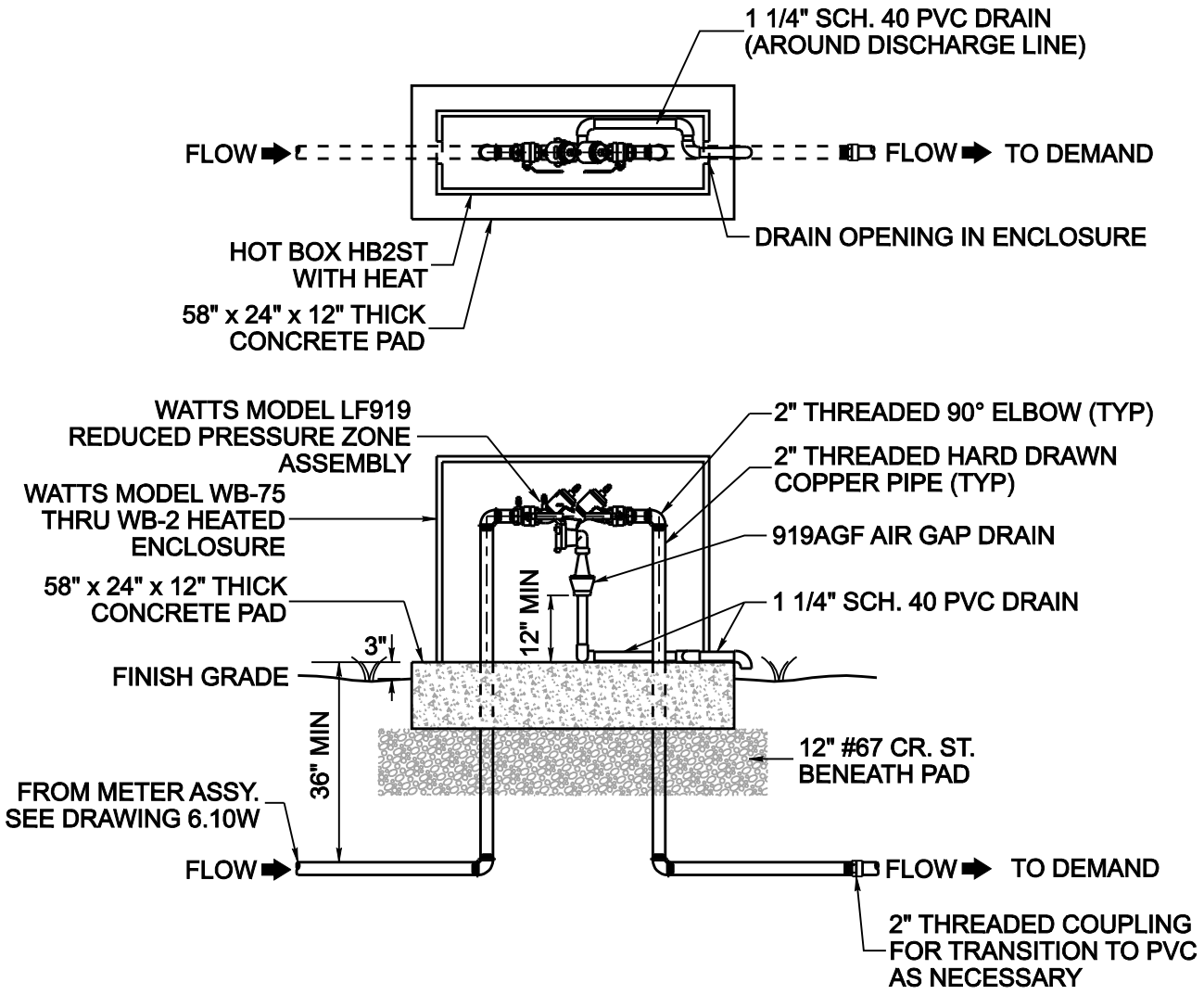
DATE: 12/2010	REV. 01/2015

NOT TO SCALE

8" DOMESTIC WATER METER VAULT ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. RPZ ASSEMBLY MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

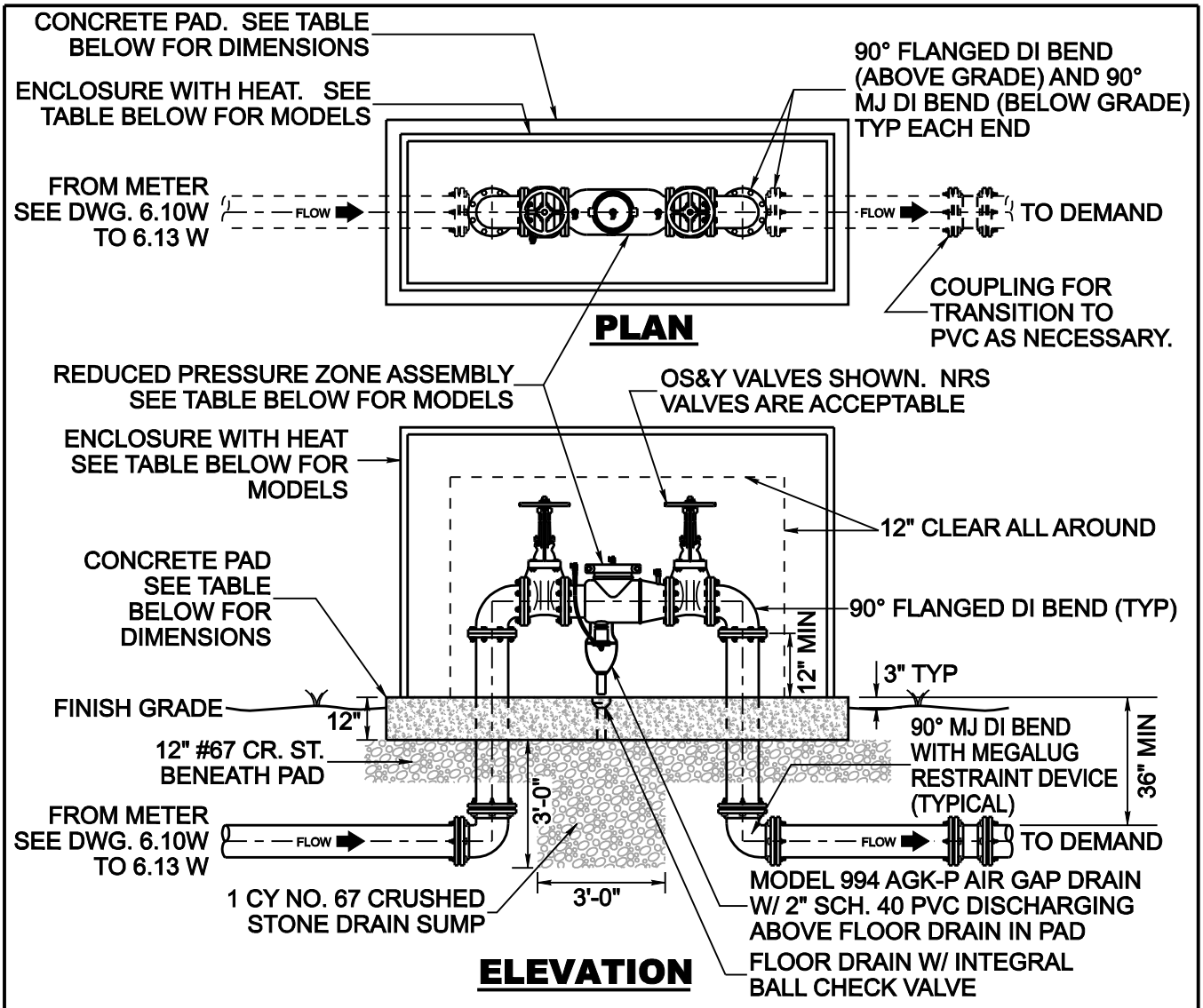
REV. 01/2015
DATE: 12/2010

NOT TO SCALE

2" REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



RPZ SIZE	RPZ	ENCLOSURE (NRS)	ENCLOSURE (OSY)	PAD (NRS)	PAD (OSY)
3"	WATTS 994	WATTS WBN3	WATTS WBE3	82" x 38"	82" x 38"
4"	WATTS 994	WATTS WBN3	WATTS WBE3	82" x 38"	82" x 38"
6"	WATTS 994	WATTS WBN4	WATTS WBE6	102" x 44"	117" x 48"
8"	WATTS 994	WATTS WBN6	WATTS WBE8	102" x 44"	130" x 52"

