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**WATER & WASTEWATER  
CONSTRUCTION  
STANDARDS &  
SPECIFICATIONS  
SPRINGFIELD, TENNESSEE**

DECEMBER 2023

## Preface

The purpose of this City of Springfield's Water Design and Construction Standards Manual, hereinafter referred to as the MANUAL, is to provide information and guidance to land developers, design engineers, and contractors that are to become a part of, or be connected to, the Springfield Water and Wastewater Department's (SWWD) system. The procedures of this MANUAL are to be followed by any person or corporation in the development of a residential subdivision, commercial or industrial development, in which the developer is required to construct facilities that will become an asset of SWWD. The ultimate goal of this MANUAL is the protection of the health and welfare of the general public through the use of proper sanitary design features, construction materials, and construction techniques.

## Safety Statement

The City of Springfield holds no responsibility for work site safety. The City promotes adherence to all enforceable laws, requirements, and regulations set forth by OSHA and TOSHA. Sole work site safety responsibility lies with the Contractor.

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# WATER

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## SECTION 1 WATER INTRODUCTION

### **1.0 PURPOSE**

The purpose of this City of Springfield's Water and Sewerage Design and Construction Standards Manual, hereinafter referred to as the MANUAL, is to provide information and guidance to land developers, design engineers, and contractors in the construction of water and sewerage facilities that are to become a part of, or be connected to, the Springfield Water and Wastewater Department's (SWWD) system. The regulations and procedures of this MANUAL are to be followed by any person or corporation in the development of a residential subdivision, commercial or industrial development, in which the developer is required to construct facilities that will become an asset of SWWD. The ultimate goal of this MANUAL is the protection of the health and welfare of the general public through the use of proper sanitary design features, construction materials, and construction techniques.

### **1.1 AUTHORITY**

SWWD was established by City of Springfield on July 20, 1905 to be responsible for the acquisition, administration, maintenance and operation of the City's water and sewer facilities, and to this end, this Manual is hereby established. The City has a legal right to provide public water service in Robertson County.

### **1.2 REFERENCES**

Certain technical aspects concerning construction materials and methods of construction are based on Tennessee Department of Highway, Standard Specifications for Road and Bridge construction, hereinafter referred to as TDOT Specifications.

Other standards or specifications referred to are those of the American Water Works Association (AWWA), the American Society of Testing Materials (ASTM), American Association of State Highway & Transportation Officials (AASHTO), Portland Cement Association (PCA), American Public Works Association (APWA), American Society of Civil Engineers (ASCE) and the Tennessee Department of Environmental Compliance.

Standard drawings showing details of certain improvements shall be complementary to and a part of this MANUAL.

### **1.3 GENERAL REQUIREMENTS**

In order to ensure that the design and construction of water and sewer facilities meet generally accepted sanitary engineering design criteria and generally recognized

construction methods for such facilities, the OWNER/DEVELOPER of lands in which water and/or sewer lines are to be constructed that are to be connected to and become a part of SWWD system, must employ a Professional Engineer, registered with the State of Tennessee. The OWNER/DEVELOPER shall employ the ENGINEER to:

- A. Prepare detailed construction drawings.
- B. "Provide continuous adequate inspection during construction to assure that all work is done in accordance with approved plan documents." (Tennessee Department of Environment & Conservation Rule 1200-5-1-.05 (6)). Inspection will also be provided by SWWD; however, the CITY has no authority waive the ENGINEER's obligation under the State's regulations.
- C. Certify to SWWD that the facilities were constructed in accordance with the approved plans and the detailed specifications contained herein.

"Certify" as used herein means an expression of professional opinion regarding the facts of the record drawings and does not constitute a warranty or guarantee, expressed or implied.

- D. Provide a complete set of "Record Drawings" to SWWD on magnetic format, if available, and reproducible media.

#### **1.4 UTILITY'S AUTHORITY**

SWWD, or its designated representative, shall decide questions which may arise as to the quality and acceptability of materials furnished and work performed. SWWD shall interpret the intent of this MANUAL in a fair and unbiased manner.

Nothing contained in this MANUAL is intended to conflict with any State or Federal laws or regulations. If any requirement of this MANUAL is found to be in conflict with a State or Federal law or regulation, then the more stringent requirement shall be met. In no case shall the requirements of this MANUAL be less stringent than any existing State or Federal law or regulation.

This MANUAL shall be revised from time to time to ensure that its requirements keep abreast with current State and Federal laws and regulations, approved construction material and recognized construction methods.

#### **1.5 OBLIGATION OF THE CONTRACTOR**

The CONTRACTOR shall perform and complete the work to the satisfaction of SWWD and in accordance with this MANUAL. The CONTRACTOR shall conduct his work so as to minimize interference with public and private business and traffic. The CONTRACTOR shall provide barricades, flagmen, maintain lights, and take other

precautions as may be necessary to protect life, property, adjacent buildings and structures. The CONTRACTOR shall be liable for all damages and injuries received or sustained by any person, persons or property in consequence of any neglect or misconduct by him or his agents, subcontractors, employees or workmen.

### **1.6 COOPERATION WITH SWWD**

Cooperation with the office of SWWD concerning construction planning and procedures is required. Reasonable notice shall be given SWWD, or its representative, prior to beginning any phase of construction. In no case should such notice be less than 24 hours.

### **1.7 DEFECTIVE MATERIAL AND WORKMANSHIP**

Materials not in accordance with the specifications, or defective work, may be condemned by the ENGINEER or SWWD at any time before final approval and acceptance by SWWD. Failure by the ENGINEER or SWWD to condemn defective work shall not be construed as an acceptance of same.

### **1.8 FINAL INSPECTION**

In addition to normal inspections which may be conducted during construction of development improvements, a Final Inspection will be made by a representative of SWWD. Final Inspection will be made prior to acceptance of any unit for maintenance by SWWD and only after all improvements are completed. As part of the Final Inspection, SWWD shall be given a completed set of Record Drawings. The Final inspection will include, but not be limited to, sanitary manholes, confirmation of measurements to services and valves, pump station performance, depth of cover, installation to proper grade of valve boxes and fire hydrants. The OWNER/DEVELOPER shall provide personnel as required to aid in the final inspection.

### **1.9 EXISTING UTILITIES**

The CONTRACTOR shall abide by the Tennessee Underground Utility Damage Prevention Act, TCA 65-31.

Special precautions shall be taken by the CONTRACTOR to avoid damage to existing overhead and underground utilities owned and operated by public or private utility companies.

Where existing utilities or appurtenant structures, they shall not be displaced or molested unless a prior agreement is made with the utility owner. In cases of damage, the utility's owner shall be notified immediately and repairs coordinated with that owner.

The OWNER/DEVELOPER, or his representatives, shall bear the entire responsibility for locating, avoiding, or repairing damage to said existing utilities.

### **1.10 PERMITS, EASEMENTS AND RIGHTS-OF-WAY**

Unless otherwise required by the agencies involved, the OWNER/DEVELOPMENT shall make application for, obtain and pay for all licenses, permits, easements and rights-of-way. The CONTRACTOR shall be required to comply with all Federal, State and County, and City ordinances, laws, and/or codes which may apply to same.

Issuance of a construction permit by SWWD should not be construed to mean that all other Federal, State and County, and City ordinances, laws, and/or codes have been obtained or complied with.

### **1.11 EXTENSIONS**

Main extension shall be in accordance with City Codes 18-207, 18-208, 18-209, 18-314, 18-315, and 18-316.

A service line shall not be allowed that circumvents the requirement for main extensions, *id Est*, constructing a service line from an existing main along a right-of-way with the meter located at the exiting main, or within a third-party easement. In such cases, the main should be extended.

In general, and without a specific waiver to the contrary, main extensions of the water system or wastewater system shall be to the outside limits of the property proposed for development. As an example, if a proposed development has existing or proposed road frontage, the system extensions shall extend the entire road frontage to help enable connections for future extensions.

## **SECTION 2 PROCEDURES**

### ***2.0 PURPOSE***

The purpose of this section is to establish a working relationship between the OWNER/DEVELOPER, ENGINEER, CONTRACTOR and SWWD by describing the step-by-step procedure to be followed by each party in initiating and completing the construction of any utility services that are to be connected to or become a part of the SWWD system.

Standards and design criteria covered in this document are limited to potable water mains and sanitary sewer mains having a diameter of twelve inches (12") or less. These standards, however, shall apply to water mains and sewer mains having diameter greater than twelve inches (12") whenever practical and feasible.

Wastewater collection lines and water distribution lines represent permanent, long term capital investments. Therefore, it becomes necessary to adopt minimum standards in order to assure present and future users will be adequately served through a system of adequately sized and located piping having long life expectancy.

### ***2.1 PRE-DESIGN CONFERENCE***

Before beginning a system extension design, the ENGINEER and OWNER/DEVELOPER should first confer with the City of Springfield's Planner in regard to growth potential and density that may result in the general area of the extension being planned. A pre-design conference with SWWD staff and the City Planner should be convened to discuss the system standards and requirements as well as any conditions or constraints related to mains where extensions are contemplated. A multi-departmental meeting may be recommended to help avoid any misunderstandings and delays.

### ***2.2 APPLICATION TO CONSTRUCT AND CONNECT***

The second step in the procedure is for the OWNER/DEVELOPER to file an application to SWWD requesting permission to connect the proposed new facilities to the existing utilities. At this time the OWNER/DEVELOPER must also make a selection in writing, on forms provided by SWWD, as to whether he intends to proceed in a manner which will entitle him to refunds of the cost of the extended facilities as provided under these regulations or prefers to recover the cost of the water and sewer utilities through some other method not requiring refunds by SWWD. If the OWNER/ DEVELOPER chooses the refund method for a subdivision, it is required that the plat for recording contain language on the face of it and in prominent lettering that any person who desires to

connect to the water and/or sewer mains in that subdivision must pay a privilege fee prior to making the connection.

The application form may be obtained at:

Springfield Water & Wastewater Department  
824 Central Avenue  
Springfield, Tennessee 37172  
Telephone (615) 382-1600  
Facsimile (615) 384-6951

It is recommended that the OWNER/ DEVELOPER engage the services of an ENGINEER in the beginning to assist in preparing the application since much of the information requested must be provided by the ENGINEER.

Information required with the preliminary application shall include:

- A. A site plan shall be provided on a plan sheet in sufficient detail to show the location of the proposed development.
- B. Information on water demand and wastewater flows.

Upon receipt of this information, SWWD will provide a preliminary evaluation of the impact the proposed development will have upon the existing facilities. From the estimated water demand and the wastewater flow provided by the ENGINEER, SWWD shall determine whether the existing water system is adequate to provide service (both domestic and fire protection) and whether the existing sewer system has capacity to receive the estimated wastewater flow. The ENGINEER is advised that additional information may be required to make this determination.

A determination that capacity is available at the time of application by SWWD indicates that capacity will be available for service immediately upon completion of the project proposed in the application. If SWWD is capable of providing these services, a letter of conditions shall be issued listing the requirements that must be met in order to obtain acceptance of the proposed facilities by SWWD. Should it be determined that capacity for water or sewer service is unavailable, the OWNER/DEVELOPER should contact SWWD to explore alternate solutions.

### **2.3 DESIGN PHASE**

Upon receipt of the letter of conditions from SWWD, the OWNER/DEVELOPER may authorize his ENGINEER to prepare plans for the proposed development, in accordance with the requirements contained in the detailed specifications of this MANUAL.

During the design phase, the ENGINEER shall work closely with SWWD to ensure that the final product meets all requirements of SWWD. All plans must show all necessary details before approval is granted.

***There shall be no provisional approval.***

### **2.3.1 WATER FACILITIES**

Plans prepared by the ENGINEER for the construction of water lines shall be drawn on plan and profile sheet, 24" x 36", to a plan scale of not greater than 1" = 50' and a profile scale not greater than 1" = 5'. In congested areas, such as a developed urban area, a scale that allows more detail may be required.

Plans shall contain the following minimum information:

#### Title Sheet

- A. Name and address of ENGINEER;
- B. Name and address of OWNER/ DEVELOPER;
- C. Name of development;
- D. Vicinity map.

#### Plan and Profile Sheet

- A. Topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines and utility easements);
- B. Pipe material, dimension ratio, and pressure rating;
- C. Pipe size;
- D. Location and type of valves;
- E. Location and size of hydrants;
- F. Location and size of blowoffs;
- G. Location and size of service lines;
- H. Profile of water line in the vicinity of other existing or proposed underground utilities;
- I. Existing facilities, *id Est* hydrants, valves lines sizes, storm drains, sewer lines, telephone lines, CATV, electric, *et cetera*;

- J. The statement "All construction shall be in accordance with The Springfield Water & Wastewater Department Manual."

The ENGINEER shall provide the following design data with the plans:

- A. Hydraulic calculations for the water system. The ENGINEER may obtain preliminary pressure readings from SWWD upon request at or near the point of connection. A minimum pressure of 20 psi must be maintained within both the proposed and existing water system under all normal operating conditions, including fire flow. It is the ENGINEER's duty to provide assurances of this through hydraulic calculations.

Efforts must be made to provide for all water lines to be looped unless a dead-end line is approved by SWWD.

- B. Hydraulic calculations shall include, but not be limited to, status of elevated tanks, pumps, hydraulic gradients of proposed and existing water lines. Network analysis such as Hardy-Cross, KYPIPE, shall be considered the acceptable standard.

### **2.3.2 SEWER FACILITIES**

Plans prepared by the ENGINEER for the construction of sewer lines shall be drawn on plan and profile sheet, 24" x 36", to a plan scale of not greater than 1" = 50' and a profile scale not greater than 1" = 5'. In congested areas, such as a developed urban area, a scale that allows more detail may be required.

Plans shall contain the following minimum information:

Title Block

- A. Name and address of ENGINEER;
- B. Name and address of OWNER/ ENGINEER;
- C. Name of development;
- D. Vicinity map.

Plan and Profile Sheet

- A. Topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines and utility easements);
- B. Pipe material, dimension ratio, and pressure rating (for force mains);
- C. Pipe size;
- D. Location and type of manholes;

- E. Location and size of services;
- F. Profile of sewer line and other existing or proposed underground utilities;
- G. Existing facilities, *id Est* hydrants, valves, water lines, storm drains, sewer lines, telephone lines, CATV, electric, *et cetera*;
- H. Name of MCC manufacturer;
- I. Manufacturer's MCC specifications;
- J. Name of pump manufacturer;
- K. Number of pumps;
- L. Manufacturer's pump specifications;
- M. Pump discharge at design TDH;
- N. Dimensions, elevations and capacity of wet well;
- O. Location of pump controls;
- P. Piping and valve arrangement inside station;
- Q. The statement "All construction shall be in accordance with The Springfield Water & Wastewater Department Manual."

The ENGINEER shall provide the following design data with the plans:

- A. Design calculations of gravity sewer lines shall show the grade, expected average flow, and capacity and velocity at minimum and peak flows between each manhole.
- B. Design calculations of sewage lift stations and force mains shall show pump capacity and velocity at minimum and peak flows between each manhole.
- C. Design calculations of sewage lift stations and force mains shall show pump capacity at design TDH, head loss through the force main, static head between pump discharge and force main discharge, the velocity through the force main, capacity of wet well and expected frequency of operation. A copy of the manufacturer's pump head curve data and specifications must be provided.

The system head curves shall be superimposed on the pump head curve chart.

## **2.4 COST ESTIMATE AND PRIVILEGE FEES**

The ENGINEER is required to submit to SWWD a cost estimate for the total water and wastewater facilities of the project. At the conclusion of each phase of the project, actual costs shall be provided to enable depreciation expenses to be calculated.

If cost recovery by the OWNER/DEVELOPER is desired, the ENGINEER shall submit a proposal as to how privilege fees can be determined in order to attempt to provide for recovery of the costs over a period not to exceed ten years. It is suggested that the privilege fee be based in a formula with the denominator being linear front footage, square footage or service connection numbers and sizes, with the final judgment to be reserved by SWWD. The numerator will be the total of all engineering and construction costs, excluding interest.

## **2.5 REVIEW PHASE**

After the completed plans have been reviewed by the OWNER/DEVELOPER with the ENGINEER, and approved by the OWNER/DEVELOPER, two sets shall be submitted to SWWD for its review and approval.

For subdivisions, the OWNER/DEVELOPER should allow a 30-day period for the review time, however, SWWD shall conduct its review as expeditiously as possible. Site plans for single lot commercial sites can usually be reviewed within one week.

SWWD shall review the plans as to the sanitary features of design and the standard specifications contained herein. Any plans submitted that do not completely comply with all requirements of SWWD shall be returned to the ENGINEER unapproved with the necessary corrections noted. After all corrections are made, the corrected plans shall be returned to SWWD so that each sheet may be stamped "Approved". Final written approval and a Notice to Proceed shall not be issued until SWWD has received a copy of the approval from Tennessee Department of Environmental and Conservation.

## **2.6 BIDDING AND AWARDING OF CONTRACT**

If the OWNER/DEVELOPER requests the refund method, bids must be advertised and received in accordance with CITY's Purchasing Procedures and are to be opened in the presence of a representative of the ENGINEER, OWNER/DEVELOPER and SWWD and any bidder who may desire to attend. Subject to joint approval of all three parties, bids may be awarded based on the lowest and/or best bid.

## **2.7 CONSTRUCTION PHASE**

Before construction begins, the OWNER/DEVELOPER shall obtain a Performance Bond to run for one year after the date of SWWD's interim acceptance of the work. The bond shall be executed by a surety company duly authorized to do business in Tennessee, and shall be in an amount not less than one hundred (100%) percent of the contract price, as security for the faithful performance of this contract and as security for

the payment of all persons performing labor and furnishing material in connection with this contract. This bond shall be on a form approved by SWWD.

## **2.8 GENERAL REQUIREMENTS**

The construction phase shall not begin until a written Notice to Proceed from SWWD is received by the OWNER-DEVELOPER. When SWWD is ready to issue a Notice to Proceed, a Pre-Construction Conference will be scheduled and conducted jointly by SWWD and the ENGINEER.

In no case shall the construction of the water and sewer system begin until the rough grade (within 0.5 feet of final grade) on the street and drainage ditches are complete.

SWWD shall be notified immediately of any conflicts encountered in the field between the water and sewer facilities and the drainage work.

**The OWNER/DEVELOPER shall be responsible to SWWD for the proper construction of the facilities.**

### **2.8.1 Inspection**

The ENGINEER shall “provide continuous adequate inspection during construction to assure that all work is done in accordance with approved plan documents.” (Tennessee Department of Environment & Conservation Rule 1200-5-1-.05 (6)).

The ENGINEER may fulfill this requirement with a representative of SWWD, with prior approval and coordination with SWWD.

**Regardless of who provides the personnel for inspection, the ENGINEER or SWWD, no pipeline shall be backfilled until a SWWD representative has had an opportunity to inspect the work.**

The CONTRACTOR shall contact SWWD when sections of 300 linear feet or less are complete to allow for this inspection. This inspection shall not relieve the OWNER/DEVELOPER or the CONTRACTOR from any latent defects not observed.

In addition to the inspection, it is directed that the CONTRACTOR or the ENGINEER's resident inspector contact the CITY's Public Works Department when water or sewer lines are constructed in CITY streets so that a representative of the Public Works Department may have the opportunity inspect the backfill material before final surface is placed on the streets.

Should the ENGINEER provide a Resident Inspector, the ENGINEER shall submit weekly inspection reports to SWWD during the construction period. Representatives of SWWD shall have the right to enter upon the project site to make periodic inspections of the work in process.

### **2.8.2 Testing**

Upon completion of construction, the CONTRACTOR shall pressure test and disinfect all water lines, and conduct infiltration, exfiltration or air tests on sewer lines, pipe deflection/deformation tests on sewer lines, and vacuum tests on manholes, as outlined in this MANUAL. Any sections of line that does not pass the prescribed test must be corrected to the satisfaction of SWWD and retested until all testing procedures are satisfied. All testing must be conducted in the presence of representatives of the OWNER/DEVELOPER, ENGINEER, CONTRACTOR and SWWD, except that the ENGINEER may represent the OWNER/DEVELOPER, if so authorized.

### **2.8.3 Record Drawings**

Record Drawings ("As-Builts") of the facilities as they are constructed are required. Field measurements for Record Drawings are to be either by the ENGINEER'S representative or the CONTRACTOR. The ENGINEER may use information provided by the CONTRACTOR in producing the Record Drawings, however, the ENGINEER is still responsible for the certification as outlined in Section 1.3.C, above, and Section 2.9, below.

The CONTRACTOR and ENGINEER are not to rely on the presence of any representative from SWWD to provide Record Drawing information; that is the responsibility of the ENGINEER and the CONTRACTOR.

The Record Drawings are intended for latter location of the facilities. As such, they shall be of sufficient detail to enable someone unfamiliar with the work to readily locate all facilities, both underground and aboveground.