NOTES:

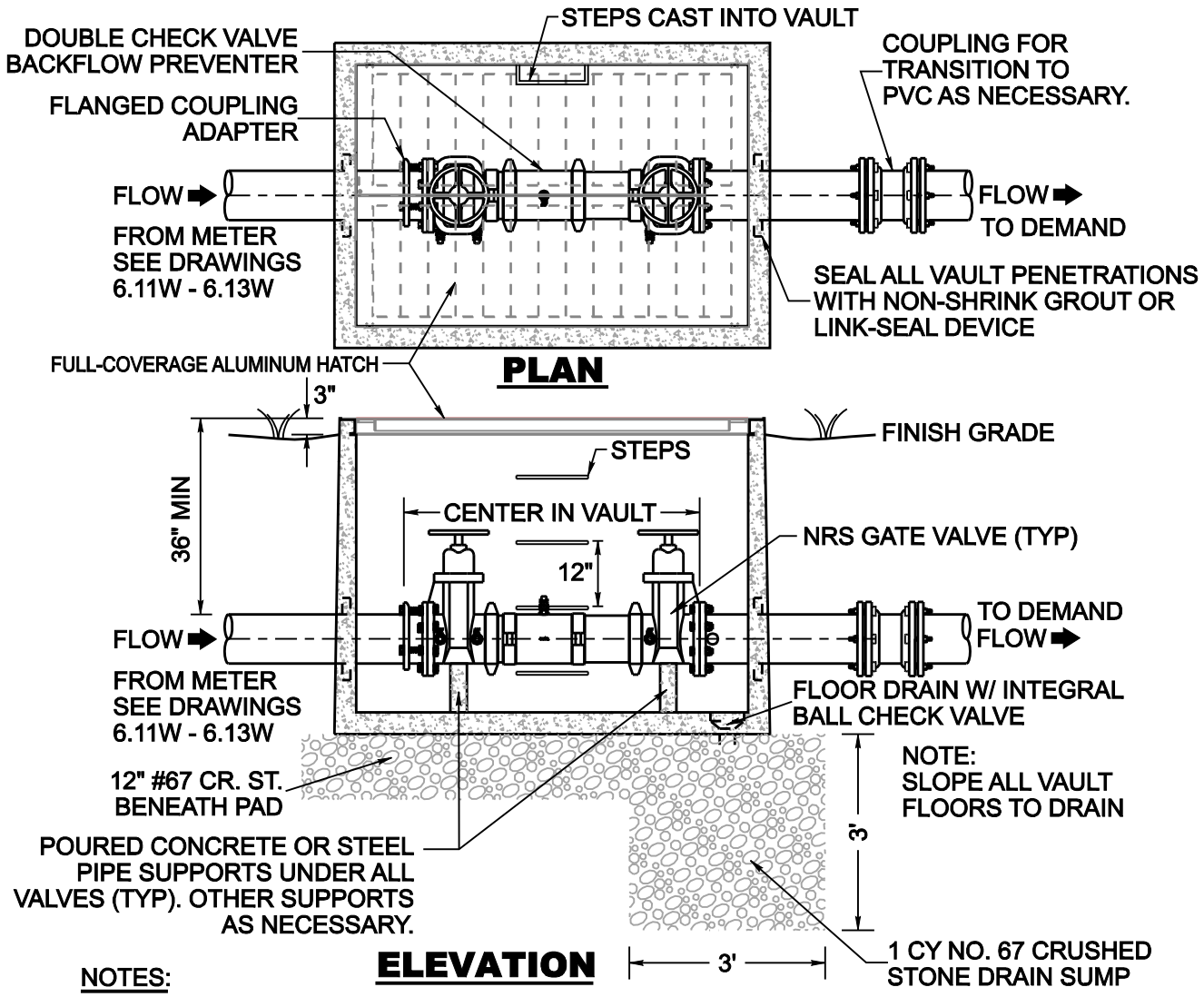
1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. RPZ ASSEMBLY MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

DATE: 12/2010	REV. 01/2015	NOT TO SCALE

3" TO 8" REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. BACKFLOW PREVENTER MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

SIZE	BACKFLOW PREVENTER	VAULT AND HATCH	FLANGED COUPLING ADAPTER
3"	WATTS 757 NRS	A&L6234CV* + A&L6234ALM	SMITH-BLAIR #912 OR ROMAC #501
4"	WATTS 757 NRS	A&L6234CV* + A&L6234ALM	SMITH-BLAIR #912 OR ROMAC #501
6"	WATTS 757 NRS	A&L7248CV6 + A&L7248ALM	SMITH-BLAIR #912 OR ROMAC #501
8"	WATTS 757 NRS	A&L7248CV6 + A&L7248ALM	SMITH-BLAIR #912 OR ROMAC #501

* VAULT RISER REQUIRED

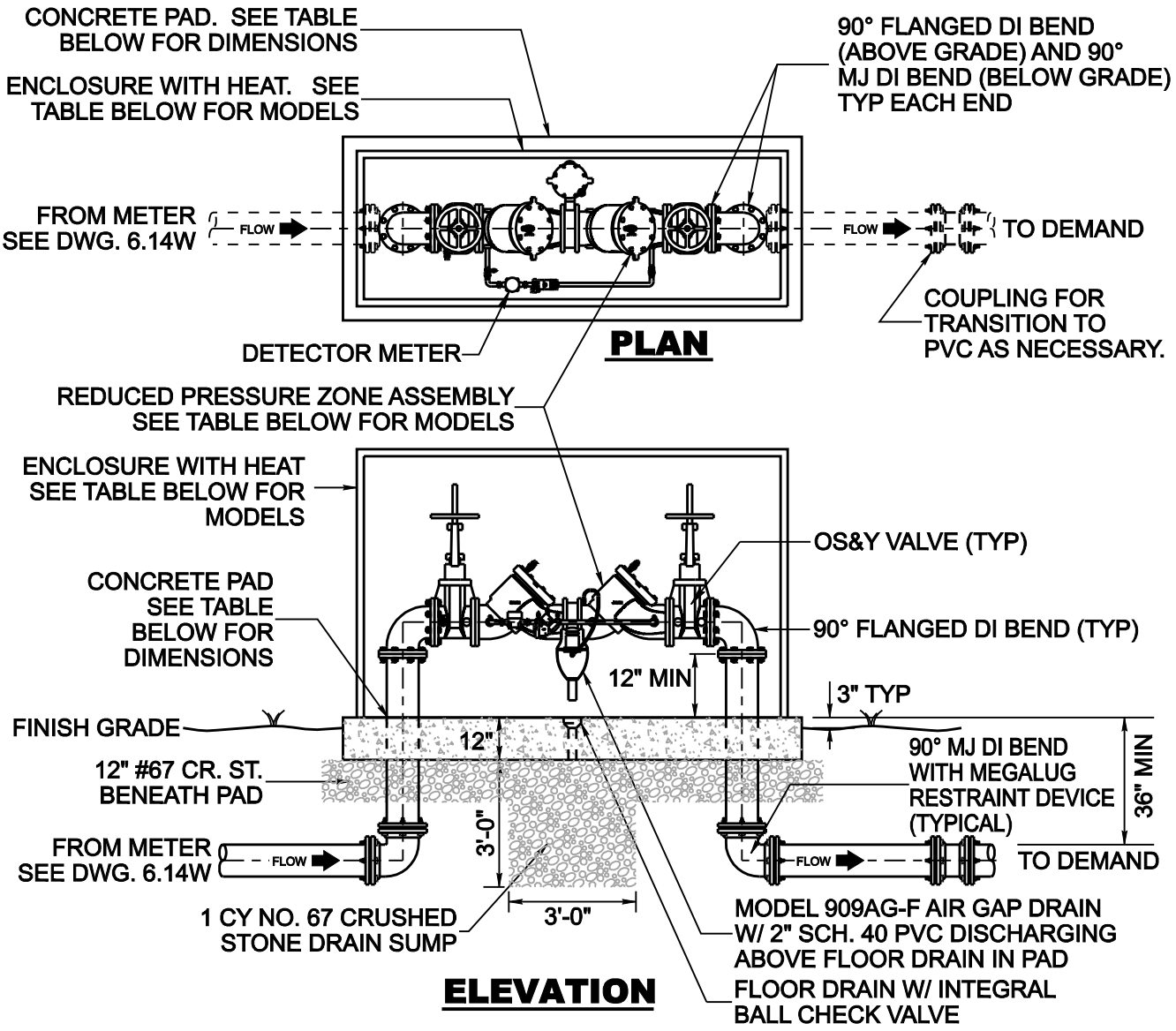
DATE: 12/2010	REV. 01/2015

NOT TO SCALE

3" TO 8" DOUBLE CHECK VALVE BACKFLOW PREVENTER ASSEMBLY

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



DRPZ SIZE	DRPZ	ENCLOSURE	PAD
6"	WATTS 909RPDA	WATTS WBN6	117" x 48"
8"	WATTS 909RPDA	WATTS WBE8	130" x 52"

NOTES:

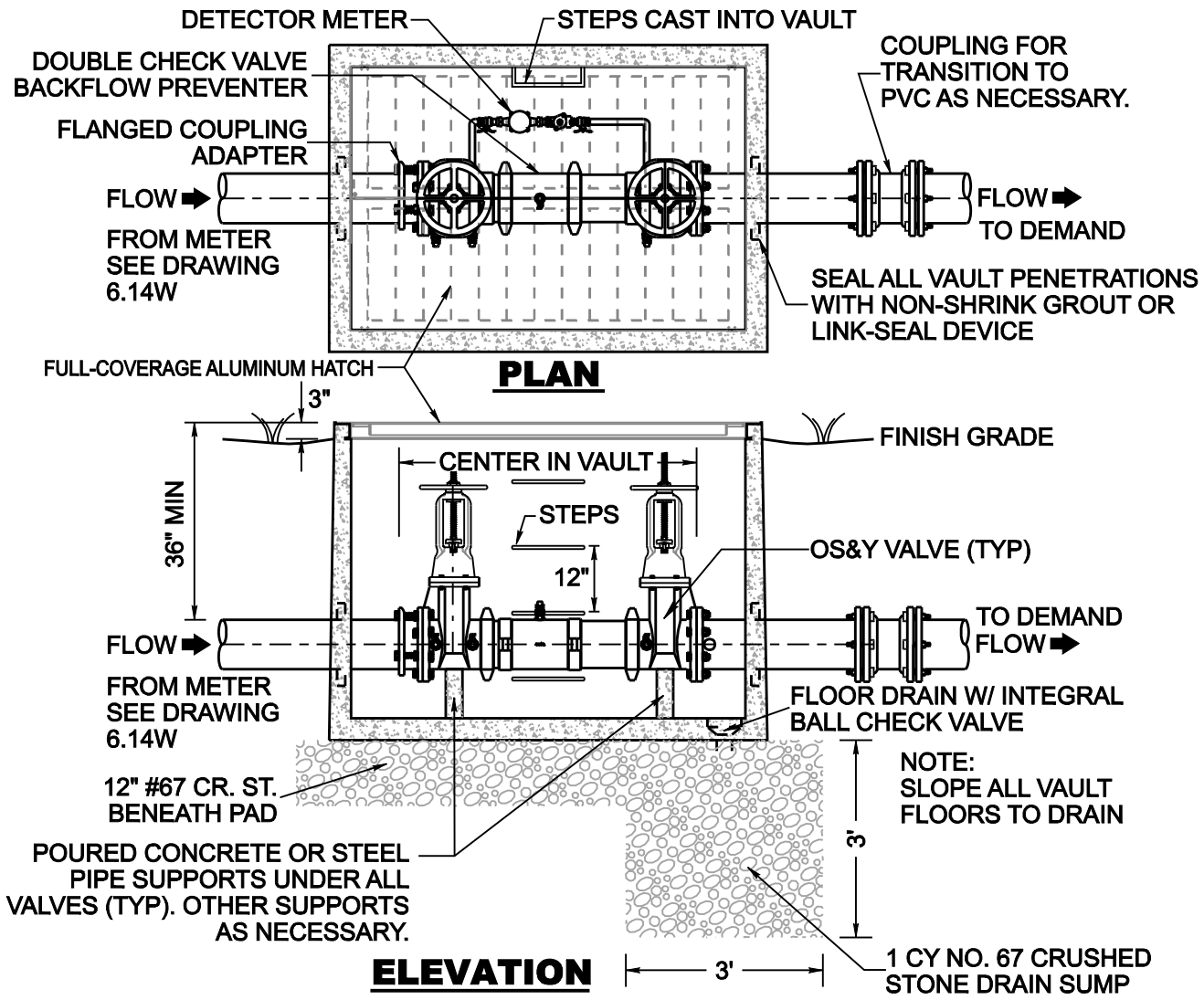
1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. DRPZ ASSEMBLY MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

DATE: 12/2010	REV. 01/2015	NOT TO SCALE

6" AND 8" DETECTOR REDUCED PRESSURE ZONE BACKFLOW PREVENTER ASSEMBLY (FOR FIRE PROTECTION SERVICE ONLY)

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. BACKFLOW PREVENTER MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

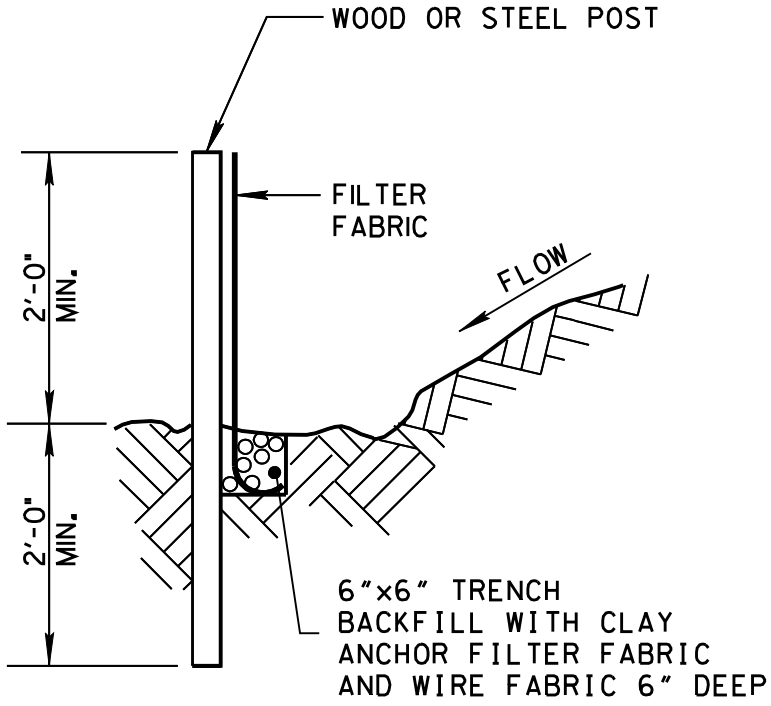
SIZE	BACKFLOW PREVENTER	VAULT AND HATCH	FLANGED COUPLING ADAPTER
6"	WATTS 757DCDA-OSY	A&L7248CV6 + A&L7248ALM	SMITH-BLAIR #912 OR ROMAC #501
8"	WATTS 757DCDA-OSY	A&L7248CV6 + A&L7248ALM	SMITH-BLAIR #912 OR ROMAC #501

DATE: 05/2012	REV. 02/2012	REV. 01/2015	NOT TO SCALE

6" AND 8" DETECTOR DOUBLE CHECK VALVE BACKFLOW PREVENTER ASSEMBLY (FOR FIRE PROTECTION SERVICE ONLY)

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. FILTER FABRIC FENCE TO BE PLACED PRIOR TO START OF ROUGH GRADING.