A. Facilities to be located shall include, but not be limited to:

- valves,
- tees or other fittings,
- fire hydrants

- manholes
  - service connections, both at the main and at the property line,
- B. New facilities shall be located by distance measurements from a known and above ground feature. If the start of construction or measurement can be readily located by above ground features, measurements may include the station number from the start of construction to a new valve, tee, manhole, or service connection.
- C. Locate from edge of proposed right-of-way or pavement the lateral distance to the facility.
- D. Locate from property lines the distance to service connections.
- E. Provide information on accurate depth of water lines, exact elevations on sanitary sewer lines, and elevations of other facilities such as storm sewers, which may be located adjacent, above or below the constructed water and/or sewer system(s).
- F. Provide horizontal control information relating all facilities to the CITY's GPS stations and the state plane coordinate system.
- G. In addition to a markup construction drawing, the above information shall be furnished, whenever possible, in an AutoCAD Release 13 compatible format.

## **2.9 CERTIFICATIONS OF COMPLETION**

Upon completion of construction, the ENGINEER shall certify in writing to SWWD that the project has been constructed in accordance with the approved plans and the standard specifications contained herein.

“Certify” as used herein means an expression of professional opinion regarding the facts of the record drawings and does not constitute a warranty or guarantee, expressed or implied.

The certifications shall state the final total project cost.

Upon receipt of project certification, release of liens from subcontractors and material suppliers, and Record Drawings, SWWD shall conduct a field inspection. Upon confirmation of Record Drawings, the facilities shall be accepted by SWWD as an extension of the existing public systems and water and wastewater service will be made available.

A Department level administrative interim acceptance and transfer of ownership of the facilities by SWWD will allow for service to be provided via the new facilities.

**All service, including temporary service, will only be provided after this action by SWWD.**

During this interim period, the maintenance, operation and/or extension of the facilities shall be the sole responsibility of SWWD. Neither the OWNER/DEVELOPER, the

CONTRACTOR, or the ENGINEER shall make connections to the system, open or close valves, operate pump stations, *et cetera*.

## **2.10 ANNUAL INSPECTION**

Twelve months following interim acceptance of the system(s) by SWWD, a follow-up inspection will be made to determine if any failures or deficiencies have occurred as a direct result of the CONTRACTOR's work and/or materials. Present at this inspection will be representatives of SWWD, the CONTRACTOR, the ENGINEER, and the OWNER/DEVELOPER.

After this final inspection and approval, SWWD shall make a recommendation to the BOARD for final acceptance and transfer of ownership as an asset of the CITY.

The OWNER/DEVELOPER will be financially responsible for correction of any and all failures or deficiencies that have occurred during that first year of service. Only after the BOARD has accepted the facilities will SWWD be responsible for the maintenance of the new facilities. Any maintenance performed by SWWD prior to final acceptance by the BOARD will be paid by the OWNER/DEVELOPER.

## **2.11 INTERPRETATION OF MANUAL**

Interpretation of this MANUAL, or the interpretation of any other SWWD standard, design criteria, or policy shall be the responsibility of the Director of SWWD. The decision of the Director shall be based on Conditions of Service policies, past practices, accepted professional principles, and practices of the water and wastewater industry.

Any disagreement with the interpretation of the Director with respect to this MANUAL, or any standard not covered herein, may be appealed to the BOARD.

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## **2.12 SITEWORK**

### **2.12.1 Clearing and Associated Grubbing**

See TDEC Erosion and Sediment Control Handbook 4<sup>th</sup> Edition.

### **2.12.2 Erosion Control and Sediment Control**

See TDEC Erosion and Sediment Control Handbook 4<sup>th</sup> Edition.

### **2.12.3 Backfilling and Trench Excavating**

The CONTRACTOR, ENGINEER, and OWNER are required to be in strict compliance with 29 CFR 1926.650 regulations with regard to trench excavation. Additionally, the

CONTRACTOR, OWNER/DEVELOPER, and ENGINEER are required to conform with the CITY's Excavation Ordinance O95-21, or its successor.

Unless specifically directed otherwise by SWWD, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8"). Where rock is encountered, it shall be removed to a minimum depth of four inches (4") below the pipe bells.

Unless specifically authorized by SWWD, trenches shall in no case be excavated or permitted to become wider than two-feet six-inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than two-feet six-inches (2'6") at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength as determined by SWWD. This determination shall take into account the actual trench loads that may result and the strength of the pipe being used.

All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

Trenches shall be kept free of water during the laying of pipe and until the pipeline has been backfilled.

Backfilling shall be as set out hereinafter.

#### **2.12.4 Obstructions**

In cases where storm sewers, gas lines, water lines, telephone lines, and utilities, or other underground structures are encountered, they shall not be displaced or molested.

Where existing facilities may have been displaced or molested, the CONTRACTOR shall immediately contact the responsible utility owner to determine the appropriate remedy.

Where adjustment may be necessary, the CONTRACTOR shall notify the utility companies in accordance with the Tennessee Underground Utilities Protection Act prior to excavation adjacent to their facilities.

### **2.12.5 Shoring, Sheeting and Bracing of Excavations**

Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions.

Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR. The ENGINEER may require the submission of shoring plans (accompanied by the supporting computations) for review prior to the CONTRACTOR undertaking any portion of the work.

Foundations adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to ensure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundations.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable walers and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameter of the pipe.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

### **2.12.6 Use of Explosives**

Blasting shall be conducted in accordance with the municipal ordinances, state laws, and the *Manual of Accident Prevention in Construction*, Section 9, as published by the Associated General Contractors of America, Inc...

All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by the CONTRACTOR.

Blasting operations shall be covered by public liability insurance, or if said public liability insurance does not cover blasting, then the CONTRACTOR shall have separate public liability insurance to cover his blasting operations.

All blasting shall be supervised and performed by qualified and licensed personnel.

### **2.13 PIPE BEDDING**

In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated.

In no case shall the supporting of pipe on blocks be permitted. See Drawing WD-5 for typical bedding.

#### **2.13.1 Earth Foundation**

All water pipe shall be laid on a bed of select native material to provide continuous support for the lower section of the pipe. Select native material shall be free from all rocks greater than one-half inch (0.5") in diameter.

#### **2.13.2 Rock Foundation**

If the trench bottom is in rock the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #67 crushed stone.

#### **2.13.3 Special Bedding**

In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the ENGINEER or SWWD, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

Granular material for Special Bedding shall be #67 crushed stone.

### **2.14 BACKFILLING PIPELINE TRENCHES**

All backfilling shall be accomplished in accordance with the requirements of this section. Any variances must be approved in writing by SWWD and the road authority having jurisdiction.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of

standard (ASTM D698) Proctor density where mechanical tamping of backfill is required.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

#### **2.14.1 Backfilling in Open Terrain Areas**

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to the spring line (centerline) of the pipe may be backfilled with select native material, free from all rocks greater than one inch (1") in diameter. This material shall be mechanically tamped.

The portion of the trench from the spring line of the pipe to a point twelve inches (12") above the pipe shall be backfilled with select native material, free from all rocks greater than one inch (1") in diameter. This material shall be mechanically tamped.

Backfilling the upper portion of the trench may be accomplished by any means approved by the ENGINEER, but as a minimum, this region shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding six inches (6") on any side is prohibited. This material shall be placed in six-inch (6") layers and mechanically tamped.

#### **2.14.2 Backfilling Under Paved Areas**

Backfilling of pipeline trenches under sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point six inches (6") below the bottom of the pavement or concrete sub-slab, shall be backfilled with #67 crushed stone. This material shall be placed in six-inch (6") layers and mechanically tamped to consolidate.

The upper portion of the trench, from a point six inches (6") below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with a base course of dense graded aggregate, crushed stone, or fine gravel and sand suitable to the appropriate governing body having jurisdiction over the street or roadway. This material shall be placed in six-inch (6") layers and mechanically tamped.

At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

### **2.14.3 Settlement of Trenches**

Wherever water lines are in, or cross, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one (1) year from the time of SWWD's interim acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the OWNER/DEVELOPER.

### **2.14.4 Under-Highway Bore and Casings**

Pipe Diameter, inches	Casing Diameter, inches	Wall Thickness, inches
6	12	0.250
8	16	0.375
10	16	0.375
12	18	0.375
14	22	0.375
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.375

### **2.15 CONCRETE CRADLE, ANCHORS OR ENCASEMENT**

Concrete cradle, anchors or encasement of water mains and fittings shall be placed where shown on the plans. Concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

When mechanical thrust restraints are not practical, and with prior approval from SWWD, water mains may utilize concrete thrust or "kicker" blocks to resist forces acting on the pipeline, as shown on Standard Drawings No. WD-6 and WD-7.

Encasement of water mains under creeks and drainage waterways shall be constructed as shown on Standard Drawing WD-9.

### **2.16 HIGHWAY AND RAILROAD CROSSINGS**

Steel encasement pipe for road and railroad crossings shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. The encasement pipe shall be installed without bends.

The water pipe shall be installed after the encasement pipe is in place per manufacturer's recommendations.

Centering cradles as manufactured by Advanced Products & Systems, Inc., or an approved equal, shall be used to position the water main in the casing pipe.

After the water pipe has been installed, inspected, and tested as specified, both ends of the casing pipe shall be closed with brick or concrete block masonry in a manner acceptable to SWWD.

### ***2.17 Steel Encasement Pipe***

Encasement pipe shall be steel, plain end, uncoated and unwrapped, have a minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 or ASTM A139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 10-foot lengths.

The wall thickness of the pipe shall be a minimum of 0.250 inches for highway crossings and 0.344 inches for railroad crossings. The diameter of the pipe shall conform to the requirements of American Railway Engineering Association for railroad crossings, and the requirements of the Tennessee Department of Transportation for highway crossings.

The carrier pipe shall be positioned in the casing pipe with casing spacers as manufactured by Advance Products & Systems, Inc., or approved equal.

### ***2.18 Pavement Renovation***

## **WATER FACILITIES**

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### **SECTION 3 DESIGN**

#### **3.0 PURPOSE**

The purpose of this section is to outline requirements for proper design, construction, inspection and final acceptance of potable water mains and appurtenances, customer services connections, and public fire protection systems.

The layout of extensions of SWWD water system will be a circular or belt system connecting smaller crossover or gridiron systems.

#### **3.1 DESIGN REQUIREMENTS**

A complete set of hydraulic computations, in a tabular form, shall be made available to SWWD which indicates average and peak flows, ground elevations, elevation of hydraulic grade line and pressures.

##### **3.1.1 Size of Water Mains**

All water mains shall be designed to carry peak flows and maintain a minimum line pressure of 20 psi at all service connections under all normal flow conditions. Design peak flows shall be the greater of the following:

- A. Flow determined by the ENGINEER as the instantaneous demand placed upon the system by the development. All assumptions and any flow data used in the design by the ENGINEER must be clearly documented and submitted with the hydraulic calculations;
- B. Hydraulic calculations for "looped" systems shall be accomplished by network analysis, such as the Hardy-Cross method by KYPIPE, EPANET, or similar means;
- C. If actual flow data are not available, theoretical calculations shall be based on all storage facilities being half-full and the appropriate Hazen-Williams friction factor shall be applied for the type of pipe being used, but in no case shall such friction factor be greater than 130;
- D. Distribution pipes shall be capable of providing a minimum flow of 500 gallons per minute (gpm) at 20 psi residual pressure for the proposed development, subsequent phases, and extensions thereof;
- E. Flow required for fire protection by Insurance Services Office (ISO) of Tennessee guidelines;

F. Computed peak flow if development is commercial or industrial.

No water main shall be smaller than eight inches (8") in diameter or as required by SWWD master plan.

### **3.1.2 Size of Service Pipe**

All service piping shall be a minimum of three-quarters inch (3/4") minimum diameter. Where greater flows are anticipated than those normally expected for residential services, the service piping shall be designed to maintain minimum 20 psi pressure at peak design flow.

### **3.1.3 Depth of Cover**

All water pipe shall be covered with a minimum of thirty inches (30") of backfill material, measured from the top of pipe to the existing and proposed final finished ground level. This requirement includes all service lines and fire hydrant branches where crossing drainage ditches.

### **3.1.4 Public Fire Protection**

The ENGINEER shall follow the current suggested minimum fire protection requirements of the Tennessee Department of Environmental & Conservation *Community Public Water Systems Design Criteria*, Robertson County Planning Commission, Springfield Municipal/Regional Planning Commission, and the Insurance Services Office (ISO) of Tennessee, SWWD, and the fire department having service jurisdiction of the proposed development, in providing for public fire protection.

The minimum standard for fire hydrant placement shall be 400 feet to any single residential property, as measured along an existing or proposed roadway.

**For multi-family, commercial, or industrial property, the minimum distance shall be 300 feet.**

### **3.1.5 Dead End Lines and Distance Between Valves and Interconnects**

Dead end lines shall be minimized.

With the exception of transmission mains, the distance between intersecting lines shall be no greater than 800 feet without prior written approval from SWWD. This requirement is generally provided by intersecting roads, however, in rural areas, where intersecting roads are not available within 800 feet, this limitation may require interconnections using utility easements.

Water lines within residential, commercial, and industrial developments shall be extended to the exterior property lines(s) of a development (or phase of development) where future connections can be made for extensions.

Water lines within residential, commercial, and industrial developments shall be extended and connected to lines within the existing water system by the OWNER/DEVELOPER.

Where dead end distribution lines are approved, they should be terminated with a fire hydrant where fire protection is to be provided, or an approved blow-off assembly where fire protection is not to be provided.

### **3.2 SEPARATION OF WATER AND SEWER LINES**

This requirement is governed by both the below standard for public mains and the Plumbing Code, Southern Building Code, Inc., for private plumbing facilities.

#### **3.2.1 Horizontal Separation**

Whenever possible sewers and sewer manholes should be laid at least ten feet (10') horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of ten feet (10'), a sewer may be laid closer than ten feet (10') to the water main provided that the bottom (invert) of the water main shall be at least twenty-four inches (24") above the top (crown) of the sewer.

Where this vertical separation cannot be obtained, the sewer shall be constructed of approved water pipe, pressure tested, in place, without leakage prior to backfilling.

#### **3.2.2 Vertical Separation**

Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least twenty-four inches (24") below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirements, the water main shall be relocated to provide this separation or the sewer line shall be reconstructed with ductile iron pipe, or prestressed concrete cylinder pipe for a distance of ten feet (10') on each side of the water line and should be pressure tested, in place, without leakage prior to backfilling. One (1) full length of water main and sewer main should be centered over the intersection so that both joints will be as far from each other as possible.

No water or sewer services shall be constructed within ten feet (10') of water or sewer main crossings.

### **3.3 PIPE MATERIAL**

All water mains shall be constructed of ductile iron or polyvinyl chloride (PVC), unless otherwise approved by SWWD, except those lines twelve inches (12") and larger shall be ductile iron.

### **3.3.1 Ductile Iron Pipe, Fittings and Joints**

Ductile iron pipe shall conform to the latest AWWA C151 (ANSI A21-51) with standard thickness as designated in AWWA C150 (ANSI A21.50).

Thickness class shall be noted on the plans by the ENGINEER.

The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C104 (ANSI A21.4). The exterior of all pipe, unless otherwise specified, shall receive either a coal tar or asphalt base coating a minimum of one (1) mil thick.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an eight (8) mil thick polyethylene encasement meeting the requirements of AWWA C105 (ANSI A21.5). Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps. If such corrosive soils are expected, the ENGINEER shall be responsible for conducting resistivity tests on the soils.

Pipe joints shall be of the push-on type, conforming to AWWA C111 (ANSI A21.11). Bells for push-on type joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket and annular recess of the socket shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled.

Pipe mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts.

Fittings shall be ductile iron conforming to AWWA C110 or AWWA C153. Fittings shall be tar-coated outside and shall receive the standard cement lining of bituminous seal coat on the inside as specified for ductile iron pipe.

Buried joints for valves and fittings shall be mechanical joint with mechanical restraint devices only.

Mechanical joint plain and bell ends of fittings shall conform to the dimension set forth in AWWA C111-72 (ANSI A21.11).

Restrained joints for ductile iron pipe shall be US Pipe TR-Flex Gripper™, US Pipe Field-Lok™, or American Pipe Lok-Fast Joint™.

In lieu of the above restraints systems for ductile iron pipe, mechanical joint fittings and pipes may be used with a restraining system that incorporates the design within a follower gland. The restraint mechanism shall consist of a plurality of individually activated gripping surfaces to maximize restraint capability. The gland shall be manufactured of ductile iron conforming to ASTM A536-80.

The gland shall be such that it can replace the standardized mechanical joint bell conforming to AWWA C111 (ANSI A21.53) and AWWA C153 (ANSI A21.53). Twist-off

nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices.

The restraining glands shall have a pressure rating equal to that of the ductile iron pipe on which it is used, and shall be EBBA Iron Systems Mega lug™, Griffin Pipe Products Company Bolt-Lok™, or a system previously approved by SWWD.

On a case-by-case basis, and only when mechanical thrust restraints are not practical, SWWD will consider a request to employ concrete thrust or “kicker” blocks as shown on Standard Drawings No. WD-6 and WD-7. Concrete thrust blocks may be used in addition to mechanical restraint devices, if in the opinion of the ENGINEER, they are required.

The cleaning and assembling of pipe and fitting joints shall be in accordance with the manufacturer’s recommendations.

### **3.3.2 Polyvinyl Chloride Pipe and Joints**

PVC water pipe shall conform, as a minimum, to AWWA C900, DR 18, Pressure Class 150.

Thickness class shall be noted on the plans by the ENGINEER.

Pipe joints shall be of the push-on type conforming to ASTM D3139 and F477 requirements for elastometric-gasket joints. All jointing material and lubricants shall be non-toxic.

Fittings for PVC pipe shall be ductile iron conforming to AWWA C110 or AWWA C153. Fittings shall be tar-coated outside and shall receive the same standard cement lining with bituminous seal coat on the inside as specified for ductile iron pipe.

All PVC pipe shall have a restraint system consisting of a mechanical joint fittings and pipes which shall incorporate the design of a follower gland for a restraint system. The restraint mechanism shall consist of plurality of individually activated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint bell conforming to AWWA C111 (ANSI A21.53) and AWWA C153 (ANSI A21.53). Twist-off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices.

The restraining glands shall have a pressure rating equal to that of the PVC pipe on which it is used and shall be EBBA Iron Systems Mega lug™, Romac Industries GripRing™, Griffin Pipe Products Company Bolt-Lok™, or a system previously approved by SWWD.

On a case-by-case basis, and only when mechanical thrust restraints are not practical, SWWD will consider a request to employ concrete thrust or “kicker” blocks as shown on Standard Drawings No. WD-6 and WD-7. Concrete thrust blocks may be used in

addition to mechanical restraint devices, if in the opinion of the ENGINEER, they are required.

### **3.4 WATER LINE APPURTENANCES**

#### **3.4.1 Gate Valves**

All valves shall conform with the latest revision of AWWA C509 and AWWA C153. All gate valves shall be of the resilient seat, ductile iron body, non-rising stem, fully bronze mounted and suitable for water working pressures of 250 psi. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship.

All valves shall be opened by turning to the left (counterclockwise).

All gate valves shall be furnished with mechanical joint end connections, unless otherwise approved by SWWD. Each underground gate valve shall be installed in a vertical position with a valve box, as shown in Drawing WD-1. Gate valves set with valve boxes shall be provided with a two-inch (2") inch square operating nut.

The operating nut shall be painted white prior to installation.

Gate valves for installation in meter vaults shall be flanged ANSI B16.1 Class 125 and hand wheel operated.

All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve. Valves shall be as manufactured by Mueller, M & H, Darling Smith, Kennedy, Tyler, or approved equal.

#### **3.4.2 Butterfly Valves**

All butterfly valves shall be of the tight closing, rubber seat type with rubber seats which are recess mounted and securely fastened to the valve body. Valves shall meet the full requirements of AWWA Specification C504. Valves shall be rated for 150 psi working pressure and shall be satisfactory for applications involving valve operation after long periods of inactivity.

Valve discs shall rotate 90 degrees from the fully open position to the tight shut position. The manufacturer shall have manufactured conforming butterfly valves for a period of at least five (5) years.

Butterfly valves shall open by turning operating nut to the left (counterclockwise).

The valve bodies shall be constructed of ductile iron (ASTM A536) and shall have integrally cast mechanical, restrained, or flanged joint ends. Two (2) trunnions for shaft bearing shall be integral with each body.

All valve discs shall be constructed of ductile iron. All disc seating edges shall be smooth and polished. Valve shafts shall be constructed of Type 304 stainless steel

(ASTM A167) and shall be a one-piece unit extending full size through the valve disc and valve bearings.