2. STEEL POSTS SHALL BE APPROVED BY OWNER PRIOR TO USE.

3. WOOD POSTS SHALL BE 2"x 2" MIN., OAK OR SIMILAR HARDWOOD.

4. POSTS SHALL BE SPACED AT 6' INTERVALS.

5. FILTER FABRIC SHALL BE SECURELY BOUND TO POSTS WITH EITHER STAPLES OR WIRE TIES.

6. FILTER FABRIC SHALL BE POLYPROPYLENE FABRIC WITH EQUVALENT OPENING SIZE (EOS) OF NO.100 SIEVE MIN., NO.40 SIEVE MAX., AS DETERMINED BY CORPS OF ENGINEERS GUIDE SPEC. CW 02215.

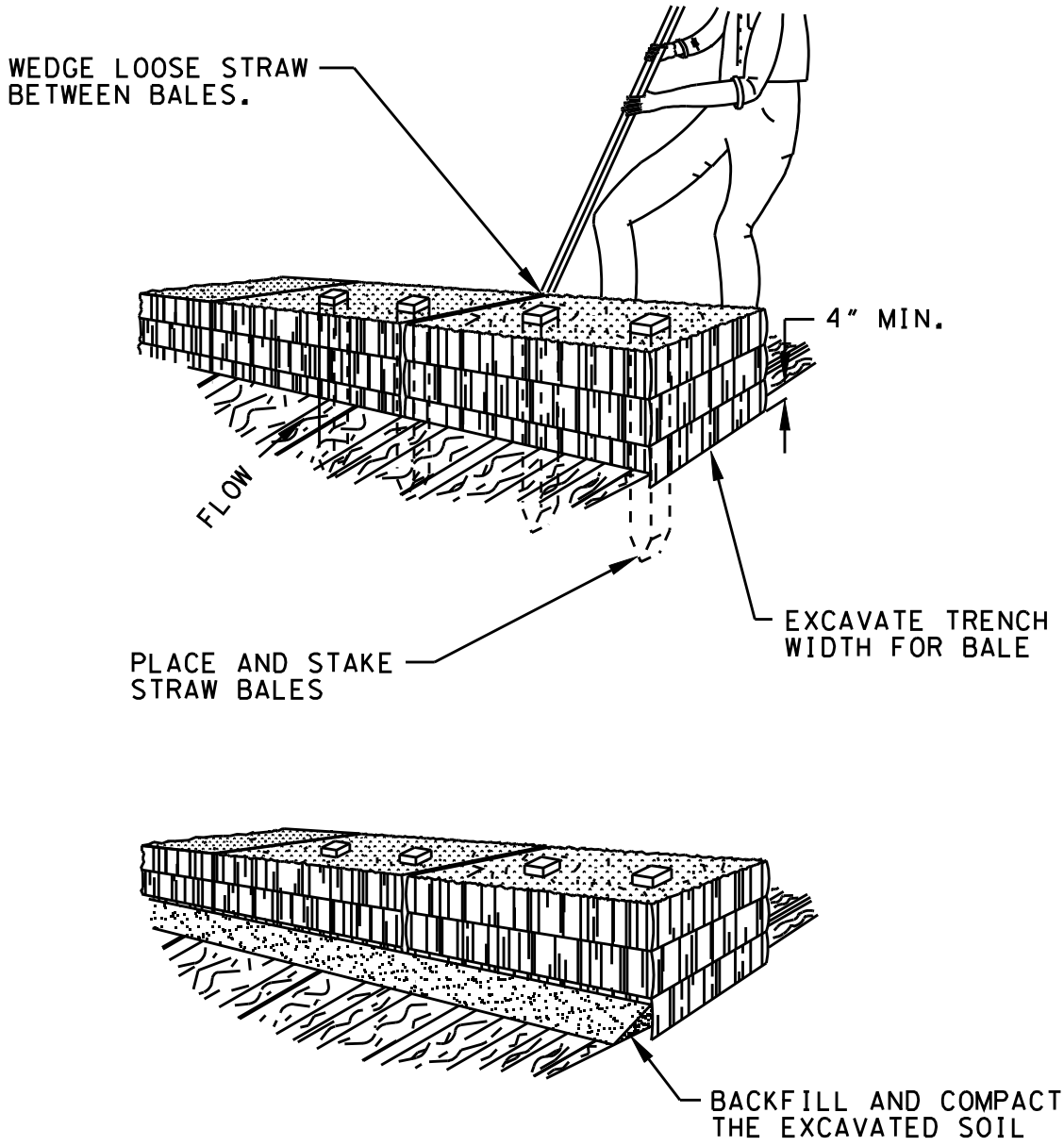
DATE: 08/2010

NOT TO SCALE

TEMPORARY SILT FENCE

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



STRAW BALE BARRIER

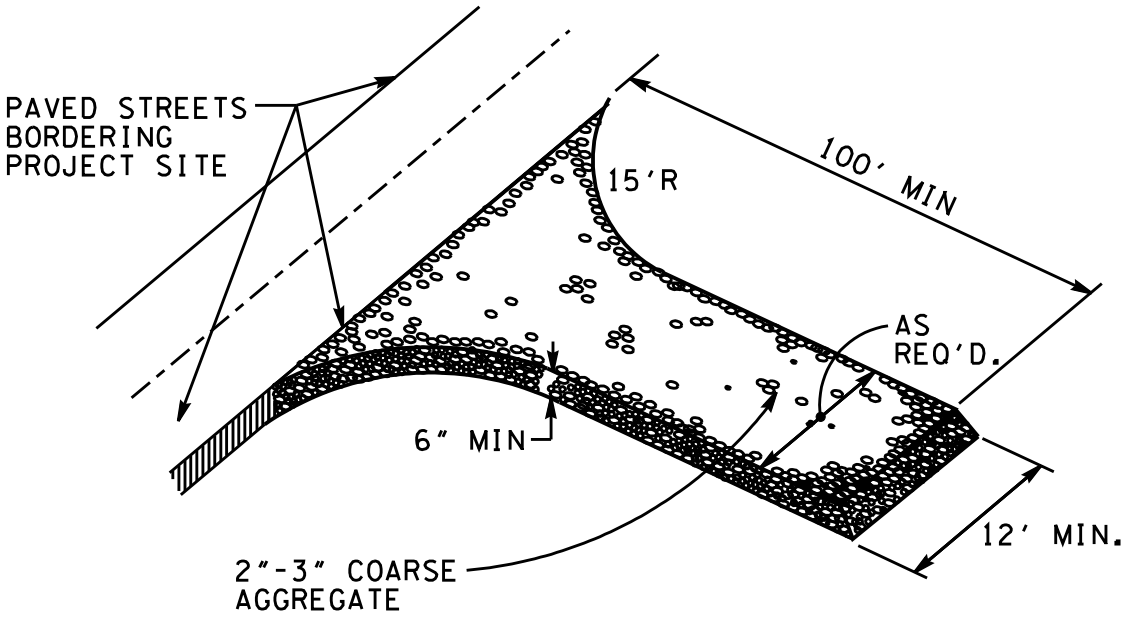
DATE: 08/2010

NOT TO SCALE

STRAW BALE BARRIER

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE:
GRAVEL PAD IS REQUIRED TO PROVIDE BUFFER AREA WHERE VEHICLES CAN DROP THEIR MUD AND SEDIMENT TO AVOID TRANSPORTING IT ONTO PAVED STREETS, TO CONTROL EROSION FROM SURFACE RUNOFF, AND TO HELP CONTROL DUST.