Valve seats shall be of a natural rubber or a synthetic compound.

Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body. Valve seats shall be designed to be leak tight in both directions.

The seat bond must withstand seventy-five (75) pounds pull under test procedure ASTM D429-58, Method B.

Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearings load shall not exceed 2,500 psi.

Valve operators shall be of the traveling-nut type designed to withstand at least 300 foot-pounds of input torque at fully open or closed positions without damage to the valve or operator. All operators shall be fully gasketed and grease-packed and designed to withstand submersion in water to 10 psi.

Valves shall require a minimum of 32 turns to open from fully closed. All surfaces of the valves shall be clean, dry and free from grease before painting. The valve interior surfaces, except seating surfaces, shall be evenly coated with black asphalt varnish in accordance with AWWA C504.

Butterfly valves set with valve boxes shall be provided with a two inch (2") square operating nut. The operating nut shall be painted white prior to installation.

Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504.

### **3.4.3 Tapping Sleeves and Valves**

All tapping valves shall conform with the latest revision of AWWA C509 and AWWA C153. All tapping valves shall be of the resilient seat, ductile iron body, non-rising stem, fully bronze mounted and suitable for water working pressures of 250 psi. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship.

All tapping valves shall be opened by turning to the left (counterclockwise).

All gate valves shall be furnished with one (1) flanged end for mating to the tapping sleeve, and one (1) mechanical joint end connection, unless otherwise approved by SWWD. Each underground tapping valve shall be installed in a vertical position with a valve box, as shown in Drawing WD-1.

Tapping valves set with valve boxes shall be provided with a two inch (2") square operating nut.

The operating nut shall be painted white prior to installation.

Tapping valves shall be as manufactured by Mueller, American-Darling, M & H or approved equal.

Tapping sleeves for connections to existing water lines shall be suitable for working pressures of 150 psi.

When a connection is made between like sized lines (*id Est*, 6" tap into an existing 6" main), or when the tap will be in a paved area or proposed paved area, the tapping sleeve shall be of the mechanical joint type.

These tapping sleeves shall be Mueller No. H-615, American Darling No. 1174, or approved equal.

When a connection is made between differing sized lines (*id Est*, 6" tap into an existing 8" main), or when the tap will not be in a paved area or proposed paved area, the tapping sleeve may be of the fabricated style. All material, sleeve and hardware, shall be of Type 304 Stainless Steel.

#### **3.4.4 Valve Boxes**

Valve boxes shall be screw-type adjustable and topped with a square traffic-style casting, John Bouchard & sons Co. No. 8006. The purpose of the square traffic-style topping is to help maintain the valve box position over the valve and to facilitate future locating.

Temporary valve boxes may be used during the construction phase in areas out of vehicle traffic. These must be replaced with permanent valve boxes prior to final acceptance of the system.

Valve boxes shall be accurately centered over valve operating nut and backfill thoroughly tamped about them. They shall be set vertically and properly adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and one to two inches (1" to 2") above ground in grass plots, fields, woods or other open terrain with a concrete collar, 24-inches diameter, or square 24-inches x 24-inches, and 4-inches thick.

**Valves box bases shall not rest on the valves but shall be supported on crushed stone fill.**

#### **3.4.5 Fire Hydrants**

The CONTRACTOR shall furnish and install fire hydrants were shown on the plans.

Hydrants shall conform in all respects to the requirements of AWWA C502. Hydrant barrel shall have safety breakage feature at the ground line.

All hydrants shall have 6-inch mechanical joint shoe connection, two 2-1/2" discharge nozzles and one (1) 4-1/2" pumper nozzle with caps. With prior approval by SWWD, exceptions may be allowed in areas where withdrawal with a pumper fire engine would not comply with the allowable levels of system residual pressure.

Connection threads and operating nuts shall conform to National Standard Specification as adopted by National Board of Fire Underwriters.

The operating nut shall be a pentagon measuring 1-1/2" on each side and shall open left (counterclockwise).

The main valve shall have 5.25" full opening and be of the compression type opening against water pressure so that the valve remains closed should the barrel be broken.

Hydrants shall be fully bronze mounted. The main valve shall have a threaded bronze seat ring assembly of such design that it is easily removable by unscrewing from a threaded bronze drain ring. The bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed.

Drainage waterways shall be completely bronze to prevent rust or corrosion.

The operating stem shall be equipped with an anti-friction thrust bearing to reduce operating torque and assure easy opening. Stops shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir sealed with O-rings to protect the operating stem from weather.

Hydrants shall be designed for 150 psi working pressure and individually shop tested to 300 psi pressure with the main valve both opened and closed. Under test, the valve shall not leak, the automatic drain shall function, and there shall be no leakage into the bonnet.

Hydrants shall be set plumb with not less than three cubic feet (3 ft<sup>3</sup>) of ¾" crushed stone and backed with at least one cubic foot (1 ft<sup>3</sup>) of Class "C" concrete.

Fire hydrants shall be located not more than ten feet (10') from the edge of existing or proposed pavement and shall not be more than twenty feet (20') from a street intersection unless otherwise specified by SWWD.

Hydrants shall be installed with a vertical distance from the center of the pumper nozzle to the proposed finished grade of 16 inches to eighteen inches (16"-18"). The "grade line" cast into the fire hydrant barrel shall be at finished grade. Mounding or excavation of fill material at the fire hydrant shall not be accepted.

All fire hydrants shall be provided with a shut-off valve in the hydrant lateral as shown on Drawing WD-3.

All fire hydrants shall be painted after installation. Care shall be taken to assure all operating mechanisms, threads, operating nuts, and cap chains are kept free of paint. The paint scheme is as follows:

- A. Base Coat: All public fire hydrants shall be painted with at least one coat of red enamel, Porter Paint No. 2472, or approved equal. The primer paint applied at the manufacturer does not satisfy this requirement; the above-mentioned coating shall be applied after installation.

- B. Hydrant Bonnet: The fire hydrant bonnet (top) shall be painted with one (1) coat of white reflective paint, as manufactured by 3M, or Alert, or approved equal.
- C. Hydrant Cap: The caps shall not be painted by the CONTRACTOR, but instead shall be painted by SWWD in a manner to identify, by color coding, the flow capacity of the fire hydrant.

Hydrants shall be Mueller Company Model A-423 or M & H Compression Type Traffic Model.

#### **3.4.6 Air Release Valves and Boxes**

Air release valves shall be the combined vacuum and air release type and shall be equipped with cast iron body and cover, stainless steel float, Buna-N seat and bronze linkage. Valve shall have one-inch threaded inlet and be suitable for 150 psi water working pressure.

Valves shall be APCO No. 200-A as manufactured by Valve and Primer Corp., Schaumburg, Illinois, or approved equal.

Air release valves shall be installed at the high point on the water main as shown on the Drawings and connected to the main by a corporation stop with inside I.P.S. threaded outlet. The inlet pipe to the valve shall be ASTM B43 extra strong seamless red brass pipe with I.P.S. male threaded ends.

The air release valve shall be installed in a standard 4-foot diameter manhole with a ventilated manhole casting. It shall be set on a minimum base of one cubic yard of  $\frac{3}{4}$ " crushed stone to allow for drainage; there shall be no concrete base for the manhole.

#### **3.4.7 Flush Hydrants**

The need for flush hydrants shall be avoided, instead relying on designs that eliminate dead-end lines and allow for hydraulic circulation and strategic placement of fire hydrants.

Flush hydrants, when needed, shall be installed at the locations shown on the Drawings, or as directed by SWWD.

Flush hydrants shall be furnished with a two-inch (2") gate valve, operated by a standard two-inch (2") square operating nut. Handwheel operators will not be accepted.

Flush hydrants shall be as shown on Standard Drawing No. WD-11, and shall be the Aquarius™, the Kupferle #77 Mainguard™, or approved equal. Site assembled flush hydrants constructed of threaded pipe will not be accepted.

### **3.4.8 Fire Protection Lines**

Installation of water lines to be used for private fire protection systems (*id Est*, sprinkler systems) shall have an approved reduced pressure backflow preventor installed wither in a weather protected enclosure or inside the facility.

Backflow prevention shall conform to the requirements set out in the Cross Connection Ordinance, Adopted September 26, 1978, or its latest revision.

Backflow preventors shall be installed as shown on Standard Drawing No. WD-10.

SWWD responsibility of fire protection lines shall end at the backflow preventor. The OWNER/DEVELOPER shall be responsible for maintenance and operation of the backflow preventor. SWWD will be afforded reasonable access to the backflow preventor for testing purposes.

### **3.4.9 Pipe Locators**

With non-metallic pipe, the CONTRACTOR shall install #14 coated copper wire six inches to twelve inches (6"-12") above the top of the pipe for inductive and conductive tracing.

In addition, with **all** pipe, the CONTRACTOR shall install a tracing tape suitable for visual identification of the buried water line. The tape shall be on 3" x 1000' rolls, blue mylar film, and printed with the words "Buried Water Main Below." Installation shall be within the same trench as the water line, centered over the water line, and at approximately one (1) foot below finished grade.

Locators shall be as manufactured by Line guard Maintenance System, or approved equal.

## **3.5 LAYING PIPE**

All pipe shall be laid with ends abutting and true to line and grade as shown on the plans. Supporting of pipe shall be as specified under "Pipe Bedding" hereinbefore.

**In no case will the supporting of pipes on blocks be permitted.**

Fittings for the water mains shall be provided and placed shown on the plans and as were directed by SWWD. All open ends of pipes and of branches shall be sealed or plugged.

**The pipe shall be lowered into the trench. In no case shall the pipe be dropped into the trench.**

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

Granular bedding material, as specified hereinbefore, shall be used to correct irregularities in the earth trench subgrade.

The interior of the pipe shall be kept clean as the work progresses. When laying of any pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material.

No backfilling (except for securing pipe in place) over pipe will be allowed until SWWD, the ENGINEER, or his representative has made an inspection of the joints, alignment and grade in the section laid, but such inspection shall not relieve the CONTRACTOR of further liability in case of defective joints, latent deficiencies that are noted later.

### **3.8 JOINING PIPE**

The type of joints described hereinbefore shall be installed in accordance with the manufacturer's recommendations.

### **3.9 TESTING OF WATER SYSTEMS**

On all projects involving the installation of water pipeline, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

- A. All water mains shall be given a hydrostatic test 150 psi, under which leakage shall not exceed the limits established in Section 4 of AWWA Standard Specifications C600.
- B. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.
- C. Duration of test shall not be less than two (2) hours for pipelines that have joints exposed prior to backfill, or four (4) hours for pipelines that have been backfilled prior to pressure testing.
- D. Where leaks are visible and evident, the joints shall be repoured, bolts retightened or re-laid, and leakage minimized regardless of total leakage as shown by test.
- E. All pipe, fittings and other materials found to be defective under test shall be removed and replaced.
- F. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.
- G. SWWD shall furnish a recording gauge and clock to be used during leakage test and pressure test. Recording pressure charts shall remain the property of SWWD at conclusion of test.

### **3.10 DISINFECTION OF WATER LINES**

New potable water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the standards outlined in AWWA C651 and to the satisfaction of SWWD.

Bacteriological testing **must** be complete and the line passed before any new lines are connected to the existing system.

After pressure testing, a solution of hypochlorite using high test hypochlorite (HTH) or equal shall be introduced into the section of the line being disinfected. The amount of HTH shall be calculated to a chlorine dosage of 50 mg/L in the main. Chlorination beyond this amount shall not be administered due to inability to monitor the changes and the risk of during disposal.

While the solution is being applied, the water should be allowed to escape at the ends of the line until tests indicated that the proper dosage has been obtained throughout the pipe. All valves and stops/cocks shall be opened and closed while chlorinating agent is in the piping system. The chlorinated water shall be allowed to remain in the pipe for 24 hours, after which a residual of at least 25 mg/L shall be obtained. The disinfection shall be repeated until 25 mg/L is obtained, after which time the main shall be thoroughly flushed until the residual chlorine content is not greater than background, or approximately 1.0 mg/L.

Following disinfection of the line, bacteriological samples shall be collected and analyzed in accordance with the requirements of TDEC and SWWD.

Samples will be collected by representatives from SWWD and transported by SWWD to a certified bacteriological laboratory.

Only after bacteriological samples have been approved, the new line then may then be connected to the system.

### **3.11 CONNECTION TO EXISTING SYSTEM**

In the case where a tapping sleeve and valve is used to connect a new system to the existing system, the tapping sleeve, valve and box and all other necessary material shall be furnished and installed by the CONTRACTOR. The actual tap of the existing the line shall be performed by SWWD after successful pressure testing of the tapping sleeve and valve by the CONTRACTOR and after receipt of the tapping fee.

In the case where a tee and valve assembly will be "cut in" to an existing line for the connection, this work will be performed entirely by SWWD, and the OWNER/DEVELOPER shall pay all costs.

After successful bacteriological testing of the new water main, the CONTRACTOR shall connect the new water main to the existing water system via the main tap installed by SWWD. The CONTRACTOR must notify SWWD when the connection is to be made so that representatives of SWWD may operate existing valves and witness the connection. A minimum notice of twenty-four (24) hours must be given.

### **3.12 CUSTOMER SERVICE CONNECTIONS**

Water service connections shall be made in accordance with the details shown on Standard Drawings No. WD-8. Locations and sizes of service connections shall be as directed by SWWD.

In new subdivisions, the CONTRACTOR shall tap the new main with a double strap bronze service saddle and a corporation stop. Service pipe shall be installed to the property line, ending with a curb stop. Record drawings shall be provided showing the terminating point. When construction of a building requires water service, an application for service shall be required at SWWD offices and a meter box installed by SWWD.

For existing mains, SWWD shall install a tap on the new main, service piping from the water main to the customer's property line, and a meter set with box at the property line.

#### **3.12.1 Pipe and Fittings**

Water services piping shall meet the following requirements:

For residential and small commercial connections, service pipe up to and including two inch (2") shall be seamless copper water tube, ASTM B 88, Type K.

For large commercial or industrial connections, service pipe four inch (4") and larger shall conform to Section 3.3.1 or 3.3.2, above.

All fittings shall be compatible with the type of service piping used.

#### **3.12.2 Corporation Stops**

Corporation stops shall have AWWA C800-66 CS threaded inlet. Outlets shall be suitable for copper water tube.

Corporation stops less than two inch (2") shall be Mueller H-15008, or approved equal. Two-inch corporation stops shall be Mueller Ori-Corp™ H-15013, or approved equal.

#### **3.12.3 Curb Stops**

Curb stops shall be Mueller H-15175 with an inlet and outlet suitable for copper tubing.

#### **3.12.4 Residential Meter Sets**

After payment of the connection fee, the meter set shall be installed by SWWD on the end of the customer service pipe. A five-foot (5') length of copper service shall be extended by SWWD from the meter box towards the customer's building to eliminate the need for the plumber to disturb the meter box.

Meter boxes shall be 5/8" x 3/4" 203RS1524RAAN Mueller Meter Box with gate valve and 15" cast iron Meter Reader Lid No. 282920 by McCullough Industries, Inc., Murfreesboro, TN, or approved equal.

# SANITARY SEWER

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## SECTION 4 SEWER INTRODUCTION

### 4.0 PURPOSE

The purpose of this section is to outline the requirements for proper design, construction, inspection, and final acceptance of manholes, sanitary sewer lines and house connections.

### 4.1 DESIGN REQUIREMENTS

A complete set of computations should be made available to SWWD which indicates depth of flow and velocities at minimum, average, and maximum daily waste flows for the different sizes of sewers proposed.

#### 4.1.1 Depth

In general, sewers shall be sufficiently deep so as to receive sewage from the first floor of all places served by the sewers and to prevent freezing, but shall not be less than thirty inches feet (30") deep.

#### 4.1.2 Slope

All sewers shall be so designed and constructed to give mean velocities, when flowing half-full, of not less than 2.0 feet per second. The minimum required slopes for 8-inch, 10-inch, and 12-inch sewer mains are shown below. These slopes are minimum, and should only be used when required; steeper slopes should be used if feasible.

#### *Slope in feet, minimum, n=0.013*

Sewer Size, D	per 100 ft	Vel/Q 20% D	Vel/Q 50% D	Max Vel/Q ~82% D
6"	<b>0.66</b>	1.43/0.04	2.32/0.23	2.65/0.46
8"	<b>0.50</b>	1.50/0.11	2.43/0.42	2.66/0.86
10"	<b>0.34</b>	1.44/0.11	2.35/0.64	2.66/1.31
12"	<b>0.20</b>	1.25/0.14	2.03/0.80	2.31/1.64

Where Vel = feet per second and Q = cubic feet per second.

All sewers should be laid with a uniform slope between manholes.

In design, daily flow patterns should be considered where zero flow may occur and re-entrainment velocity, rather than the mean velocity, may be required to be the design

point. Consideration should be given for the potential for system expansion in designing sanitary sewers.

Minimum and maximum slope should be calculated in two (2) ways. If the system will experience somewhat constant flow throughout a twenty-four (24) hour period, minimum slope may be calculated based on the pipe flowing full.

If, however, the system can be expected to have large fluctuations during a twenty-four (24) hour period, such as commercial area that will have zero flow during the night, then the slopes shall be calculated assuming the pipe is half full.

The minimum slope should allow for the initial development, the ultimate build-out of the project, and reasonable contributions from off-site development.

Variations of the design criteria will be considered, and the ENGINEER is encouraged to consult with SWWD.

Sewers on eighteen percent (18.0%) slope of greater, or when specified by SWWD, shall be anchored with concrete collar anchors.

### ***Slope in feet, Anchors***

<u>Slope</u>	<u>Anchor Spacing</u>
18% to 25%	< 36 feet O.C.
25% to 35%	< 24 feet O.C.
35% or greater	< 16 feet O.C.

Ductile iron pipe shall be used when slopes are greater than specified below:

<u>Pipe Size</u>	<u>Slope</u>
8"	18.0%
10"	13.0%
12"	9.0%

### **4.1.3 Size of Sewer Mains**

New sewer systems shall be designed on the basis of an average daily flow of sewage of not less than 250 gallons per day per equivalent residential connection, exclusive of sewage or other waste flow from industrial plants. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable.

### **4.1.4 Size of Sewer Services**

Laterals and sub-main sewers shall be designed to carry a minimum of 400 gallons per day. These values assume the flow contribution from infiltration, but an additional allowance shall be made when conditions are unfavorable.

## **4.2 PIPE MATERIALS**

All pipe, joint, and fittings for sanitary sewer shall be constructed of polyvinyl chloride (PVC) or ductile-iron pipe (D.I.P.), unless otherwise approved by SWWD.

### **4.2.1 Polyvinyl Chloride Pipe, Fittings, and Joints**

PVC pipe shall be extruded from Type I, Grade 1, polyvinyl chloride material designated as PVC 1120, meeting ASTM Specifications D3034, with a **minimum** standard dimension ratio of SDR35.

Thickness class shall be noted on the plans by the ENGINEER.

Alternative pipe, such a pressure water pipe or iron pipe, may be required if local laying conditions warrant.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

Standard laying lengths shall not exceed 13.0 feet. The pipe shall have a bell on one end. The male ends of pipe must be beveled on the outside. The pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction workers, superintendents, and inspectors in visual inspection of pipe installation.

Pipe must be delivered to job site by means which will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after deliver to the job site, it must be stored in shaded location and strung as needed.

### **4.2.2 Ductile Iron Pipe, Fittings and Joints**

In cases where the finished grade is to be 12 feet or greater, ductile iron pipe shall be used in lieu of PVC.

All ductile cast iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C150 requirements. Thickness class shall be noted on the plans by the ENGINEER. Fittings shall be ductile iron conforming to AWWA C110 or AWWA C153.

Ductile iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coat on the inside in accordance with ANSI A21.4 requirements. Thickness of the lining shall be as set out in aforesaid specification. Pipe and fittings shall have standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil thick.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE". Shop inspection and testing shall be in accordance with the AWWA standards cited above and shall be certified by an independent laboratory.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an 8-mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps. If such corrosive soils can be reasonable expected, the design engineer shall be responsible for conducting resistivity tests on the soil.

#### **4.2.3 Steel Encasement Pipe**

Encasement pipe shall be steel, plain end, uncoated, unwrapped, have welded joints and be in at least ten-foot (10') lengths. The steel pipe shall have a yield point strength of 35,000 psi and conform to AWWA C202. The wall thickness of the pipe shall be a minimum of 0.250" for highway crossings and 0.344" for railroad crossings.

The thickness and diameter of encasement pipe shall conform to requirements set forth by the Tennessee Department of Transportation, Bureau of Highways for highway crossings and American Railway Engineering Association for railroad crossings.

The carrier pipe shall be positioned in the casing pipe with casing spacers as manufactured by Advance Products & Systems, Inc., or approved equal.