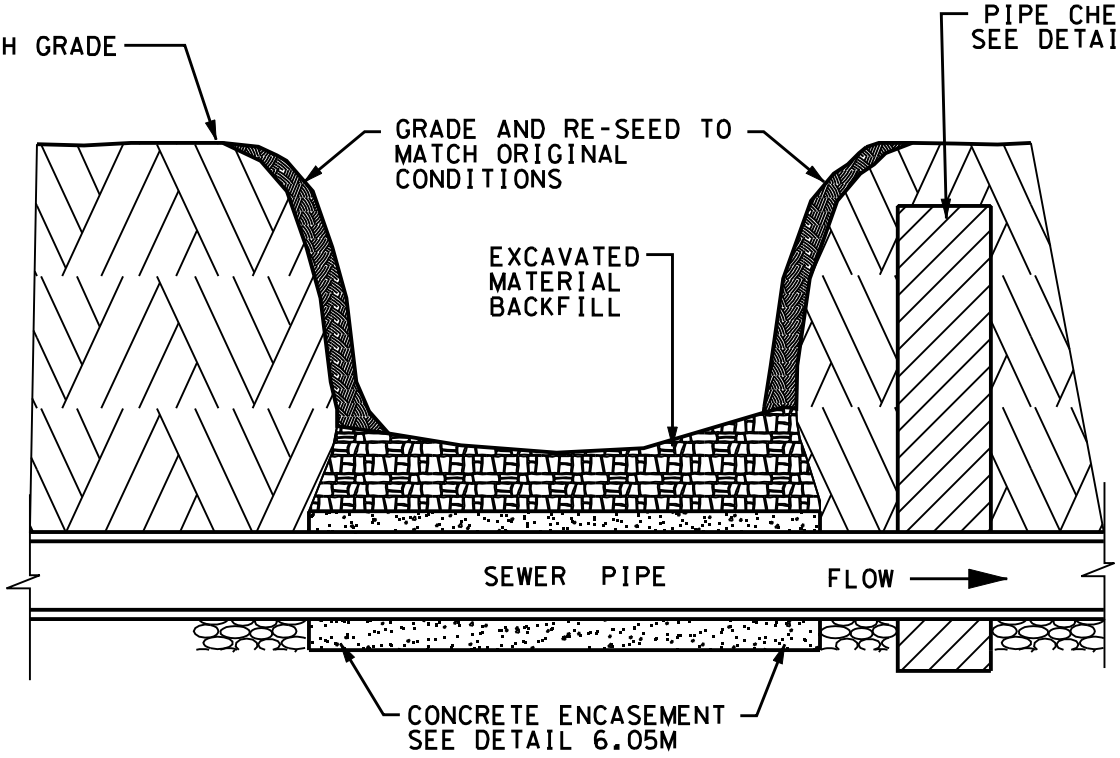
DATE: 08/2010

NOT TO SCALE

TEMPORARY CONSTRUCTION ENTRANCE

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE: FOR A NO-BLAST CREEK CROSSING, CROSSING IS TO BE PERFORMED AS FOLLOWS.

1. LINE DRILL ON 8" CENTER-TO-CENTER ACROSS THE CREEK ALONG EACH EDGE OF PROPOSED DITCH (36" DITCH WIDTH).
2. PERFORM ADDITIONAL LINE DRILLING BETWEEN PROPOSED DITCH EDGES AS NEEDED.
3. BREAK ROCK BETWEEN LINE DRILL HOLES WITH HOE-RAM AND REMOVE FRACTURED ROCK AS NEEDED TO ALLOW FOR PIPE INSTALLATION.
4. INSTALL PIPE AT GRADE AND ENCASE IN CONCRETE PER DETAIL 6.04M. TOP OF CONCRETE TO EXTEND 8" ABOVE TOP OF PIPE. (CONCRETE TO BE CLASS "B" AS SPECIFIED IN CONTRACT DOCUMENTS. ENCASEMENT WIDTH TO BE POURED THE WIDTH OF THE TRENCH WITH A MINIMUM OF 4" ON EACH SIDE.)
5. BACKFILL OVER CONCRETE WITH ORIGINAL EXCAVATED MATERIAL.
6. GRADE CREEK BANK AND CREEK BOTTOM TO MATCH ORIGINAL GRADE.
7. RE-SEED BANKS TO MATCH ORIGINAL CONDITIONS.

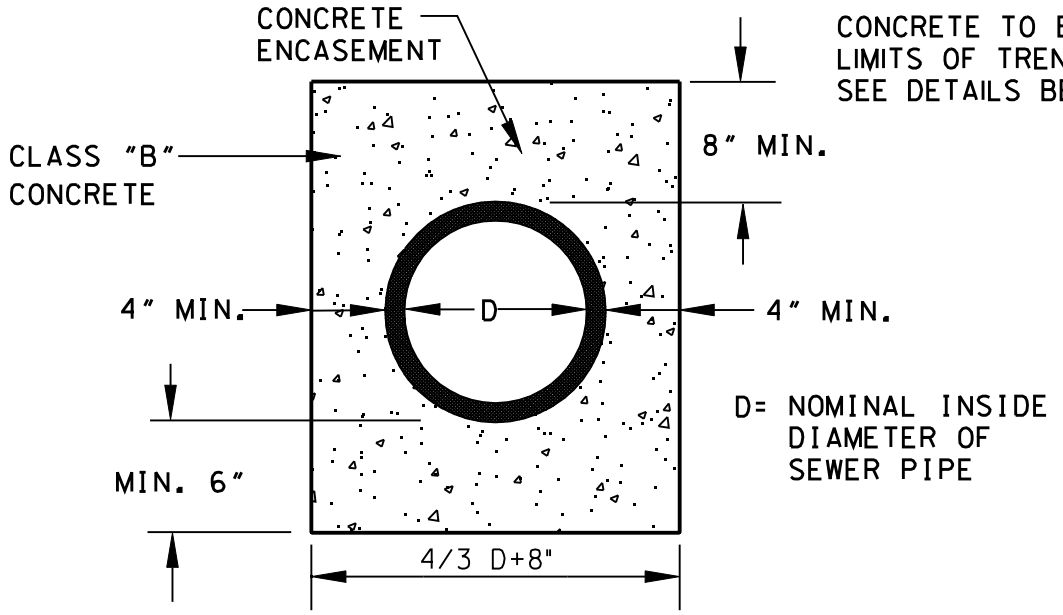
DATE: 08/2010

NOT TO SCALE

CREEK CROSSING

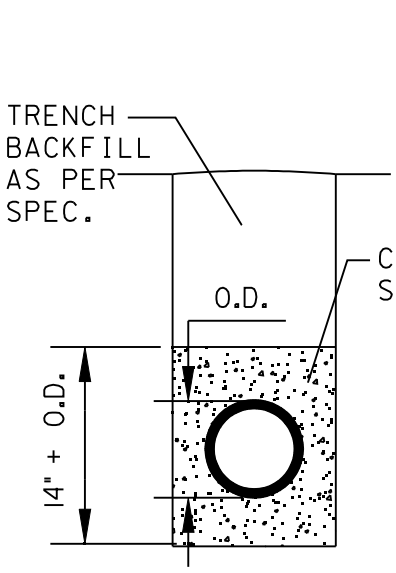
STANDARD DETAILS

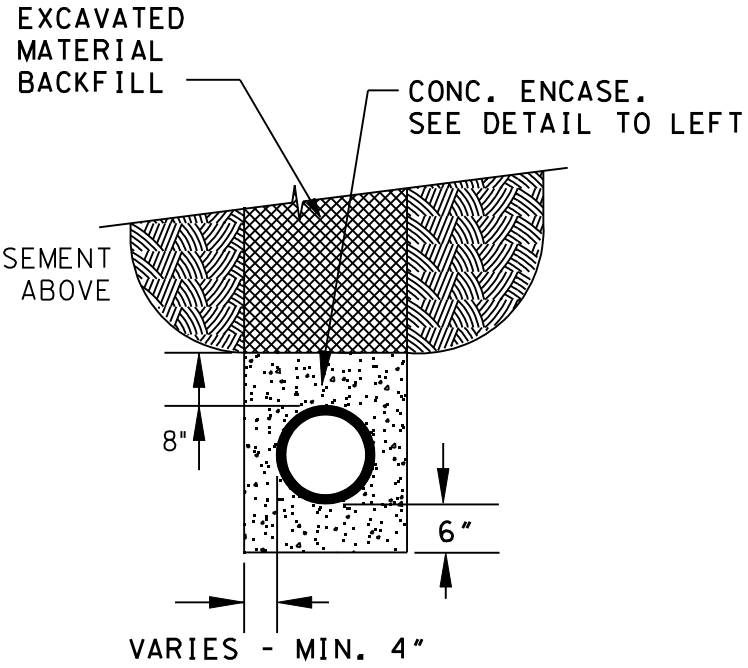
LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE:
CONCRETE TO BE POURED TO LIMITS OF TRENCH EXCAVATION. SEE DETAILS BELOW.

D= NOMINAL INSIDE DIAMETER OF SEWER PIPE





STANDARD CONCRETE ENCASEMENT

CREEK BOTTOM CONCRETE ENCASEMENT

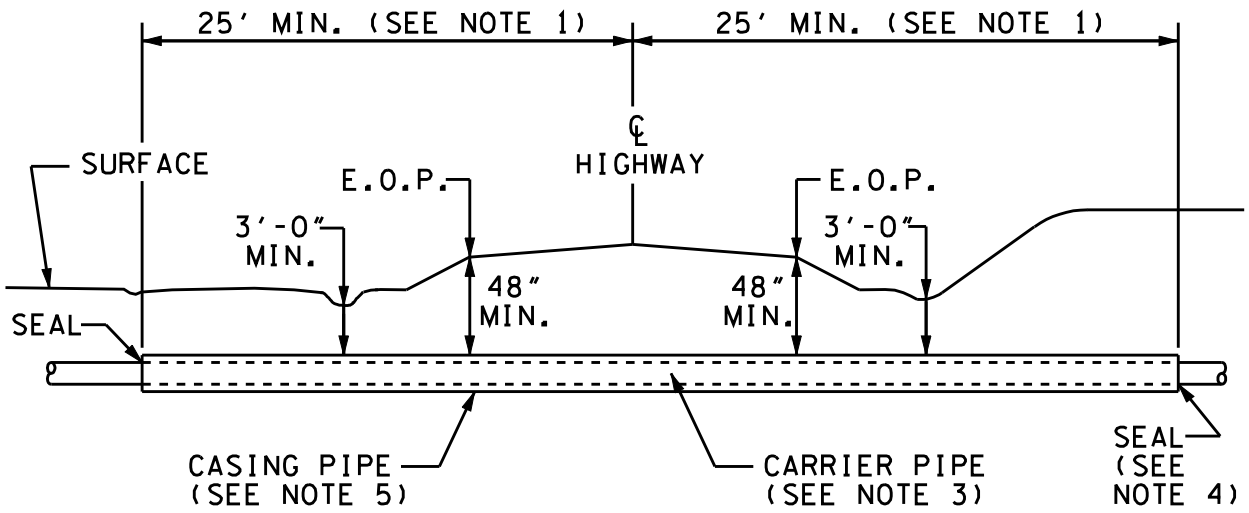
DATE: 08/2010

NOT TO SCALE

CONCRETE PROTECTION FOR UTILITY LINES

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTES:

1. CASING SHALL EXTEND TO THE GREATER OF THE FOLLOWING DISTANCES:

   A. 2' BEYOND TOE OF SLOPE
   B. 5' BEYOND CENTERLINE OF DITCH
   C. MIN. OF 25' WHEN CASING IS SEALED AT BOTH ENDS

2. BORED CROSSINGS SHALL BE PERMITTED AND INSTALLED TO MEET THE REQUIREMENTS OF ALABAMA DEPARTMENT OF TRANSPORTATION AND/OR LIMESTONE COUNTY HIGHWAY DEPARTMENT.

3. CARRIER PIPE SHALL BE DUCTILE IRON PIPE AS REQUIRED BY OWNER. CARRIER PIPE SHALL BE CENTERED IN THE CASING PIPE. CARRIER PIPE SHALL BE INSTALLED USING CASING SPACERS. SPACERS SHALL BE PLACED AT PIPE JOINT MIDPOINT AND 1' FROM EACH END OF PIPE JOINT. SEE DETAIL 6.07M FOR CASING SPACER AND END SEAL DETAILS.

4. ENDS OF CASING PIPE SHALL BE SEALED UTILIZING SYNTHETIC RUBBER SEALS WITH STAINLESS STEEL BINDING STRAPS.

5. REFER TO SPECIFICATION FOR CASING PIPE THICKNESS AND DIAMETER.

DATE: 08/2010

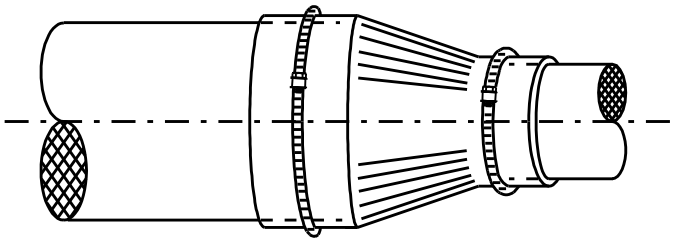
NOT TO SCALE

BORE AND JACK FOR HIGHWAYS

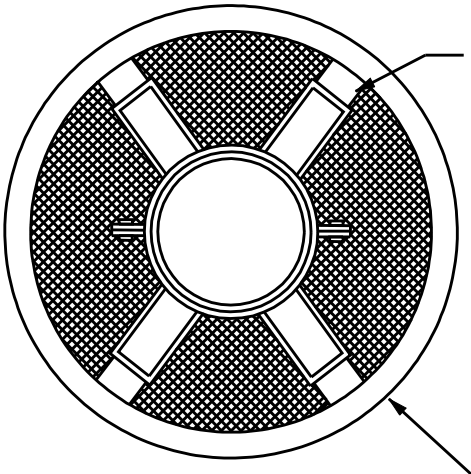
STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

NEOPRENE RUBBER WRAP AROUND END SEALS WITH STAINLESS STEEL BANDS WITH WORM SCREWS. ADVANCE PRODUCTS & SYSTEMS, INC. TYPE AW, PIPELINE SEAL AND INSULATOR, INC, TYPE W OR APPROVED EQUAL.

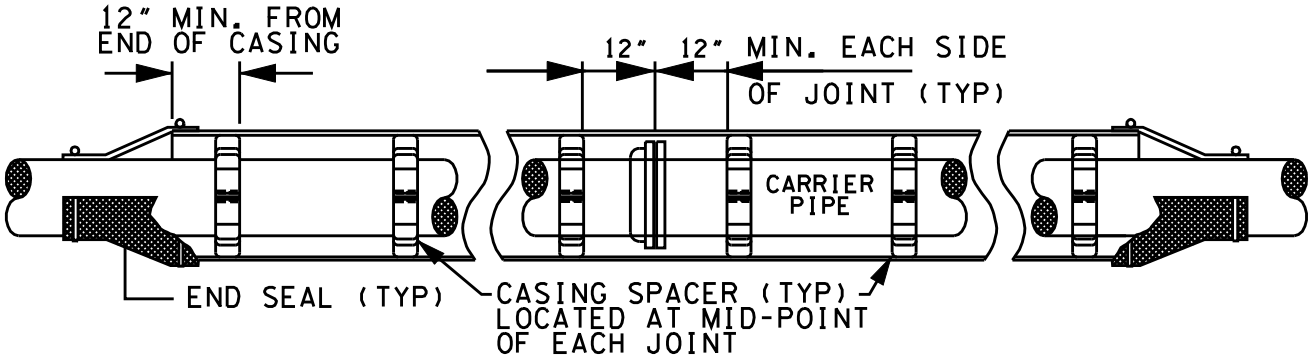


END SEAL



SECTION

COATED CASING SPACER, 14 GA. STEEL, FUSION BONDED PVC COATING OR FLEXIBLE EPDM LINER, 2 PIECE, 2" WIDE GLASS REINFORCED POLYMER RUNNERS, PVC LINER. PIPELINE SEAL AND INSULATOR, INC. TYPS C, ADVANCE PRODUCTS AND SYSTEMS, INC. TYPE S18 OR EQUAL.