#### **4.2.4 Pipe Locators**

With **all** pipe, the CONTRACTOR shall install a mylar tape suitable for visual identification of the buried sewer line. The tape shall be on 3" x 1000' rolls, green mylar film, and printed with the words "Buried Sewer Main Below." Installation shall be within the same trench as the sewer line, centered over the sewer line, and at approximately one (1) foot below finished grade.

Locators shall be as manufactured by Line guard Maintenance System, or approved equal.

### **4.3 TRENCH EXCAVATION**

The CONTRACTOR, ENGINEER, and OWNER are required to be in strict compliance with 29 CFR 1926.650 regulations with regard to trench excavation. Additionally, the CONTRACTOR, OWNER/DEVELOPER, and ENGINEER are required to conform with the CITY's Excavation Ordinance O95-21.

Unless specifically directed otherwise by SWWD, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches (8"). Where rock is encountered, it shall be removed to a minimum depth of four inches (4") below the pipe bells.

Unless specifically authorized by SWWD, trenches shall in no case be excavated or permitted to become wider than two-feet six-inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than two-feet six-inches (2'6") at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength as determined by SWWD. This determination shall take into account the actual trench loads that may result and the strength of the pipe being used.

All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

Trenches shall be kept free of water during the laying of pipe and until the pipeline has been backfilled.

Backfilling shall be as set out hereinafter.

#### **4.3.1 Obstructions**

In cases where storm sewers, gas lines, water lines, telephone lines, and utilities, or other underground structures are encountered, they shall not be displaced or molested.

Where existing facilities may have been displaced or molested, the CONTRACTOR shall immediately contact the responsible utility owner to determine the appropriate remedy.

Where adjustment may be necessary, the CONTRACTOR shall notify the utility companies in accordance with the Tennessee Underground Utilities Protection Act prior to excavation adjacent to their facilities.

#### **4.3.2 Shoring, Sheet piling and Bracing of Excavations**

Where unstable material is encountered or where the depth of excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheet piling, bracing and shoring, or the sides sloped to the angle of repose.

Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions.

Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR. The ENGINEER may require the submission of shoring plans (accompanied by the supporting computations) for review prior to the CONTRACTOR undertaking any portion of the work.

Foundations adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to ensure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundations.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable walers and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameter of the pipe.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

#### **4.3.3 Use of Explosives**

Blasting shall be conducted in accordance with the municipal ordinances, state laws, and the *Manual of Accident Prevention in Construction*, Section 9, as published by the Associated General Contractors of America, Inc.

All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by the CONTRACTOR.

Blasting operations shall be covered by public liability insurance, or if said public liability insurance does not cover blasting, then the CONTRACTOR shall have separate public liability insurance to cover his blasting operations.

All blasting shall be supervised and performed by qualified personnel.

#### **4.3.4 Trench Dams**

In areas where construction can influence ground water, and at each existing or proposed open drainage crossing by a sewer line, trench check dams shall be installed to help prevent the migration of ground water along the trench

In areas of high-water level, trench dams shall be placed at the inlet and outlet of each manhole, and at 200-foot intervals.

At crossings of open storm systems, a trench dam shall be placed both upstream and downstream of the crossing.

Trench dams may be constructed either of native clay material, or of ABS as manufactured by McRip Manufacturing.

#### **4.4 PIPE BEDDING**

In all cases, the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches (4") above the bottom of the trench as excavated.

Supporting of pipe shall be as set out hereinafter. **In no case shall the supporting of pipe on blocks be permitted.** See Drawing SD-1 for typical bedding methods.

##### **4.4.1 Earth Foundation**

All sewer pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #67 crushed stone.

##### **4.4.2 Rock Foundation**

If the trench bottom is in rock the excavation shall be undercut to a minimum depth of six inches (6") below the bottom of the pipe.

The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #67 crushed stone.

##### **4.4.3 Special Bedding**

In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the SWWD, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by SWWD to replace poor subgrade material, shall be classified as "Special Pipe Bedding".

Granular material for "Special Pipe Bedding" shall be #67 crushed stone.

#### **4.5 LAYING PIPE**

The laying of sewer pipe in finished trenches shall be commenced at the lowest point so that the spigot or tongue ends point in the direction of flow.

The CONTRACTOR may use either a laser instrument or grade string and batter boards set from grade stakes to set grades on sewer lines. Regardless of the technique used, the CONTRACTOR shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the CONTRACTOR.

All pipe lengths shall be laid with ends abutting and true to line and grade as given by the ENGINEER. They shall be fitted and matched so that when laid they will form a sewer with a smooth and uniform invert. Supporting of pipe shall be as set out hereinbefore under "Pipe Bedding". **In no case shall the supporting of pipe on blocks be permitted.**

Branches, fittings and specials for sewer lines shall be provided and laid as and were directed by SWWD or shown on the plans.

**In no case shall the pipe be dropped into the trench.** Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by SWWD. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be cut so as to leave a smooth end at right angles to the longitudinal axis of the pipe.

When laying of pipe is stopped at the end of the day, the exposed end of pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material and precautions taken to prevent floatation of pipe by runoff into trench.

#### **4.6 JOINING PIPE**

The type of joints described hereinbefore shall be installed in accordance with the manufacturer's recommendations.

#### **4.7 BACKFILLING PIPELINE TRENCHES**

All backfilling shall be accomplished in accordance with the details shown on Standard Drawing SD-1 and the requirements of this section. Any variances must be approved in writing by SWWD.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95% of standard (ASTM D698) Proctor density where mechanical tamping of backfill is required.

Before final acceptance, the CONTRACTOR will be required to level off all trenches or to bring the trench up to the level of the surrounding terrain. The CONTRACTOR shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

In all cases walking or working on the completed pipelines, except as may be necessary in tamping or backfilling, will not be permitted until the trench has been backfilled to a point one foot (1') above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

#### **4.7.1 Backfilling in Open Terrain**

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

In all cases the lower portion of the trench, from the pipe bedding to the spring line (centerline) of the pipe shall be backfilled with #67 crushed stone.

When using ductile iron pipe, the portion of the trench from the spring line of the pipe to a point six inches (6") above the pipe shall be backfilled with material free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. This material shall be placed in six-inch (6") layers and mechanically tamped.

When using PVC pipe, the portion of the trench from the spring line of the pipe to a point twelve inches (12") above the pipe shall be backfilled with #67 crushed stone.

The upper portion of the trench above the crushed stone portion shall be backfilled with material free from large rock. Incorporation of rock having a volume exceeding one-quarter cubic foot (6-inches on any one side) is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by SWWD. This material shall be placed in six-inch (6") layers and mechanically tamped.

#### **4.7.2 Backfilling Under Paved Areas**

Backfilling of pipeline trenches under sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point six inches (6") below the bottom of the pavement or concrete sub-slab, shall be backfilled with #67 crushed stone, or as directed by the road authority having jurisdiction. The upper portion of the trench, from a point six inches (6") below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with a base course of dense grade aggregate, or crushed stone, fine gravel and sand suitable to the governing body having jurisdiction

over the street or roadway. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

#### **4.7.3 Settlement of Trenches**

Wherever sewer lines are in, or across, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one (1) year from the time of interim acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the CONTRACTOR. Repair of settlement damage shall meet the approval of the appropriate governing body.

### **4.8 MANHOLES**

Manholes shall be installed at the end of each line, at all changes in grade, size or alignment; at all line intersections; and at distances not greater than 400 feet. Manholes of the form and dimensions shown on the approved plans shall be built as directed. The manhole shall be constructed of either precast concrete rings (See Standard Drawing No. SD-2, 3, & 4) or cast in place. They shall be constructed on 3,500 psi concrete foundations with rebar.

#### **4.8.1 Standard Manholes**

The standard manholes shall be five feet (5') or more in depth, measured from the base of the cover frame to the top of the concrete footing and shall be of eccentric cone-type of construction.

#### **4.8.2 Shallow Manholes**

The shallow manholes shall be five feet (5') or less in depth, measured from the base of the cover frame to the top of the concrete footing and shall be of flat top construction as shown on Standard Drawing SD-3.

#### **4.8.3 Standard Drop Manholes**

A drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four inches (24") or more above the manhole invert and shall be built as a part of the standard manhole. The vertical pipe shall be outside the manhole as shown on the plans and encased with concrete. The pipe which is laid to the drop portion of the manhole shall be supported with 3,500 psi concrete extending from the drop stack to the reinforced base of the manhole as shown on Standard Drawing SD-4.

#### **4.8.4 Precast Concrete Rings**

Precast concrete rings for manholes shall conform to ASTM C76, Class II, Wall B, with a minimum concrete strength of 4,000 psi, except those rings for manholes over twelve

feet (12') deep shall be Class III. O-ring gaskets shall be installed between connected ring sections.

#### 4.8.5 Monolithic Cast-In-Place Manholes

For monolithic manholes, concrete shall be Class A design mix. For each days pour, the CONTRACTOR shall test two (2) cylinders in compliance with ASTM 172, ASTM C31, and ASTM C39. These tests shall be conducted by a TDOT certified laboratory.

Manholes shall be a standard 4-foot diameter, with a maximum depth of monolithic manholes not to exceed twenty feet (20'). The minimum wall thickness shall be six inches (6").

The base concrete shall be Class A, vibrated on a firm subgrade foundation, or suitable crushed stone bedding. The base shall have a minimum diameter of eight inches (8") greater than the outside diameter of the manhole, and a minimum thickness, including the area under the pipe as follows:

<u>Manhole Depth</u>	<u>Base Thickness</u>
0-8 feet	8"
8-12 feet	10"
12-20 feet	12"

All water shall be removed from the form before and during placement of the concrete. The first placement of base concrete shall consist of approximately  $\frac{1}{2}$  yd<sup>3</sup> of concrete deposited evenly around the walls and vibrated until there is a minimum slope of 60° from the bottom of the forms to the bearing surface, both inside and outside the manhole. When this is complete, and before additional concrete is added, the concrete must be carefully vibrated on each side of the pipe.

Additional concrete must be deposited in evenly distributed layers of eighteen inches (18"), with each layer vibrated to bond to the preceding layer. The wall spacers must be raised as the placements are made with the area from which the spacer is withdraw carefully vibrated.

Should a cold joint be required, a formed groove and reinforcing dowels (#5 bars 36 inches long at 12-inch centers) will be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and a layer of mortar applied on the surface to ensure a competent bond.

Adjustment rings shall be formed and/or poured into the top section of the manhole to provide manhole casting adjustments equal to two (2) courses of brick.

The forms may be removed twenty-four hours (24 hrs.) after concrete placement. At this time, a membrane curing compound with a fugitive dye shall be applied by power spraying to the outside of the manhole. The CONTRACTOR shall submit the

manufacturer's descriptive details of the curing compound for approval before application.

Monolithic manholes shall be backfilled to the same level simultaneously around the perimeter. The manholes shall not be backfilled until the concrete reaches 75% of the specified design strength. A select gravel backfill material shall be placed adjacent to the manholes in areas where expansive clays exist.

Couplings between manholes and pipe shall be in accordance with 4.7.9 below.

#### **4.8.6 Inverts**

Manhole inverts shall be formed from 3,500 psi concrete. Inverts for a "straight-through" manhole 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, as shown, and shall form a smooth, even half-pipe section as shown in Standard Drawing SD-5.

#### **4.8.7 Steps**

Manhole steps shall be made of fabricated aluminum alloy 6061, T6, as manufactured by Alcoa, #15295, or approved equal.

Manhole steps shall be free from sharp edges, burrs, or other projections which may be a safety hazard and shall be of sufficient strength to support a live load of 350 pounds at any point.

The minimum width of the tread, or cleat shall be ten inches (10") and be designed to prevent foot slippage. The lugs and struts shall be designed to project a minimum clear distance of four inches (4") from the wall when the step is secured in the wall. Steps shall be positioned vertically over a pipe inlet or outlet and at a maximum spacing of sixteen inches (16") on center.

Steps shall be of the same size, projection, spacing and alignment in each manhole.

#### **4.8.8 Frames and Covers**

Manhole covers must sit neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent slipperiness. The lids shall have two (2) pick holes approximately 0.25" wide and 0.5" deep with 0.375" undercut all around. Lids on sanitary sewer manholes shall not be perforated.

Manhole castings for manholes shall consist of cast iron frames and twenty-four inches (24") clear inside diameter covers, weighing not less than 340 pounds per frame and cover. They shall be John Bouchard & Sons Co., No. 1155, as shown on Standard Drawing SD-9.

If manhole is located below flood level for 25-year rainfall, watertight manhole castings are required. Watertight manhole casting shall consist of cast iron frames with

machined bearings surfaces, gasket seal, and bolted lids. Watertight manhole casting shall be John Bouchard & Sons Co., No. 1123, as in Drawing SD-11.

#### **4.8.9 Pipe Entrance Couplings**

A watertight pipe to manhole gasket system using a flexible molded neoprene compound boot meeting the latest requirements of ASTM C443, or rubber meeting the latest requirements of ASTM C923 shall be installed for each manhole opening.

Gaskets shall be designed to allow up to 20° axial deflection.

Internal expanding bands or sleeves shall be constructed of Type 304 stainless steel meeting the latest requirements of ASTM C923 and shall be designed to allow contraction around the boot to clamp and seal the boot to the pipe.

Pipe to manhole connections made in the field in existing manhole walls shall be one of the following:

- A. A rigid entrance coupling with a confined rubber O-ring meeting the latest requirements of ASTM D1869 and ASTM D1869 for receiving pipe, installed using non-shrink grout; or,
- B. Manholes may be cored in the field. Each manhole shall have a flexible molded neoprene compound boot meeting the applicable ASTM standards referenced above.

The resilient connectors shall be the Kor-N-Seal, or approved equal.

#### **4.9 TESTING OF SYSTEM GRAVITY SEWER SYSTEM**

The testing of gravity sewers shall be accomplished by the CONTRACTOR in accordance with the procedures listed hereinafter.

##### **4.9.1 Preparation for Testing**

Prior to any testing of a gravity sanitary sewer line for water tightness, the CONTRACTOR shall prepare the lines as outlined below:

- A. After the collection and/or outfall lines have been brought to completion, and prior to the final inspection, the CONTRACTOR shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the lines of any and all dirt, debris and trash.
- B. Prior to the final inspection, the ENGINEER shall inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the plans.

- C. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.
- D. The CONTRACTOR shall lay sewer lines, including house connections so that the ground water infiltration shall not average more than 1,500 gallons per 24 hours per mile of sewer without regard to the diameter of the sewer. Only the length of the main sewers shall be used in making the foregoing computation even though the house connections (from the main sewer to the property line) should be in place and included as a part of the system when infiltration is measured. This requirement may be applied to a portion of the contract work, such as the sewers in a separate drainage area or to a single section of line between two (2) manholes.
- E. Prior to final acceptance, the CONTRACTOR is required to conduct a television inspection of the main to determine its condition. A copy of the tape(s) from this inspection is to be furnished SWWD.

#### **4.9.2 Low Air Pressure Test**

SWWD requires all sanitary sewers to receive a low-pressure air test for leakage. The air test will be made after all house connections have been installed to property lines and backfilling is complete.

The first series of air tests is to be made after 2,000 linear feet of sewer have been laid but before 4,000 linear feet are completed. The purpose of this first series of tests is to assure both the CONTRACTOR and the OWNER/DEVELOPER that the material and method of installation meet the intent of these specifications. The remainder of the tests are to be conducted after approximately each additional 10,000 linear feet have been laid.

All ties and end of sewer services shall be plugged with flexible joints, 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.

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

Immediately following this check or cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two (2) minutes shall be allowed for temperature stabilization.

The requirements of this specification shall be considered satisfied provided that the time required, in seconds, for the pressure to decrease from 3.5 to 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than that shown in the "Allowable Time Table" listed below, which is for 400-foot sections of pipe. For testing of shorter sections of pipe, SWWD shall determine duration of test.

#### ALLOWABLE TIME TABLE per 400 FEET

<u>Pipe Size</u>	<u>Time (Min.)</u>
6"	3.0
8"	4.0
10"	4.5
12"	5.5

#### 4.9.3 Exfiltration Test

For an exfiltration test, the CONTRACTOR shall test each section of pipe between manholes after it has been laid but prior to backfilling of joints. Exfiltration test shall be conducted by plugging the lower end of the section of sewer to be tested and filling the sewer with water to a point approximately five feet (5') above the invert at the lower end and at least one foot (1') above the pipe at the upper in, observing for leakage at all joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 110% times the infiltration limits set out hereinbefore. **All observed leaks shall be corrected even though exfiltration is within the allowable limits.** Exfiltration test will normally be required for flat sections of sewer that are expected to be below the wet season ground water table.

#### 4.9.4 Infiltration Test

To conduct an infiltration test, the CONTRACTOR shall plug the open ends of all lines at the manhole so that measurements may be made at each section of the sewer line. This infiltration test will not be made until the sewer line is completed, and the CONTRACTOR will be required to correct all conditions that are conducive to excessive infiltration and may be required to relay such sections of the line that may be corrected otherwise. **All observed leaks shall be corrected even though infiltration is within allowable limits.**

#### 4.9.5 Manhole Vacuum Test

Before final acceptance, all manholes shall be vacuum tested to at least 10" Hg. The test shall be considered acceptable when the vacuum remains at 10" Hg, or drops no lower than to 9" Hg within the time period specified below.

Manholes 4-foot in diameter shall be required to sustain a vacuum with no more than 1" Hg drop according to the following schedule.

<u>Manhole Depth</u>	<u>Time to Drop 1" Hg</u>
4-10 ft	75 seconds
10-15 ft	90 seconds
15-25 ft	105 seconds

If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. If the manhole joint mastic or gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole retested.

Before testing, all pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while a vacuum is pulled. Installation and operation of the vacuum equipment shall be in accordance with equipment specifications and instructions provided by the manufacturer. The test head shall be placed in the cone section of the manhole.

Before final acceptance, SWWD will televise the interior of the sanitary sewer main to help assure compliance design, material, workmanship and record drawings. Any defects noted in this inspection shall be corrected by the CONTRACTOR.

#### **4.9.6 Pipe Deformation Testing**

With the installation of PVC pipe, the CONTRACTOR shall conduct pipe deformation tests with a "go, no-go" mandrel.

The mandrel shall be constructed with a minimum of 6 inches untampered length and shall be a minimum of 95% of the pipes' true inside diameter.

The minimal diameter of the mandrel for each pipe size shall be:

<u>Pipe Size</u>	<u>Mandrel Diameter (inches)</u>
6"	5.62
8"	7.52
10"	9.41
12"	11.19

The mandrel shall be pulled each pipe section, from manhole to manhole, without binding on the pipe walls.

The CONTRACTOR shall be responsible for placing a rope in the pipe, either as construction advances, or after construction. This rope shall be suitable for pulling the mandrel through each section of pipe.

SWWD will provide the mandrels for this test.

#### **4.10 SERVICE CONNECTIONS**

SWWD shall approve the location of the points on the collector sewers where tees and wyes are to be installed for service connections. The CONTRACTOR shall lay the service connection lines from this point to the property line, or easement line.

##### **4.10.1 Size of Service Connections**

All service connections, unless otherwise specified or directed, shall be 6-inch PVC, with a 6-inch cleanout installed at the property line, as specified herein and as indicated on the Drawings. Trenching, pipe laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with standard plugs.

Service connection pipe shall be the same as used in the collector lines and shall be placed between the tee branch to customer property line.

##### **4.10.2 Depth and Bedding**

For shallow sewers (ten (10) feet or less in depth) in rock or earth trenches, the tees shall be encased entirely with crushed stone #67 and fully compacted.

For deep sewers (greater than ten feet (10') in depth) in rock, the tees shall be encased entirely with Class "B" concrete. The lateral pipe shall be laid vertically from the branch to a point to meet the probable building sewer grade. From this point the lateral pipe shall be laid on a uniform slope to the property line to match the probable grade of the building sewer.

##### **4.10.3 Slope**

Under normal conditions, where elevations are not critical, service connection pipe shall be laid on a slope of not less than one foot (1') per 100 feet (approximately 1/8-inch per foot.) Where elevations are critical, minimum grade may be 0.5 foot per 100 feet laid with laser equipment or batter boards and grade line string, the same as specified for main sewers.

The pipe shall be laid on a uniform grade from the tee branch to meet the probable building sewer grade at the street right-of-way line so that no bends will be needed for the final connection.

##### **4.10.4 Cleanouts**

On new construction, the CONTRACTOR will be responsible for providing a cleanout at the property line in accordance to SD-6.

On existing mains that are tapped by SWWD, SWWD will be responsible for providing a cleanout at the property line.

#### **4.10.5 Service Connections to Manholes**

The tapping of service connections into manholes on the newly constructed sewers will not be permitted, except where approved by the SWWD. Where it is necessary to do so, the invert of the service connection shall not be higher than a point three inches (3") below the top of the bench to prevent the accumulation of solids on the bench. If the invert elevation difference between the main and the service connection is greater than two feet (2'), a standard drop connection shall be provided for a service connection that is tapped into a manhole.

The installation of tees or wyes for service connections shall be concurrent with the construction of the main sewer. Installation of service laterals off these connections shall follow immediately or concurrently with the construction of the main.

#### **4.11 CONNECTIONS TO EXISTING SYSTEM**

In most cases, a new manhole will be required to connect to the existing system. SWWD will be responsible for the installation of this manhole and for making the tap into the existing line. An inlet into this manhole shall be provided for the CONTRACTOR to connect the new pipe.

The cost of the new manhole and tap will be the responsibility of the OWNER.

The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sewers to an existing collector line. A representative of SWWD must be present while the connection is being made. SWWD should be given at least a twenty-four-hour (24 hr.) advance notice before the connection is made.

#### **4.12 CONCRETE CRADLE, ANCHORS AND ENCASEMENT**

Concrete cradle, anchors or encasement of sewer lines and/or fittings shall be placed where shown on the plans. Concrete shall be Class C and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

#### **4.13 SEPARATION OF WATER LINES AND SEWER LINES**

This requirement is governed by both the below standard for public mains and the Plumbing Code, Southern Building Code, Inc., for private plumbing facilities.

##### **4.13.1 Horizontal Separation**

Whenever possible sewers and sewer manholes should be laid at least ten feet (10') horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of ten feet (10'), a sewer may be laid closer than ten feet (10') to the water main provided that the bottom (invert) of the water main shall be at least twenty-four inches (24") above the top (crown) of the sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of approved water pipe, pressure tested, in place, without leakage prior to backfilling.

#### **4.13.2 Vertical Separation**

Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least twenty-four inches (24") below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirements, the water main shall be relocated to provide this separation or the sewer line shall be reconstructed with ductile iron pipe, or prestressed concrete cylinder pipe for a distance of ten feet on each side of the water line and should be pressure tested, in place, without leakage prior to backfilling. One full length of water main and sewer main should be centered over the intersection so that both joints will be as far from each other as possible.

#### **4.14 HIGHWAY AND RAILROAD CROSSINGS**

Encasement pipe shall be steel, plain end, uncoated and unwrapped, have a minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 or ASTM A139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 10-foot lengths.

The wall thickness of the pipe shall be a minimum of 0.250 inches for highway crossings. The diameter of the pipe shall conform to the requirements of American Railway Engineering Association for railroad crossings, and the requirements of the Tennessee Department of Transportation for highway crossings.

The carrier pipe shall be positioned in the casing pipe with casing spacers as manufactured by Advance Products & Systems, Inc., or approved equal.

## **SECTION FIVE PUMP STATIONS AND FORCE MAINS**

### **5.0 PURPOSE**

The purpose of this section is to outline specifications for a sewage pumping station and force main that is to become a part of the Springfield Wastewater Sewerage System.

### **5.1 PUMP STATION DESIGN CRITERIA**

Design calculations for sewage pump stations shall include the pump capacity at the design TDH, static head between the pump discharge and the force main discharge, capacity of the wet well, frequency and duration of operation, and operating conditions of the force main.

### **5.2 SCOPE**

The work to be performed under this section of the specifications consists of the furnishing of all labor, materials, equipment and services necessary for furnishing and installing factory built, underground submersible sewage pumping stations and force mains, complete and in proper operating condition. The location, size, and details of the stations shall be as shown on the plans. The work for the station shall include excavation, placing the concrete base slab, construction of the pump and valve pits, including hatches and covers, connecting the influent sewers to the station, all interior piping, the force main, and all other necessary piping, valves and fittings required.

Other work to be performed under this section includes backfilling, grading, electrical work as shown on the drawings or specified in this section and acceptance tests.

### **5.3 GENERAL**

The underground submersible sewage pumping station shall be furnished with all necessary equipment installed in a precast concrete manhole as shown on the drawings and in accordance with Drawing SD-14. The principal items of equipment in the station shall include two vertical, motor-driven non-clog submersible sewage pumps, necessary gate and check valves, required piping, central control panel with circuit breakers, motor starters, access hatch, and automatic pumping level controllers, vent piping, slide rails, and other required appurtenances and wiring.

The pumps shall be factory tested by manufacturer for capacity, power requirement and efficiency at specified minimum operating head, rated head, shut off head and at as many other points as necessary to provide certified pump performance curves. Copies of certified performance curves shall be furnished to SWWD and ENGINEER for approval prior to shipment of the pumps.

### **5.4 PUMPS**

The pumps shall be as manufactured by ITT Flygt, or approved equal.

The pumps shall be capable of handling unscreened sewage at pumping rate adequate for the total dynamic head and flow rate required for proper operation of the system in which it exists.

The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well. The pump shall be easily removable for inspections or service, requiring no bolts, nuts or other fastenings to be disconnected. Each shall be fitted with a chain of adequate length and strength to permit raising and lowering the pump for inspection and removal. The lift-out rail type system shall be designed in such a way that solids are fed in an up-flow direction to the impeller with no feet, rails or other obstruction below inlet.

There shall be no need for personnel to enter the wet well.

All major parts, such as the stator casing, oil casing, sliding bracket, volute and impeller shall be of gray iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be of stainless steel.

The pumps shall be capable of continuous dry pumping in a totally dry condition without damage to the motor or seals.

The pump and impeller shall be capable of passing all material in normal domestic and commercial sewage including reasonable amounts of foreign objects such as wood, plastics, glass, rubber, sanitary napkins, disposable diapers and solids up to three inches (3") in diameter.

The pump shaft shall be full-diameter magnetic stainless steel and shall rotate on two permanently lubricated bearings with a bearing life of 40,000 hours. Seals shall be in tandem, tungsten carbide-carbon upper, and tungsten carbide-tungsten carbide lower and shall operate in a lubrication system.

## **5.5 PUMP MOTORS**

The submersible electric motor shall be rated at the specified horsepower shaft output and be connected for 240 Volt, 60 Hz, 3-phase electric current.

The motor shall be squirrel-cage induction shell type 1,700 RPM and shall conform to NEMA standards for electric motors. Before locating the site of the pump station, the ENGINEER shall determine the availability of power service by coordinating design with the Springfield Electric Department or Cumberland Electric Membership Cooperative.

Pump motors shall be housed in an airtight, watertight, explosion-proof submersible type housing, suitable for use in Factory Mutual Class 1 Division 1 Group D locations, and shall have Class "F" insulated winding which shall be moisture resistant. The motor shall be NEMA Design B rated 155 °C maximum. The housing may be filled either with air or with clean high dielectric oil. Bearing lubrication shall be provided either by sealed oil bath bearings in the air-filled housing or by the high dielectric oil in the oil-filled housing. Motor winding shall be securely held in the housing with machine screws or it shall be pressed into the housing. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally no submerged condition. Heat from

motor windings shall be transferred to the outer housing in an efficient enough manner to prevent overheating under normal operating conditions.

Motors shall be supplied with heat sensing units attached to motor winding. The heat sensing units shall trip the starter if motor overheats.

The pump motor shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet of water.

The cable entry water seal design shall be such that precluded specific torque requirements to insure a watertight and submersible seal. Epoxies, silicones or other secondary sealing systems shall be used. The cable entry junction box and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign materials gaining access through the top.

The motor power cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable.

A double electrode shall be mounted in the lower end of the seal chamber to detect any water leakage into seal chamber. Electrodes are to be connected to a red signal light control panel. This seal leakage detector shall not stop motor, but indicate leakage so that pump lower seal can be serviced before motor is damaged.

## **5.6 LEVEL CONTROLS**

The level sensor shall be a solid-state direct-submersible transducer with a stainless-steel housing. The range of the transducer shall be as required for the desired application with excitation voltage of 15-45 volts DC. The transducer shall incorporate a diffused silicon semiconductor sensor protected by an integral stainless-steel diaphragm and fill fluid. The transducer shall be mounted at the bottom of a pit with support bracket and be cable connected providing an analog input signal to a meter/controller. The analog signal shall be 4-20 milliamp or 1-5 Volts DC as required.

The operating temperature shall be -40 °F to 176 °F and the accuracy shall be  $\pm 0.5\%$  O.S. (including linearity, hysteresis and repeatability).

The liquid level transducer shall be Control Systems, Inc., Model 57SN (non-clogging), or approved equal.

## **5.7 MOTOR CONTROLS**

Motor controls shall consist of a duplex control panel in a NEMA 4 waterproof enclosure, and shall have a dead front with separate removable inside panel to protect electrical equipment. Panel will contain circuit breakers, magnetic starter and HAND-OFF-AUTO switch for each motor. Duplex panels will include an automatic electric alternator.

A high-water alarm flashing light shall be supplied in separate NEMA 4 enclosure and mounted at the control box. All motor controls shall include all equipment required by the manufacturer and SWWD to insure proper operation of the pumping station.

The pump level controller shall be Control Systems, Inc., Model MPCT Level Controller. It shall have continuous display and control of the liquid level in the well. It shall be directly attached to the 57SN transducer to display sensor output, transmit a 4-20 ma signal and control auxiliary equipment via twelve (12) built-in control relays.

(Note: System shall be capable of connecting to a telemetry system at some future time.)

Pump motors shall be provided with thermal switches to monitor stator temperatures. The stator phase of each motor shall be equipped with an embedded thermal switch. The CONTRACTOR shall coordinate between the pump supplier and the pump control panel supplier to provide motor overload protection and alarm functions.

### **5.8 ELECTRICAL WIRING**

The pumping stations shall be completely wired at the factory, in accordance with the NEC and shall be color coded. The pump cables shall be one continuous cable, without splices or junction boxes of any type, from the pump to the control panel. All wiring outside the control cabinet shall be in rigid conduit or "Sealtite". All accessory equipment shall be permanently wired with suitable disconnecting means and overload protection. Cord, plug and receptacle type connections will not be acceptable.

### **5.9 OUTSIDE ELECTRICAL SERVICE**

Connection of electrical service to the pumping station shall be as indicated on the drawings and further specified herein.

- A. The service pole shall be fully treated, southern yellow pine roofed 15° and gained before treatment.
- B. The weatherproof switch and meter socket shall be fastened to rustproof channels that are banded to the pole with rustproof bands.
- C. The service entrance fitting at the pole shall be cast aluminum with stainless steel screws.
- D. Conduit and conduit fittings shall be heavy, threaded, galvanized steel. Fittings shall have neoprene gaskets for covers. Conduit shall be fastened to the service pole with two-hole, heavy, galvanized straps with rustproof lag screws - minimum spacing on 5-foot centers.
- E. Control wire extensions shall be made as detailed on the drawings. Components shall be NEMA 4.
- F. Insulating bushings of the heavy fiber reinforced type shall be employed on all conduit terminations.
- G. All screws and fasteners are to be rustproof, double hot dipped galvanized, Monel metal or stainless steel.

- H. Fuses shall be Bussman “Low-Peak”, or approved equal.
- I. **All** the electrical work shall be inspected and approved by an electrical inspector. Two copies of the certificates of approval by the Electrical Inspector shall be provided to SWWD and a label of acceptance must be glued inside the door of the disconnect before final acceptance.

### **5.10 SEWAGE PIPE, FITTINGS AND VALVES**

All inside piping shall be Class 52 Ductile Iron Pipe, flanged ANSI Class 125 inside and terminating in mechanical joints bells outside. Outside piping shall conform to the requirements set out hereinbefore.

Gate valves shall be resilient seat conforming to AWWA C509, with ductile iron bodies conforming to AWWA C153. Check valves shall be weight loaded, external lever type, bronze fitted, conforming to AWWA C508. Gate valves shall be provided on the discharge lines of each pump and a check valve on the discharged line between each pump and gate valve as shown on the plans.

A pressure gauge shall be installed downstream of the check valve. Coupling adapters shall be Type 912 cast iron as manufactured by Smith-Blair, or approved equal.

#### **5.10.1 Air Release Valve**

Air release valves shall conform to the specifications in Section 3.4.6., above.

### **5.11 CONCRETE BASE, WETWELL AND VALVE PIT**

Class “A” reinforced concrete shall be provided for the pumping station base slab as shown on the plans. The pump well shall be of precast reinforced concrete pipe of the dimensions as shown on the drawing, or approved equal. Valve pit shall have a one-quarter inch (0.25”) aluminum checkered plate covering, as manufactured by Bilco, or approved equal.

All interior concrete surfaces of the wet well to be painted with two coats of TNEMEC TAR # 413, or approved equal.

### **5.12 FACTORY TESTING**

The pump manufacturer shall perform inspection tests on each pump before shipment to insure proper operation of the pump and compliance to the CONTRACTOR’S purchase order.

### **5.13 ACCEPTANCE TEST**

After installation, the pumping station shall be given a running test of all equipment. During the test, all piping and seals shall be checked to ensure no leaks occur at all and controls shall be carefully checked and balanced for proper operation.

The CONTRACTOR shall furnish all necessary tools, materials, equipment and supervision of the test; however, the OWNER-DEVELOPER will furnish the electrical energy.

Any defects in the equipment or failure to meet the guaranteed requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of SWWD as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

#### **5.14 TOOLS, SPARE PARTS AND MANUALS**

The CONTRACTOR shall furnish the following to the SWWD as spare parts.

- A. One (1) upper shaft seal;
- B. One (1) lower shaft seal;
- C. One (1) transducer;
- D. Two (2) complete sets of O-ring seals for the various mated surfaces where watertight sealing is necessary;
- E. Two (2) leak detective sensors;
- F. One (1) multiple point controller card;
- G. Any special tools required for such purpose, shall be furnished. Tools shall be supplied in a substantial steel tool box;
- H. A complete operating and maintenance manual, in duplicate, shall be furnished;
- I. A one year's supply of lubricants shall be supplied.
- J. The CONTRACTOR shall furnish three (3) copies of the operating manual to SWWD.

## **5.15 SITE DEVELOPMENT**

### **5.15.1 Stripping and Topsoiling**

Before excavation and grading is commenced for pumping station, the topsoil and sod shall be removed from the areas affected and stockpiled. Then final grading is accomplished, the topsoil shall be spread evenly over the excavated areas. Rough grading shall have been carried approximately six inches (6") below finished grade and brought back up to grade with topsoil as set out herein.

### **5.15.2 Site Grading and Fill Around Structures**

All materials used for backfill around pumping stations shall be of a quality acceptable to SWWD and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations walls or other permanent work shall be re-filled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills with terraces around the structures, the fill shall be placed in layers not exceeding twelve inches (12") in depth and shall be kept smooth with an approved type roller and/or compacted to the satisfaction of SWWD. When, in the opinion of the ENGINEER, it is not practical to roll sections of the fill immediately adjacent to buildings or structures, then such sections shall be thoroughly compacted by means of mechanical tamping, hand tamping or puddling as may be required by the ENGINEER. All fills shall be placed so as to load structures symmetrically.

The grading shall be brought to the levels shown on the plans or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches (2") in diameter. Rock and/or shale excavation which has been removed may be placed in the fills, but it shall not be closer than twelve inches (12") from finished grade.

### **5.15.3 Excavation**

Excavation shall be accomplished in such places as indicated on the drawings to the lines, grades and elevations shown, or as directed. The excavation shall be maintained in such a manner so as to be well drained at all times. Temporary drains, or drainage ditches, shall be installed by the CONTRACTOR to intercept or divert surface water. The CONTRACTOR shall provide adequate facilities for promptly and continuously removing water from the excavation. Should unstable material be encountered, or if the depth of excavation exceeds six feet (6'), the sides of the excavation shall be supported by sheeting, bracing and shoring, or the sides sloped to the angle of repose.

### **5.15.4 Clean Up**

The CONTRACTOR shall remove all objectionable matter resulting from his operations. The requirements of this MANUAL, Section 7, Seeding and Sodding, shall be adhered to in this construction.

## **5.16 FORCE MAIN**

### **5.16.1 Design Requirements**

Sanitary sewer force mains shall be designed to that the minimum velocity of two feet per second (2.0 fps) is developed when the sewage pumps are operating at the design TDH.

Sufficient velocity should be considered in the design to re- entrain solids after the pump station has been off. The maximum velocity of a force main shall be six feet per second (6.0 fps).

Separation of sanitary sewer force main shall follow the guidelines set of in Section 3.2 and Section 4.13.

### **5.16.2 Pipe Materials**

- A. Ductile Iron Pipe, Fittings and Joints - Section 3.3.1.
- B. Polyvinyl Chloride Pressure Pipe and Joints - Comply with Section 3.3.2. Substitute dimension ratio to specify pipe at system working pressure plus 50 psi.
- C. Steel Encasement Pipe - See Section 3.3.3.

### **5.16.3 Testing of Sewage Force Mains**

On all projects involving the installation of sewage force mains, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

- A. Leakage in pipelines, when tested at normal system operating pressure plus 50 psi, shall not exceed 5 psi pressure loss during the duration of the test.
- B. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.
- C. Pipelines shall be tested before backfilling at joints except where otherwise required by necessity, local ordinance, or public convenience.
- D. Duration of test shall be not less than two hours.
- E. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be re-laid, bolts retightened, and leakage minimized, regardless of total leakage as shown by test.
- F. All pipe, fittings and other materials found to be defective under test shall be removed and replaced by the CONTRACTOR.
- G. Lines which fail to meet tests shall be repaired and retested as necessary until the requirements are compiled with.

H. SWWD shall furnish a recording gauge and clock used during leakage test and recording pressure charts during duration of test.

#### **5.16.4 Thrust Restraint**

In compliance with 3.3.1 or 3.3.3.

#### **5.16.5 Pipe Locators**

With non-metallic pipe, the CONTRACTOR shall install #14 coated copper wire six inches to twelve inches (6"-12") above the top of the pipe for inductive and conductive tracing.

In addition, with **all** pipe, the CONTRACTOR shall install a tracing tape suitable for visual identification of the buried force main line. The tape shall be on 3" x 1000' rolls, green or brown mylar film, and printed with the words "Buried Force Main Below." Installation shall be within the same trench as the force main line, centered over the force main line, and at approximately one (1) foot below finished grade.

Locators shall be as manufactured by Line guard Maintenance System, or approved equal.

#### **5.17 CONNECTION TO EXISTING SYSTEM**

All sanitary sewer force mains must connect to manholes at the flow channel elevation. The ENGINEER shall show details on his plans indicating the method of connecting force mains to manholes.

All interior concrete surfaces of the manhole are to be painted with two coats of TNEMEC TAR # 413, or approved equal.

## **SECTION 6 CONCRETE**

### **6.0 PURPOSE**

The purpose of this section is to outline specifications for concrete utilized in the construction of water mains, sanitary sewers, and sewage pump stations and other related items in the construction of public facilities.

### **6.1 CEMENT CONCRETE**

Cement concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, with or without air entrainment as required, combined in the proportions and mixed to the consistency specified; and shall be deposited in such forms and to such dimensions as indicated on the plans or as specified by the ENGINEER.

#### **6.1.1 General**

All cement concrete shall be in accordance with TDOT for the various classes and types as specified therein. Unless otherwise directed by SWWD, the classes or types of concrete to be used in various types of construction shall be as set forth below.

#### **6.1.2 Class "A"**

Unless otherwise specified, all concrete shall be Class A.

##### **A. Fine Aggregate**

Proportioned by dry weight of fine to coarse aggregate between thirty to forty-five percent (30%-45%).

##### **B. Coarse Aggregate**

Structural: No. 57.

Precast: No 57 or No 67.

##### **C. Minimum Compressive Strength**

28-day, 4000 psi, average any 3 cylinders.

##### **D. Slump**

One to three inches (1"-3") for mass concrete and heavy reinforced section; two to four inches (2"-4") for slabs, columns, *et cetera*.

E. Mixing Water:

Deduct moisture content of the aggregate from the amount of mixing water required.

**6.1.3 Class “B”**

Use for anchors, kickers, encasement for pipeline, and fill, unless otherwise specified.

A. Fine Aggregate

Proportioned by dry weight of fine to coarse aggregate between thirty to forty-five percent (30%-45%).

B. Coarse Aggregate

No. 57.

C. Minimum Cement Content

Five (5.0) bags per yd<sup>3</sup> (470 pounds).

D. Minimum Compressive Strength

28-day, 2500 psi, average any 3 cylinders.

E. Slump

Five to eight inches (5”-8”) for pipe encasement; two to four inches (2”-4”) for slabs, columns, *et cetera*.

F. Mixing Water

Deduct moisture content of the aggregate from the amount of mixing water required.

**6.1.4 Cement**

Cement shall conform to ASTM C150 for Type I, Portland Cement with three to six percent (3.0%-6.0%) air by volume added to the mix, or ASTM C175 for Type IA, Air Entraining Portland Cement.