ELEVATION

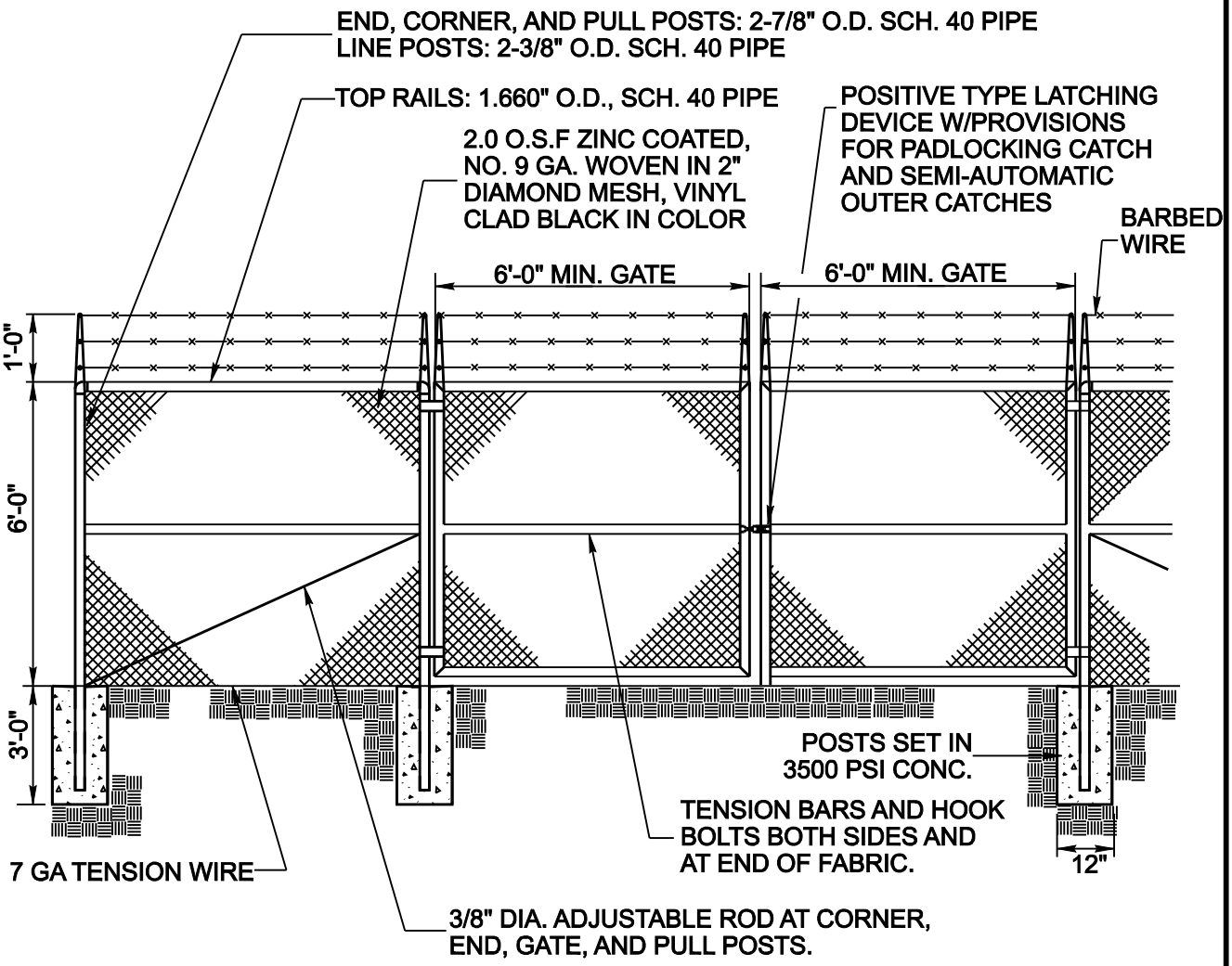
DATE: 08/2010

NOT TO SCALE

CASING SPACER AND END SEAL DETAILS

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA



NOTE:

ALL POSTS AND OTHER APPURTENANCES SHALL BE HOT DIP GALVANIZED W/ MIN. 2.0 O.S.F. ZINC. ALL FITTINGS SHALL BE MALLEABLE OR DUCTILE IRON OR STEEL. FENCE FABRIC AND ALL APPURTENANCES TO BE VINYL COATED, COLOR TO BE BLACK.

REV. 01/2015
DATE: 02/2012

NOT TO SCALE

STANDARD CHAIN-LINK FENCE DETAIL

STANDARD DETAILS

LIMESTONE COUNTY WATER AND SEWER AUTHORITY
LIMESTONE COUNTY, ALABAMA

7.0

APPENDIX

Sample: Deed of Conveyance

Sample: Contractor Final Certification

CONTRACTOR CERTIFICATION

TO: General Manager
Limestone County Water and Sewer Authority
17218 Highway 72 West
Athens, AL 35612

Dear Sir:

This is to certify that we have installed the following water mains, sanitary sewer lines and appurtenances:

Being the construction of _____
_____
_____
in vicinity of _____ to serve_____
_____, all as more particularly shown by plans on file in the office of the General Manager of the Limestone County Water and Sewer Authority.

For labor and materials used in installing the water lines and appurtenances was $_____. For labor and materials used in installing the sanitary sewer and appurtenances was $_____.

The sum having been paid to us in full, we hereby release all claims as to labor and materials on this job. We also certify that all claims for labor and materials furnished us for use on the above water mains and sanitary sewer lines have been satisfied in full.

Signed this _____ day of _____, 20___.

BY_____
Company Name_____

STATE OF ALABAMA

COUNTY OF _____

Before me _____, a Notary Public within and for the State and County aforesaid, personally appeared _____ with whom I am personally acquainted and who upon his oath acknowledged himself to be the _____ The within named bargainer, a _____ and that he as such being authorized so to do, executed the forgoing instrument for the purpose therein contained by signing the name of the _____ by the said _____ as such _____.

Witness my hand and official seal in the office at _____ on this the _____day of _____, 20____.

My Commission expires _____

DEED OF CONVEYANCE

For and in consideration of Ten and no/100 ($10.00), cash in hand paid by the **Limestone County Water and Sewer Authority** to _____, Owner in fee simple of the following lines and appurtenances.

Being the construction of_____

_____

_____

in the vicinity of _____ to serve _____

_____, all as more particularly shown by plans on file in the office of the General Manager of the Authority, its successors and assigns, the above described lines and appurtenances.

The said line and appurtenances are conveyed, subject to the assumption by the Limestone County Water and Sewer Authority of Limestone County, Alabama, in the future of full responsibility of ownership of said lines and appurtenances.

The said conveyors agree to adjust all water and/or sanitary sewer castings within the roadways of this project to complete the final paving operations of the roads in compliance with the roadway finished grades. The acceptance of the deeds of conveyance by the Limestone County Water and Sewer Authority does not relieve the conveyors from full compliance with the specifications in the completion of said work.

The said conveyors agree that all work will be warranted for one (1) year from the date of deed in accordance with the specifications of the Authority per the approved plans for the above referenced project.

The said conveyors covenant and bind themselves, their heirs and assigns, to warrant and forever defend the title to the said lines herein conveyed, to the Limestone County Water and Sewer Authority.

We hereby certify that we ascertained and confirmed the correctness of all the facts and representations as set out in the statement by _____, set forth herein and we have paid to _____, the sum of $_____ for the water lines and appurtenances and the sum of $_____ for the sewer lines and appurtenances as described on the preceding page.

In witness whereof, the said conveyors have executed this deed on the _____ day of _____, 20___.

_____
Name

_____
Title

STATE OF ALABAMA
COUNTY OF _____

Before me _____, a Notary Public within and for the State and County aforesaid, personally appeared _____ with whom I am personally acquainted and who upon his oath acknowledged himself to be the _____ The within named bargainer, a _____ and that he as such being authorized so to do, executed the forgoing instrument for the purpose therein contained by signing the name of the _____ by the said _____ as such _____.

Witness my hand and official seal in the office at _____ on this the _____day of _____, 20____.