**6.1.5 Water**

Water shall be potable, kept free from injurious amounts of oil, acid, alkali, organic matter or other such deleterious substances.

**6.2 AGGREGATE FOR PORTLAND CEMENT CONCRETE**

Aggregate shall meet the gradation requirements as set out in Table 6 and shall meet the requirements of AASHTO M-43.

### **6.2.1 Fine Aggregate**

Fine aggregate shall consist of natural sand having clean uncoated grains, free from injurious amounts of clay, flaky material, lignite, organic material and other such foreign substances.

### **6.2.2 Coarse Aggregate**

Coarse aggregate shall be crushed stone, gravel or slag having clean, hard, uncoated particles. Crushed stone is preferred for coarse aggregate; gravel or slag shall not be used unless prior written approval is obtained from SWWD. It shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces.

### **6.3 ADMIXTURES**

Admixtures for adding air to concrete made with Type I Portland Cement, must meet the requirements of ASTM C226.

### **6.4 CONSISTENCY OF CONCRETE**

The consistency of the concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement, but without permitting the materials to segregate or excess water to collect on the surface. When the specified slump is three inches or less, the tolerance shall be plus or minus one-half inch (0.5"). When the specified slump is greater than three inches (3.0"), the tolerance shall be plus or minus one inch (1.0").

### **6.5 TRANSPORTING OR CONVEYING CONCRETE**

Concrete shall be conveyed from the mixer to the place of final deposit immediately after mixing by methods which will prevent the separation or loss of material.

Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery and without segregation of the material.

For trucks used to deliver ready mixed concrete, the number of revolutions of the drum at mixing speed, the number of revolutions of the drum at agitation speed and other such details shall conform to ASTM C94 or TDOT Section 501.10. In all such cases, however, the concrete shall be delivered to the job site and discharged within sixty minutes (60 minutes), or before the drum has been revolved 300 times, whichever comes first, after the mixing water has been added to the other ingredients. In hot weather or under other conditions contributing to quick stiffening of the concrete, a time less than sixty minutes (60 minutes) may be permitted by SWWD with prior written approval.

**Non-agitating type trucks shall not be used to haul ready mixed concrete.**

## **6.6 PLACING CONCRETE**

Concrete shall be delivered to its position of placement, within the required time for delivery after mixing and within the required time interval between delivery of batches, as specified hereinbefore or by SWWD for the method of mixing and handling employed.

Water shall be removed from all foundation excavation or form work before the concrete is deposited. The method and manner of placing shall be such as to avoid the possibility of segregation or separation of aggregates or the displacement of the reinforcement. Placing of the concrete shall be such as to entirely fill the form, but not to bulge or distort the forms or their alignment. Special care shall be taken to fill each part of the forms by depositing concrete as near to its final position as possible, to work the coarser aggregate back from the face and to force the concrete under and around the reinforcing bars with displacing them.

The concrete shall not be allowed to drop freely more than three or four feet (3'-4'). In thin sections, drop chutes of rubber, canvas or metal shall be used. Drop chutes shall be provided in several lengths or shall be in sections which can be hooked together so that the length can be adjusted as work progresses.

When vibrating is required, it shall be done by methods and equipment approved by SWWD.

## **6.7 CURING**

All concrete shall be cured for a period of not less than seven (7) days after pouring. The method used to provide curing shall be approved by SWWD. Membrane curing, plastic sheet curing, and wetted burlap curing will be considered satisfactory.

If at any time during the seven-day curing period, the air temperature is 40 °F or less, concrete shall be insulated and/or heated as directed by SWWD to aid curing and to prevent freezing. Protective covering which will protect the surface of freshly placed concrete from rain shall be readily available at the site of the work. Concrete damaged as a result of failure on the part of the CONTRACTOR to adequately protect the concrete from rain or freezing shall be removed and replaced at the expense of the CONTRACTOR as directed.

## **SECTION SEVEN SEEDING AND SODDING**

### **7.0 PURPOSE**

The purpose of this section is to outline specifications for proper seeding, sodding, and landscaping in areas of construction.

### **7.1 SEEDING, SODDING AND LANDSCAPING**

Unless otherwise specified by SWWD, all graded areas shall be left smooth and thickly sown with a mixture of grasses.

If the construction work is brought to completion when, in the opinion of the ENGINEER or SWWD, the season is not favorable for the seeding of the grounds, then the CONTRACTOR shall delay this item of the work until the proper season for such seeding as directed by the ENGINEER or SWWD.

### **7.2 PREPARATION**

Soil preparation for seeding or sodding shall begin after final grading has been completed.

#### **7.2.2 Fertilizer**

After final grading, the entire area to be seeded shall be fertilized with number 12-12-12 fertilizer at a rate of 1,000 pounds per acre.

#### **7.2.3 Agricultural Lime**

Agriculture lime shall be added at a rate of 4.4 tons per acre or as specified by the ENGINEER.

#### **7.2.4 Soil Preparation**

After the fertilizer and agricultural lime has been distributed, the CONTRACTOR shall disc or harrow the ground to thoroughly work the fertilizer into the soil.

### **7.3 APPLICATION**

Seeding or sodding operations shall commence after soil preparation. Any areas that have been washed out shall be repaired prior to seed application.

#### **7.3.1 Seeding**

The seed shall be broadcast either by hand or by approved sowing equipment. After the seed has been distributed, the CONTRACTOR shall then lightly cover the seed by

use of a drag or other approved device. The seeded area shall then be covered with straw to a depth of approximately 1-1/2 inches. Any necessary reseeding or repairing shall be accomplished by the CONTRACTOR prior to final acceptance.

### **7.3.2 Seed Rate and Mixture**

Seed shall be applied at a rate of not less than eighty-seven pounds (87 pounds) per acre. All seed shall be certified.

In areas of managed lawns, the mixture shall consist, by weight, of:

- Kentucky Fescue #31
- Creeping Red Fescue
- White Clover

In areas of road right-of-ways or rural easements, the mixture shall consist, by weight, of:

- Kentucky Fescue #31
- English Rye
- Lespedeza

### **7.3.3 Sodding**

Sodding will not be required unless specifically set forth by SWWD or the ENGINEER. When sodding is required, it shall be at least 60% good quality Kentucky Bluegrass, strongly rooted, and free of pernicious weeds and shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid, and the finished surface shall be true to grade, even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas and shall be raked to insure sealing the sod joints. The sodded areas shall be thoroughly watered.

## **SECTION 8 DEFINITIONS**

AASHTO American Association of State Highway & Transportation Officials.

APWA American Public Works Association

ANSI American National Standards Institute.

APPROVED Material, equipment, workmanship, process or method that has been accepted by SWWD as suitable for the proposed use.

ASCE American Society of Civil Engineers.

ASTM American Society for Testing and Material.

AWWA American Water Works Association, latest revision.

BOARD The Board of Mayor and Aldermen of the City of Springfield, Tennessee.

CFR 29 CFR 1926.650 Federal OSHA regulations concerning trench safety.

CITY The City of Springfield, Tennessee.

CONTRACTOR The person, firm or corporation with whom the OWNER/DEVELOPER has executed an agreement to perform the utility construction for the project.

CROSS-CONNECTION Any physical construction whereby SWWD's water supply is connected with any other water supply systems, whether private or public, or either inside or outside any building in such a manner that a flow of water into SWWD's water supply is possible, either through the manipulation of valves or because of ineffective check or back-pressure valves, or other arrangement.

CUSTOMER Any person who receives water and/or wastewater services from the CITY through SWWD, either under an expressed or implied contract, requiring such person to pay SWWD for services.

DWELLING Any single structure occupied by one or more persons for residential purposes.

EASEMENT A legally dedicated right-of-way for SWWD to install water and/or wastewater lines within specified boundaries.

ENGINEER A Professional Engineer, registered in the State of Tennessee as set out in T.C.A. 62-2-101 through 62-2-807.

EXISTING DEVELOPED AREA A developed area within the corporate limit having streets, water and/or sewer lines and appurtenances which have been accepted for operation and maintenance by the CITY.

MANUAL The Water and Sewerage Design & Construction Standards Manual of the CITY and SWWD.

NEW SUBDIVISION A development of a tract or parcel of land having two or more lots and having proposed dedicated streets.

OWNER/DEVELOPER An individual, group of individuals, partnership, firm, association or corporation that is constructing, or having constructed, water and/or sewer facilities that are to become a part of, or be connected to SWWD water and/or sewer systems.

PCA Portland Cement Association.

PREMISES Any structure or group of structures, including land, operated by as a single business or enterprise.

RECORD DRAWING (As-Built) A certification by the ENGINEER, whose stamp appears on the plans, that the measurements, depths, materials, and facilities that are shown on the plans are true and correct and are constructed in accordance with the MANUAL.

RESIDENT INSPECTOR The ENGINEER is required to “provide continuous adequate inspection during construction to assure that all work is done in accordance with approved plan documents.” (Tennessee Department of Environment & Conservation Rule 1200-5-1-.05 (6)).

The ENGINEER may partially fulfill this requirement with a representative of SWWD, with prior approval and coordination with SWWD. SWWD cannot, however, waive the ENGINEER’s responsibility under State rules and regulations.

Regardless of who provides inspection, RECORD DRAWINGS remain the responsibility of the CONTRACTOR and ENGINEER.

TDOT Tennessee Department of Transportation.

SANITARY SEWER A pipe or conduit that primarily carries sewage, and to which storm, surface, and ground waters are not intentionally admitted.

SHALL Means a mandatory requirement.

SWWD The Springfield Water & Wastewater Department.

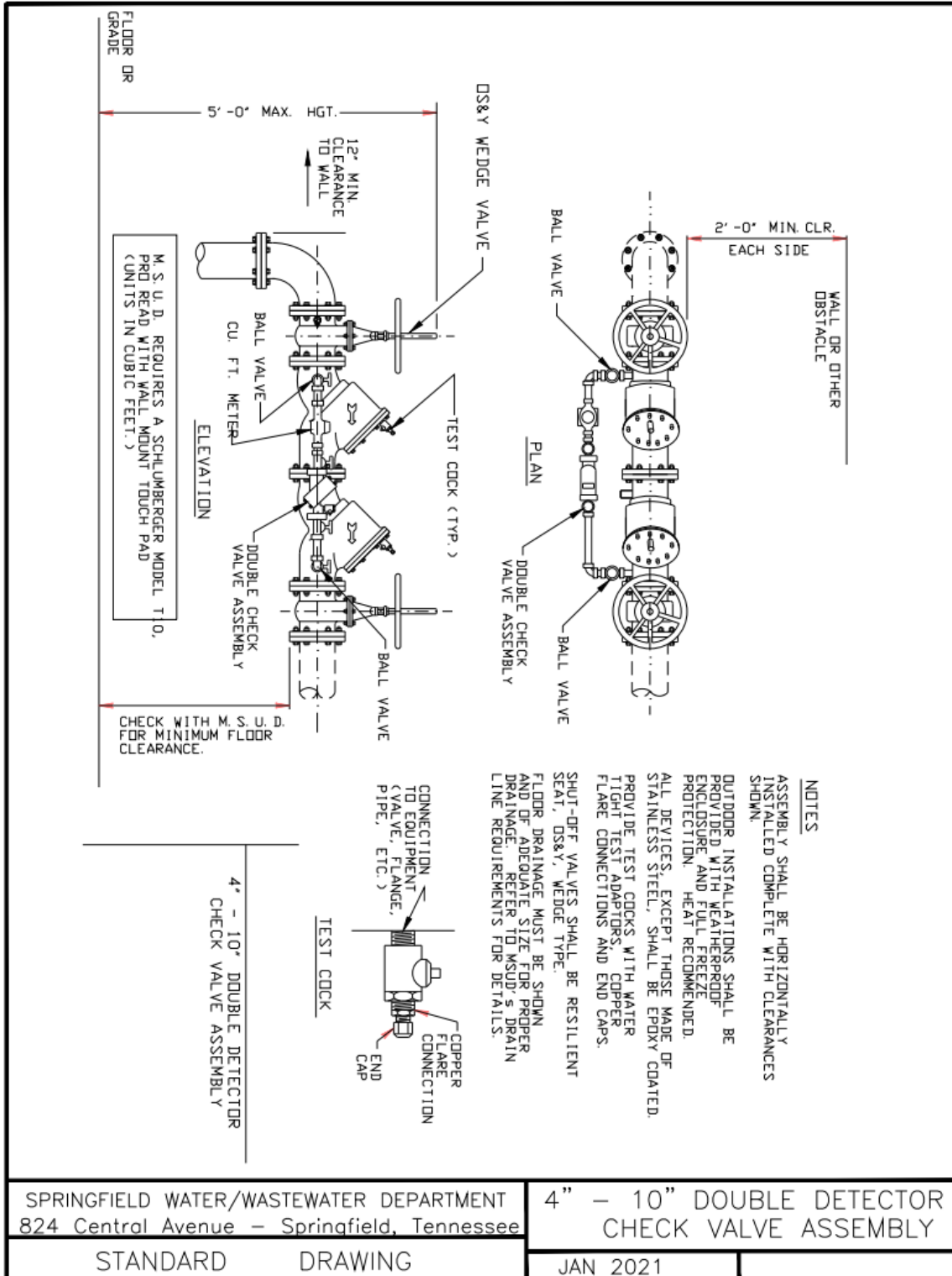
UNIT An individual part of a multiple unit development, requiring separate water and wastewater service.

WATER SYSTEM The system of pipes, pumps, and storage tanks used to treat and convey potable water to the customers of SWWD.

WASTEWATER SYSTEM The system of pipes, pumps and tanks used to collect and treat sanitary wastewater from the customers of SWWD.

# SECTION 9 WATER DRAWINGS

## 4 TO 10 DOUBLE DETECTOR VALVE



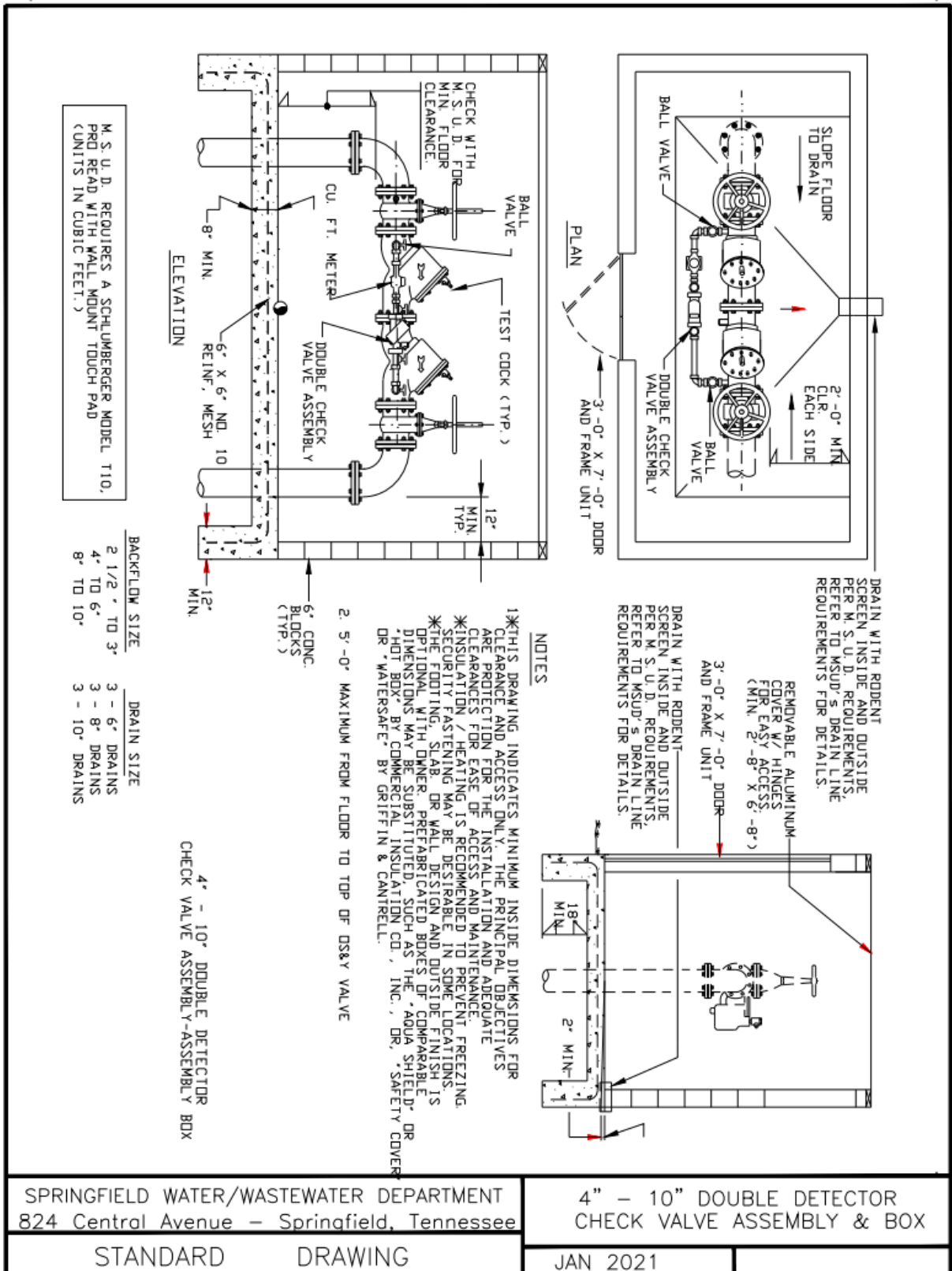
SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue - Springfield, Tennessee

4" - 10" DOUBLE DETECTOR  
CHECK VALVE ASSEMBLY

STANDARD DRAWING

JAN 2021

# 4 TO 10 DOUBLE DETECTOR- MODEL



SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue - Springfield, Tennessee

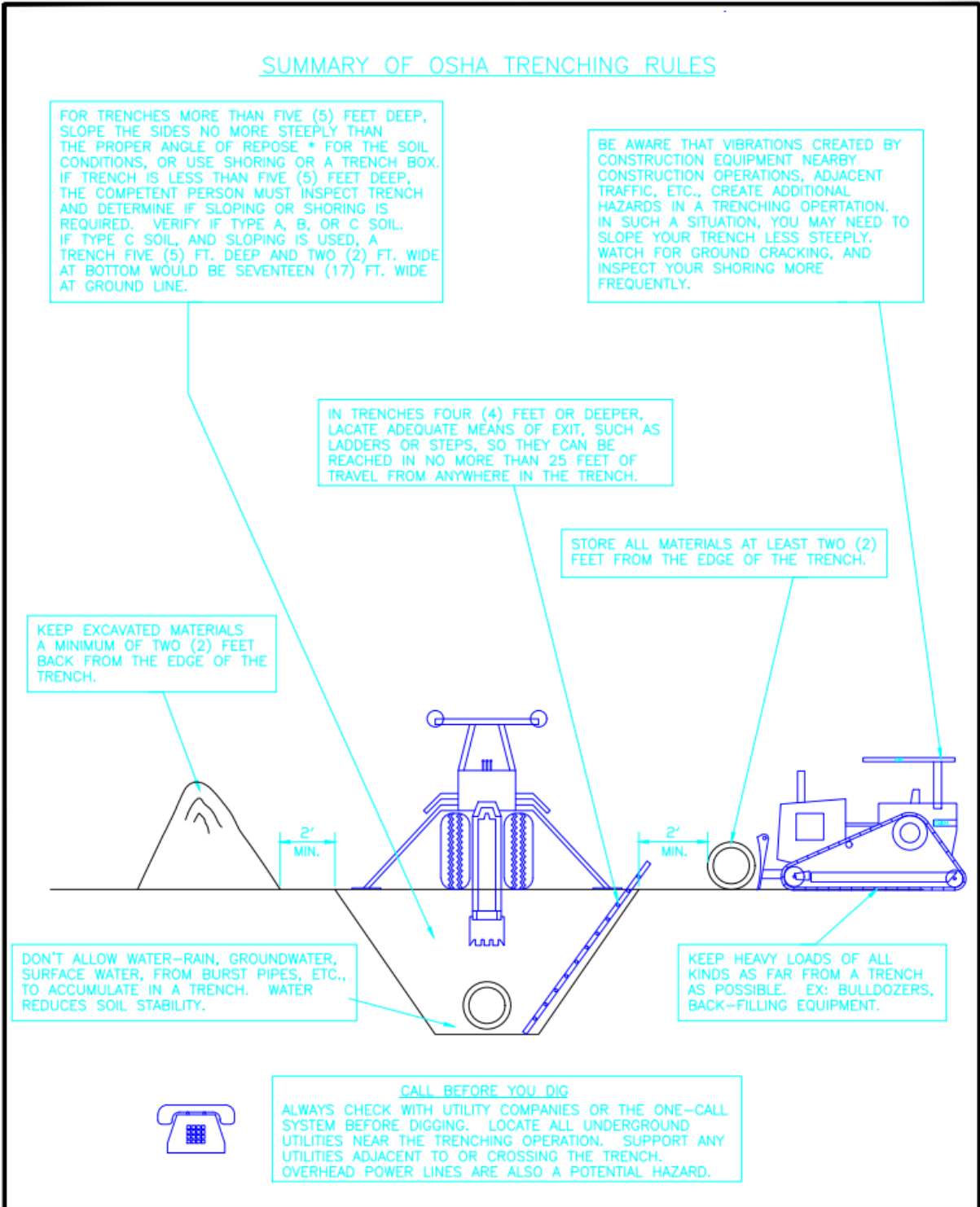
4" - 10" DOUBLE DETECTOR  
CHECK VALVE ASSEMBLY & BOX

STANDARD DRAWING

JAN 2021

**GEN-1 OSHA- MODEL**

SUMMARY OF OSHA TRENCHING RULES



SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

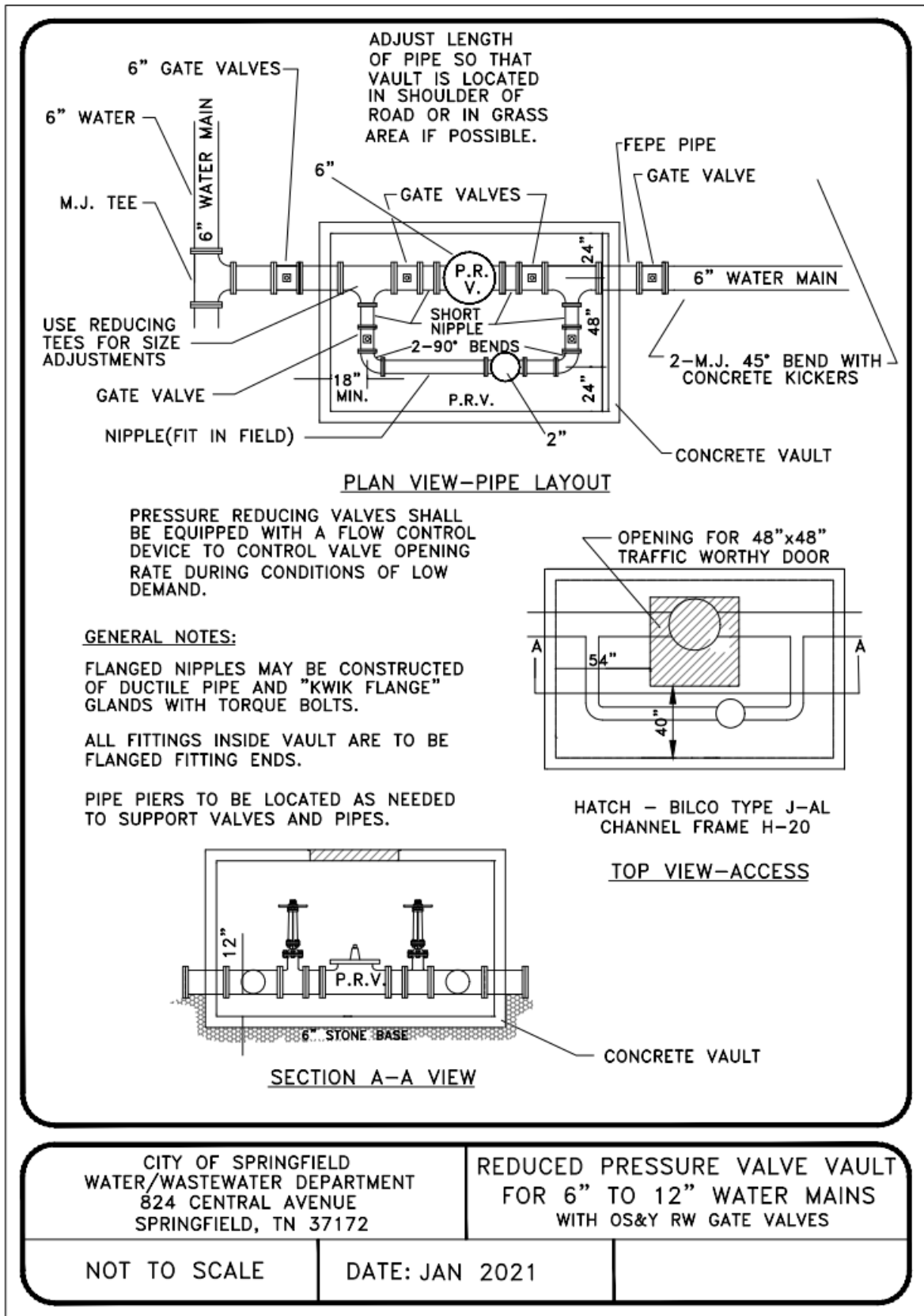
OSHA TRENCHING RULES

STANDARD DRAWING

JAN 2021

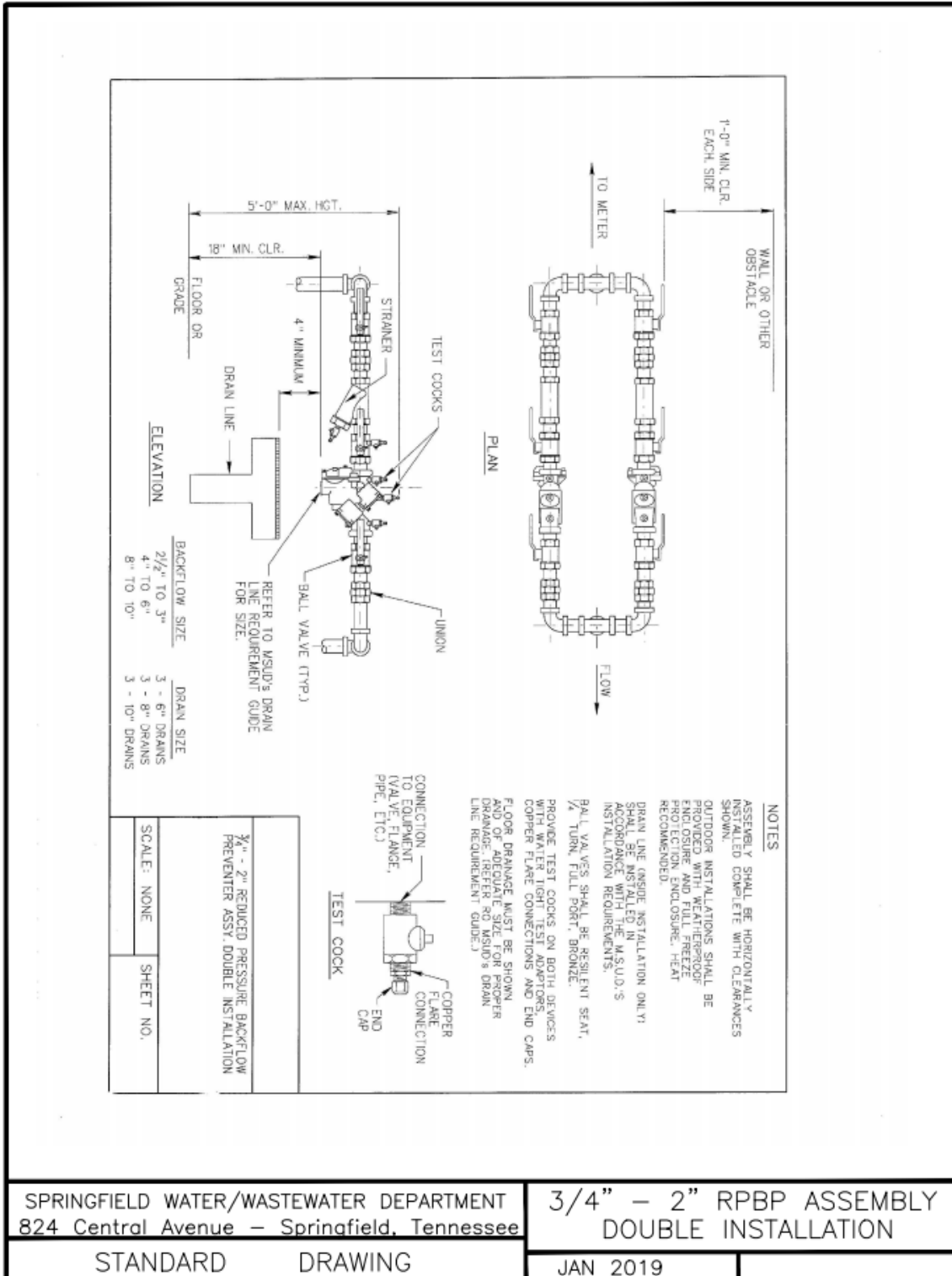
DWG. NO. GEN-1

**PRV VAULT- MODEL**





# RPBP DOUBLE INSTALLATION- MODEL



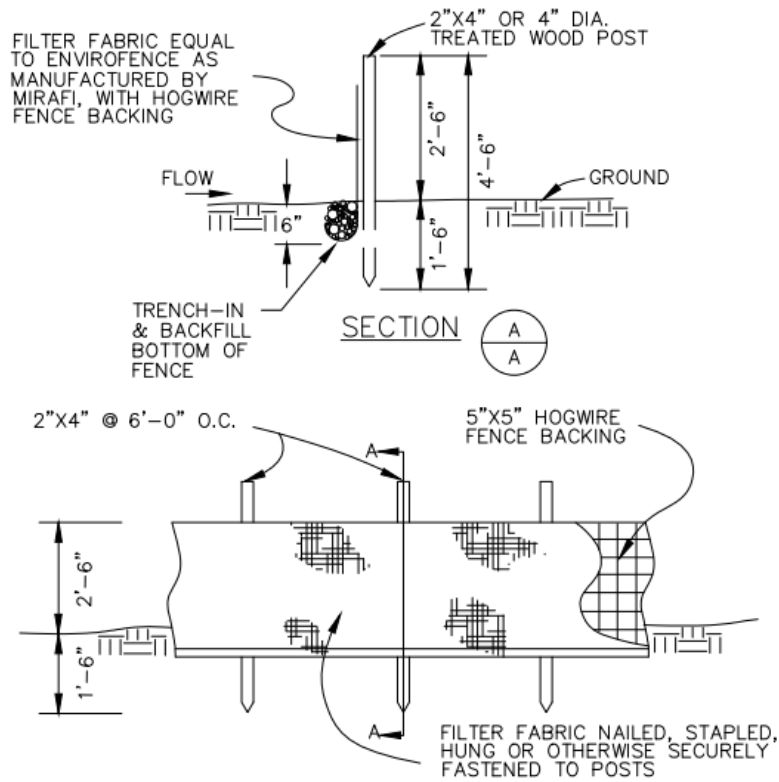
SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue - Springfield, Tennessee

3/4" - 2" RPBP ASSEMBLY  
DOUBLE INSTALLATION

STANDARD DRAWING

JAN 2019

**STD-G-01 SILT**



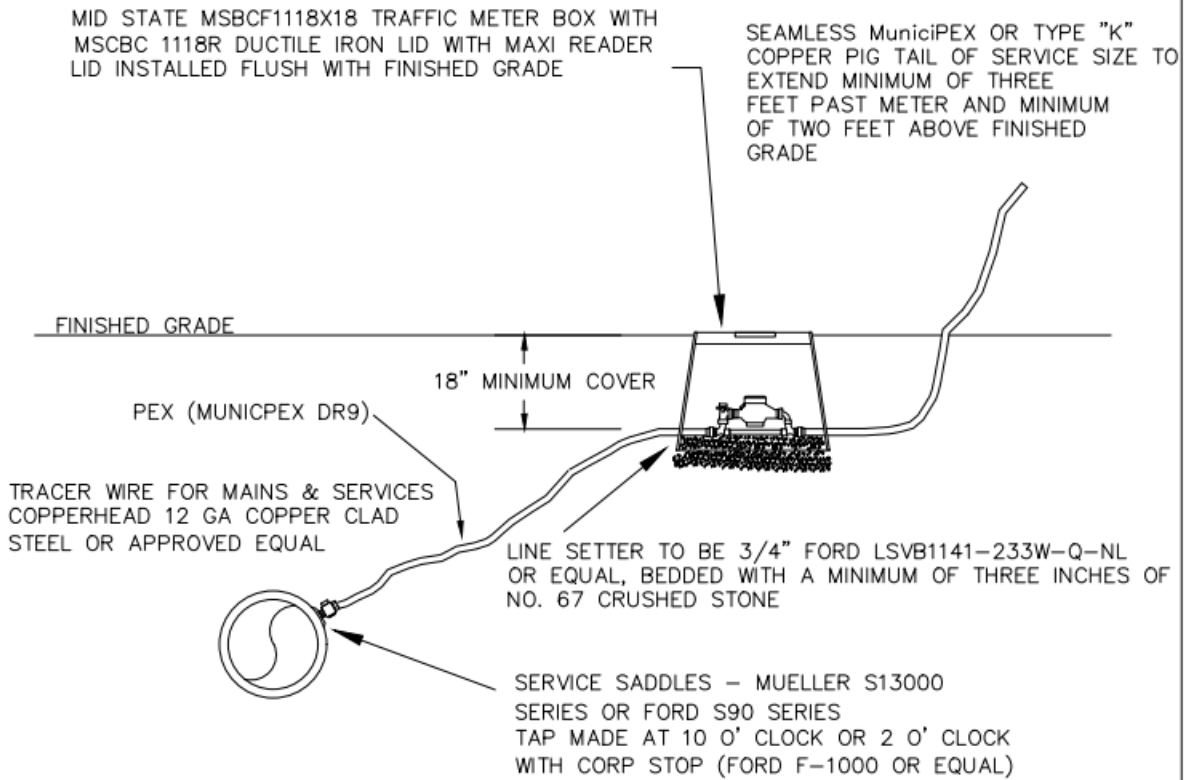
ELEVATION

SILT FENCE DETAIL

	SPRINGFIELD WATER/WASTERWATER	DATE : JAN 2021
		SCALE : N.T.S.
STANDARD DETAILS		STD-G-01

**STD-W-01 SHORT TAP**

NOTE: 3/4" METERS FURNISHED BY SWWD

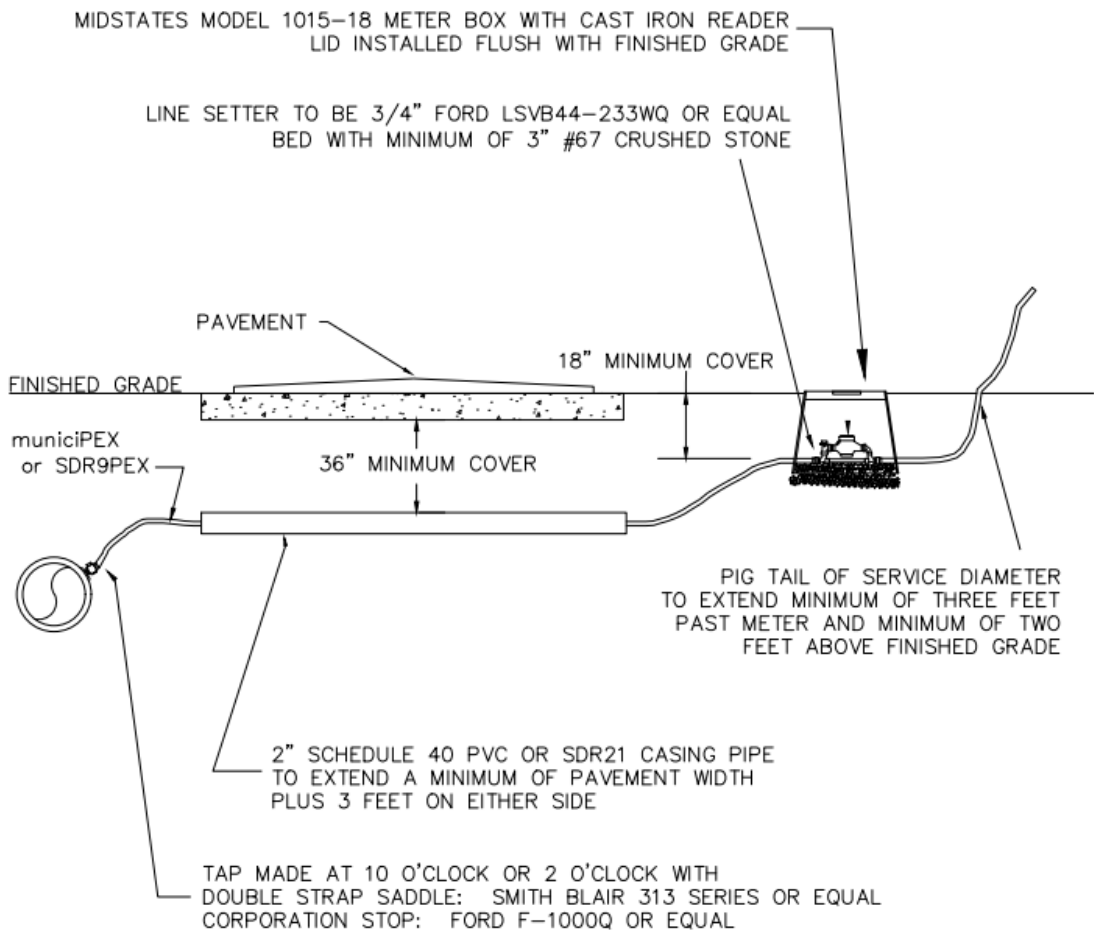


3/4" SHORT TAP ASSEMBLIES

	SPRINGFIELD WATER	DATE : JAN 2021
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-01

**STD-W-02 LONG TAP**

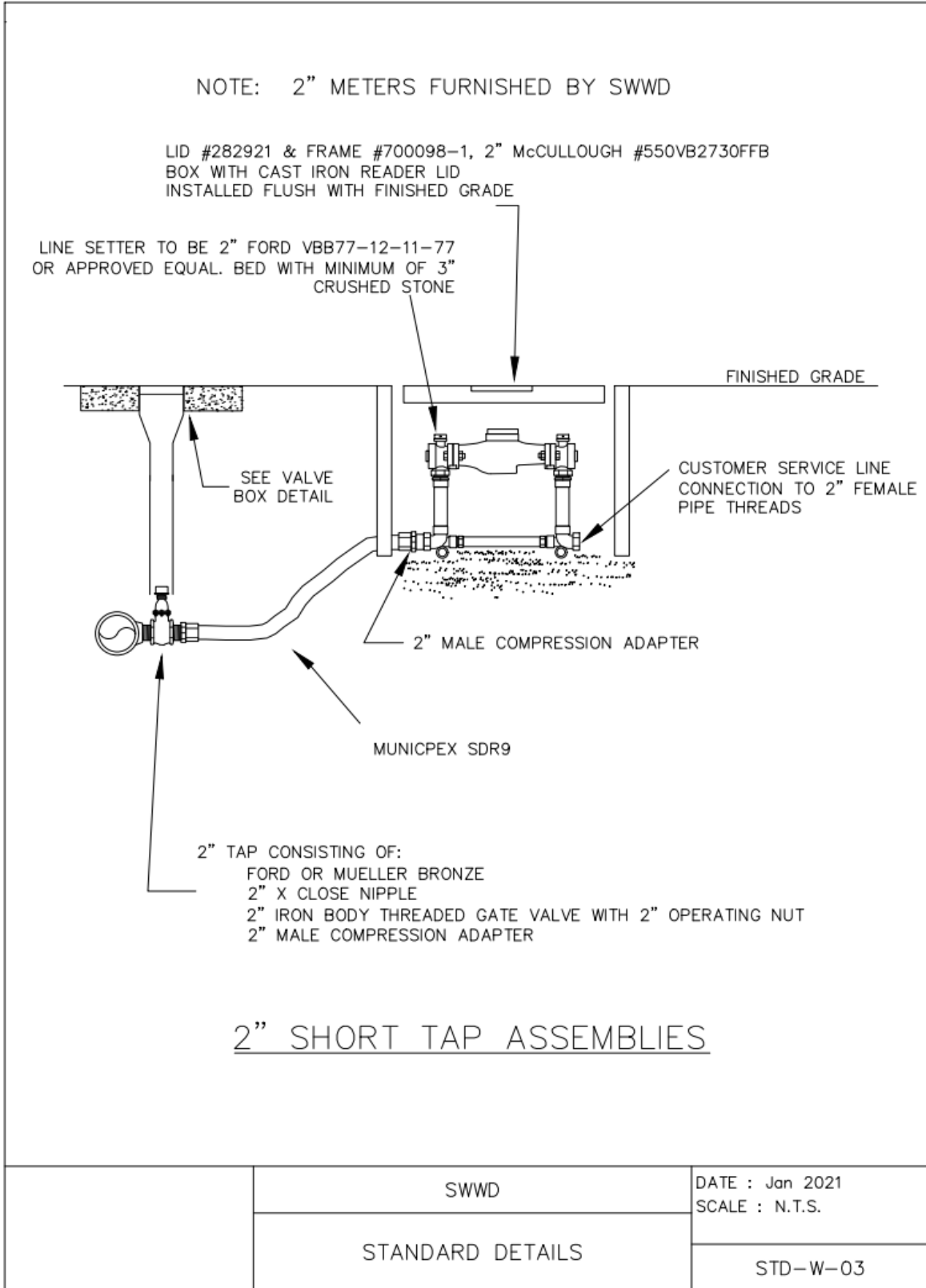
NOTE: 3/4" AND 1" METERS FURNISHED BY SWWD



3/4" AND 1" LONG TAP ASSEMBLIES

	SPRINGFIELD WATER	DATE : Jan 2021
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-02

**STD-W-03 2 INCH SHORT TAP**



SWWD

DATE : Jan 2021  
SCALE : N.T.S.