My Commission expires _____

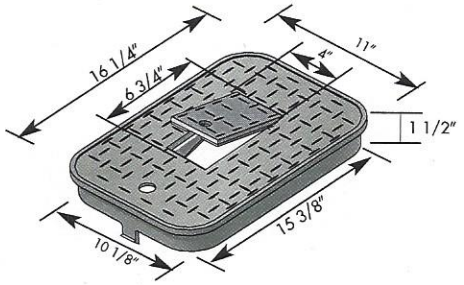
NDS
WE PUT WATER IN ITS PLACE

TECHNICAL SPECIFICATIONS

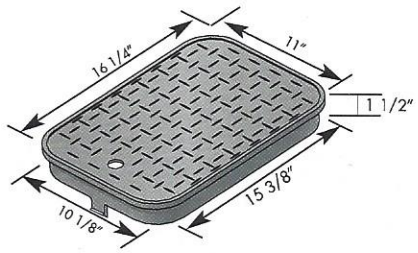
NDS 13x20 Jumbo AMR Boxes

NDS 13x20 AMR Meter Boxes and Covers

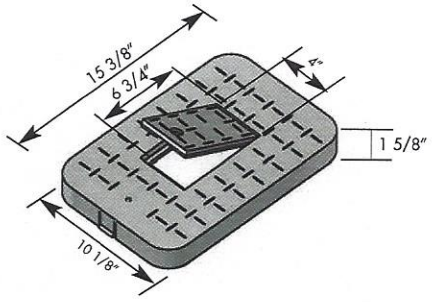
NDS 13"x20" AMR/TR meter boxes and covers are injection molded of structural foam recycled polyolefin material with a melt index between 10-12. Coloring and UV stabilizers are added, along with processing lubricants when needed. The 13"x 20" body shall be tapered and have a minimum wall thickness of .25". The body shall have a double wall at the top cover seat area with a minimum thickness of .187". The cover seat area shall have 16 structural support ribs on the underside of the seat, each with a minimum thickness of 3/16". The bottom of the body shall have a 1" flange. The 12"x 17" cover shall have an average thickness of .250".



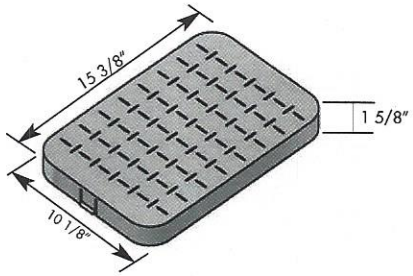
Overlapping Reader Cover



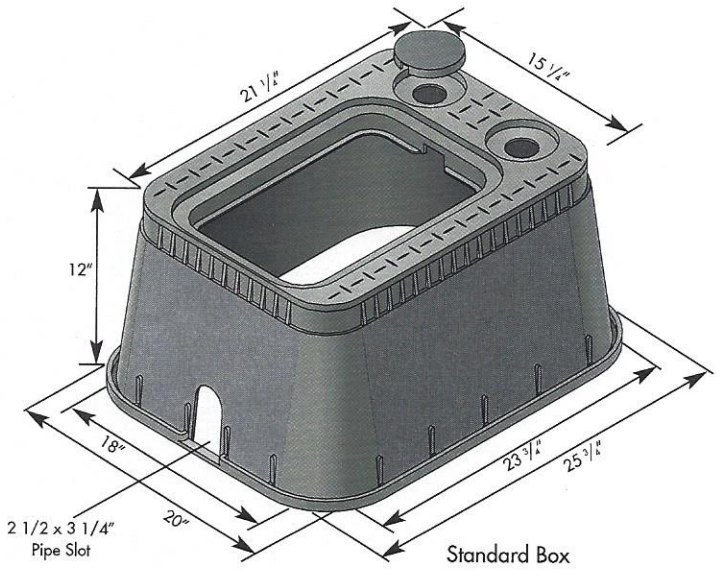
Overlapping Solid Cover



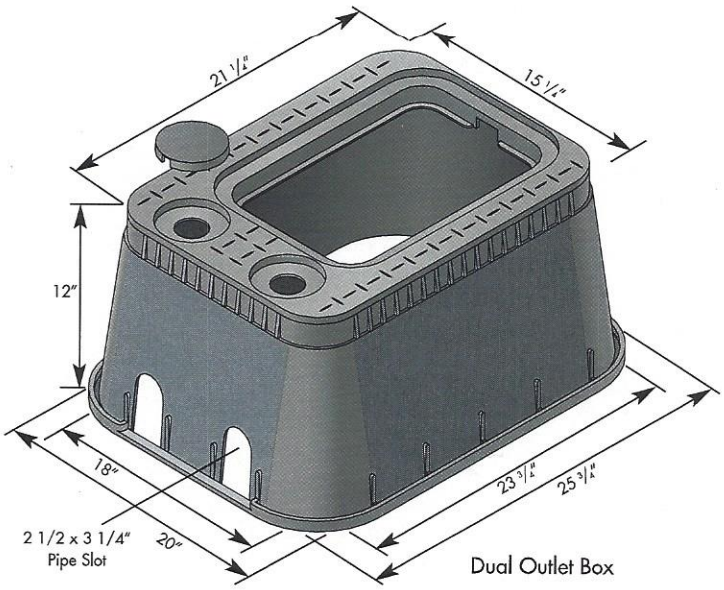
Drop In Reader Cover



Drop In Solid Cover



Standard Box



Dual Outlet Box

Product is not to be installed in concrete and is not to be used in vehicular applications. Weights and dimensions are nominal.

Part Number	Description		Cover Type	Color (Box/Cover)	Weight Ea
Drop In Box & Cover					
D15AMR2-DI	13"x20"x12" Jumbo AMR Box	Drop-in Cover - Water Meter	Solid Plastic	Black/Black	16.20
D15AMR2-DIR	13"x20"x12" Jumbo AMR Box	Drop-in Meter Reader Cover - Water Meter	Plastic w/ Plastic Reader	Black/Black	16.20
D15AMR2-DICIR	13"x20"x12" Jumbo AMR Box	Drop-in Meter Reader Cover - Water Meter	Plastic w/ Cast Iron Reader	Black/Black	17.40
Overlapping Box & Cover					
D15AMR2-OLSB	13"x20"x12" Jumbo AMR Box	Overlapping Cover - Water Meter	Solid Plastic	Black/Black	16.40
D15AMR2-OLLOC	13"x20"x12" Jumbo AMR Box	Overlapping Locking Cover - Water Meter	Solid Plastic	Black/Black	16.60
D15AMR2-OLR	13"x20"x12" Jumbo AMR Box	Overlapping Meter Reader Cover - Water Meter	Plastic w/ Plastic Reader	Black/Black	16.40
Drop In Cover Only					
D1200-DISBL		12"X17" Drop-in Cover - Water Meter	Solid Plastic	Black	2.20
D1200-DIRBL		12"x17" Drop-in Meter Reader Cover - Water Meter	Plastic w/ Plastic Reader	Black	2.20
D1200-DICIRLID		12"x17" Drop-in Meter Reader Cover - Water Meter	Plastic w/ Cast Iron Reader	Black	3.40
Overlapping Cover Only					
D1200-OLSBL		12"x17" Overlapping Cover - Water Meter	Solid Plastic	Black	2.40
D1200-OLLOCBLD		12"x17" Overlapping Locking Cover - Water Meter	Solid Plastic	Black	2.60
D1200-OLRBL		12"x17" Overlapping Meter Reader Cover - Water Meter	Plastic w/ Plastic Reader	Black	2.40
Box Only					
D15AMR2-B/O	13"x20"x12" Jumbo AMR Box with Pipe Knockouts			Black	13.06
D15AMR2-DU B/O	13"x20"x12" Jumbo AMR Box with Dual Pipe Slots			Black	10.20
Accessories					
D15AMR-PLUG	D15AMR Hole Plug			Black	0.10

Call for additional options and availability

Properties of Unfoamed Resin		
	ASTM Test Method	**Polyolefin**
Tensile Strength, Yield	ASTM D 638	3400-4400 PSI
Density	ASTM D 792	.900-.956
Notched Izod Impact Strength	ASTM D 256	1.5-15 ft. lbs/in.
Heat Deflection Temperature @ 66 PSI, Degreees F.	ASTM D 648	150-212 degrees F.

Shipping Configuration		
	Box	**Lid**
Pallet	48	96
Pieces per Stack	12	16
Stack per Pallet	4	6
Pallet Dimensions	42"x48"x48"	42"x42"x36"

NDS
WE PUT WATER IN ITS PLACE

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