STANDARD DETAILS

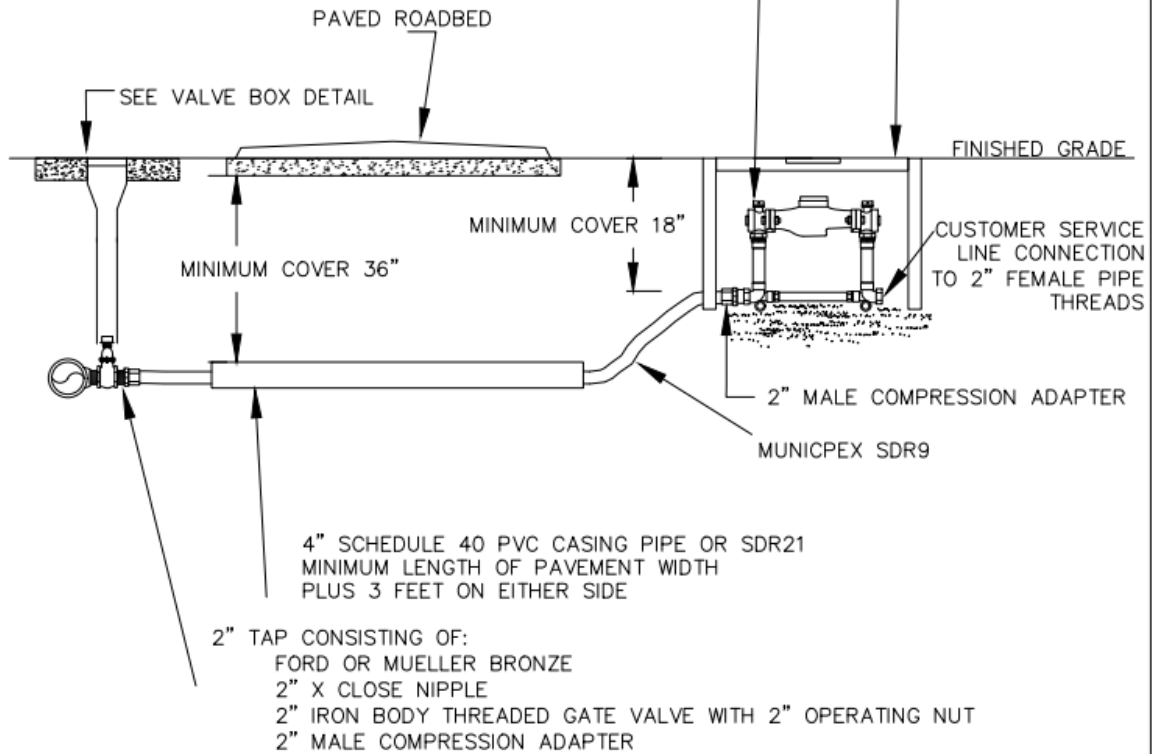
STD-W-03

**STD-W-04 2-INCH-LONG TAP**

NOTE: 2" METERS FURNISHED BY SWWD

LID #282921 & FRAME #700098-1, 2" McCULLOUGH #550VB2730FFB  
BOX WITH CAST IRON READER LID  
INSTALLED FLUSH WITH FINISHED GRADE

LINE SETTER TO BE 2" FORD VBB77-12-11-77 OR APPROVED EQUAL.  
BED WITH MINIMUM OF 3" CRUSHED STONE

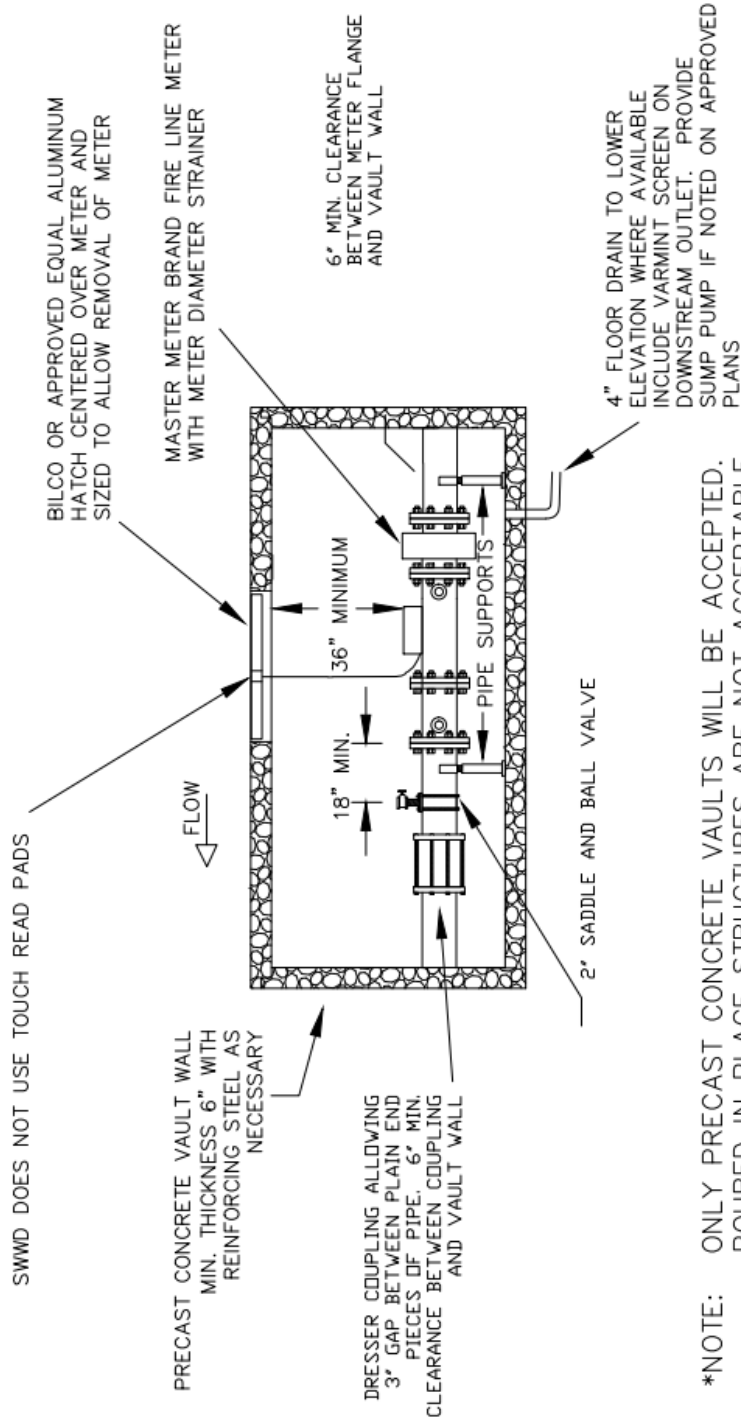


2" LONG TAP ASSEMBLIES

	SWWD	DATE : JAN 2021 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-04

**STD-W-05A 4 INCH METER**

PRE-CAST CONCRETE VAULT METERS 4" AND LARGER  
PROFILE VIEW

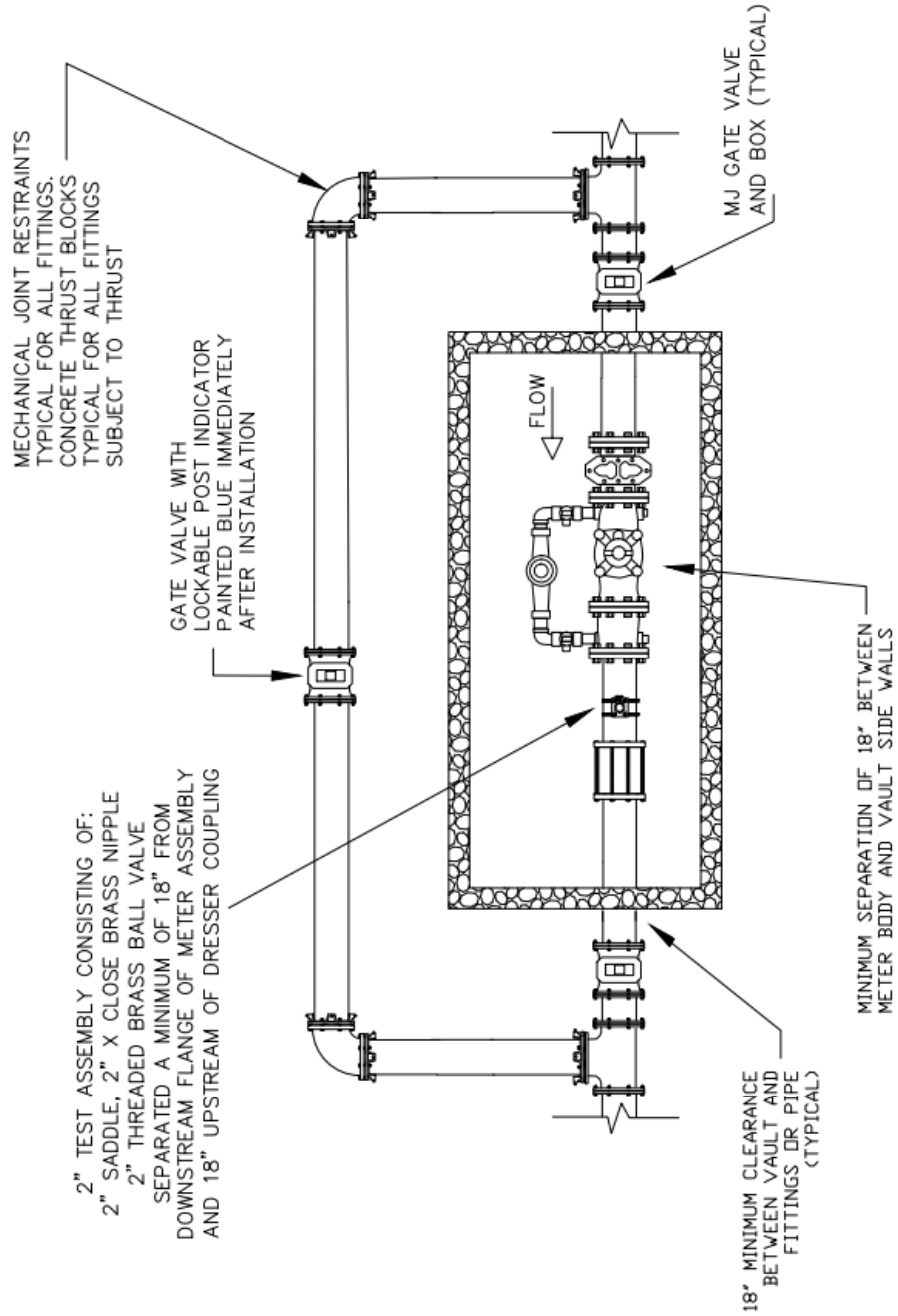


\*NOTE: ONLY PRECAST CONCRETE VAULTS WILL BE ACCEPTED. POURED IN PLACE STRUCTURES ARE NOT ACCEPTABLE. ALL EXTERIOR MECHANICAL JOINT FITTINGS SUBJECT TO THRUST SHALL BE RESTRAINED WITH MECHANICAL JOINT RESTRAINTS. SEE WHUD FOR METER SIZING AND SPECIFICATIONS. PROVIDE A MINIMUM OF 12 INCHES OF NO. 67 CRUSHED STONE BEDDING UNDER VAULT.

	CITY OF SPRINGFIELD WATER DEPT.	DATE : Jan 2021
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-05A

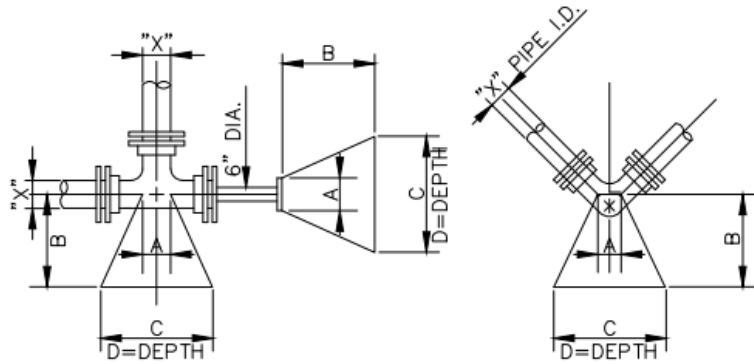
**STD-W-05B 4 INCH METER**

PRE-CAST CONCRETE VAULT METERS 4" AND LARGER  
PLAN VIEW - LID NOT SHOWN FOR CLARITY



	SPRINGFIELD WATER AND WASTEWATER	DATE : Jan 2021
		SCALE : N.T.S.
	STANDARD DETAILS	STD-W-05B

**STD-W-06 BLOCKING**



200 PSI TEST PRESSURE  
2000 PSF SOIL BEARING

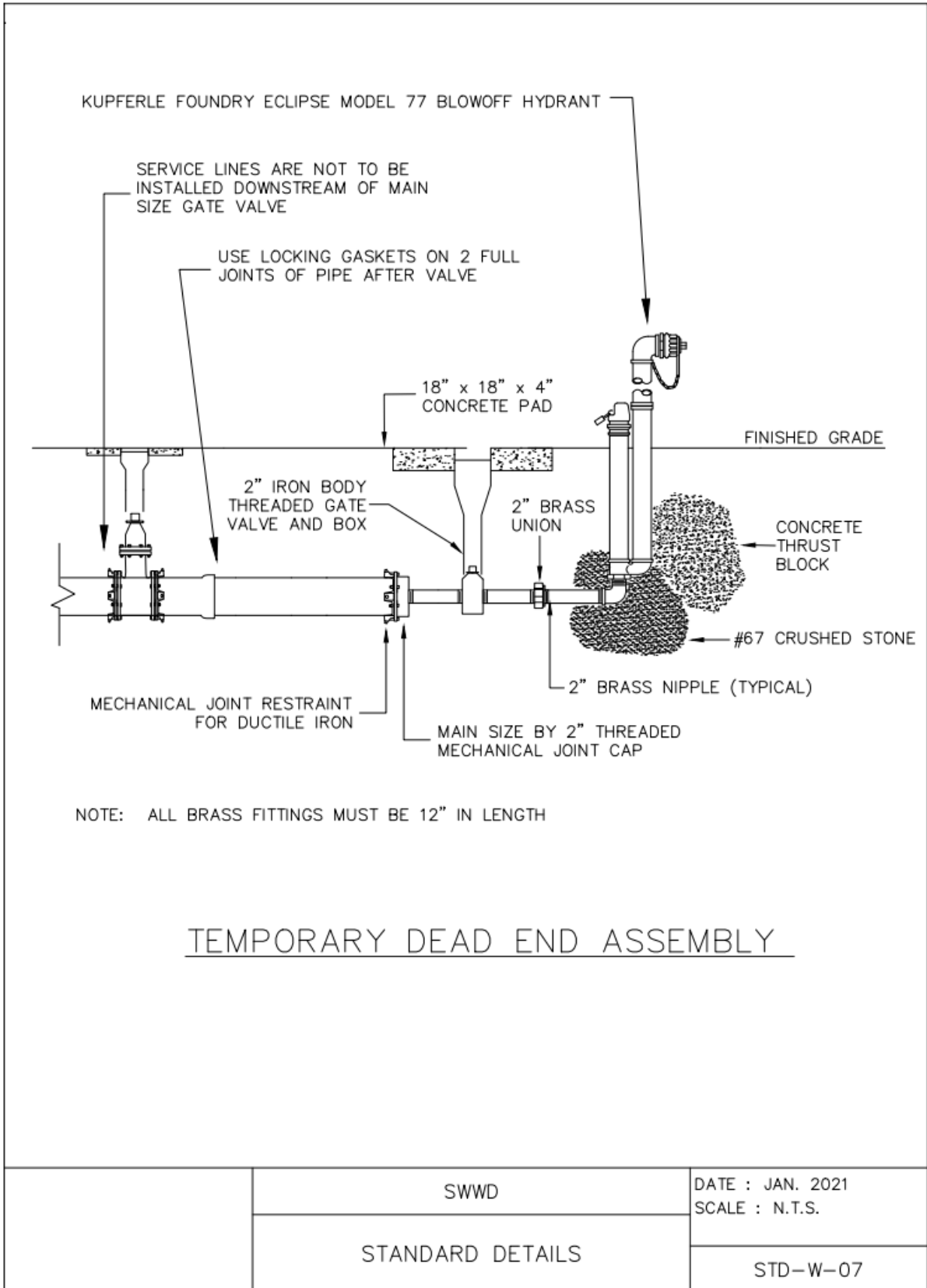
BLOCKING DIMENSIONS							
	X*	A	B	C	D		
DEAD END & TEES	10"	1'-0"	2'-6"	4'-0"	2'-6"		
	8"	0'-10"	2'-3"	3'-3"	2'-0"		
	6"	0'-8"	1'-6"	2'-6"	1'-6"		
BENDS	10"	1'-0"	3'-6"	5'-0"	2'-9"		
	90°	8"	0'-10"	2'-9"	4'-0"	2'-3"	
		6"	0'-8"	2'-0"	3'-0"	1'-9"	
		10"	1'-0"	1'-9"	3'-0"	2'-6"	
	45°	8"	0'-10"	1'-6"	2'-6"	2'-0"	
		6"	0'-8"	1'-3"	2'-0"	1'-6"	
		10"	1'-0"	1'-4"	2'-6"	1'-6"	
	1 1/2"	8"	0'-10"	1'-0"	2'-0"	1'-3"	
		6"	0'-8"	0'-9"	1'-6"	1'-0"	
		1 1/4"	10"	1'-0"	0'-6"	1'-6"	1'-3"
			8"	0'-10"	0'-6"	1'-4"	1'-0"
			6"	0'-8"	0'-6"	1'-0"	0'-9"

X\* = DIAMETER OF PIPE TO BE BLOCKED

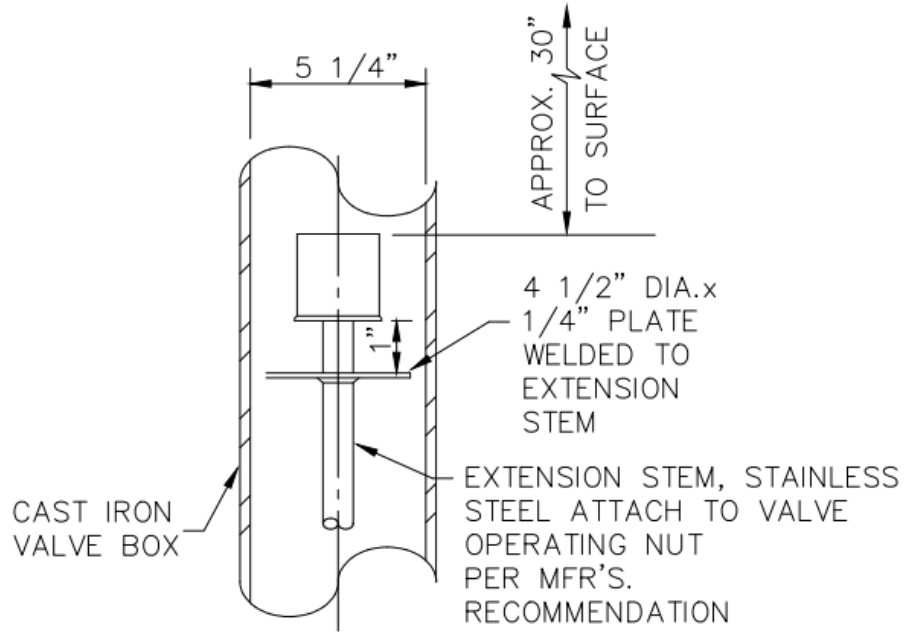
TYPICAL BLOCKING DETAIL

	SWWD	DATE : Jan 2021
	STANDARD DETAILS	SCALE : N.T.S.
		STD-W-06

**STD-W-07 DEAD END**



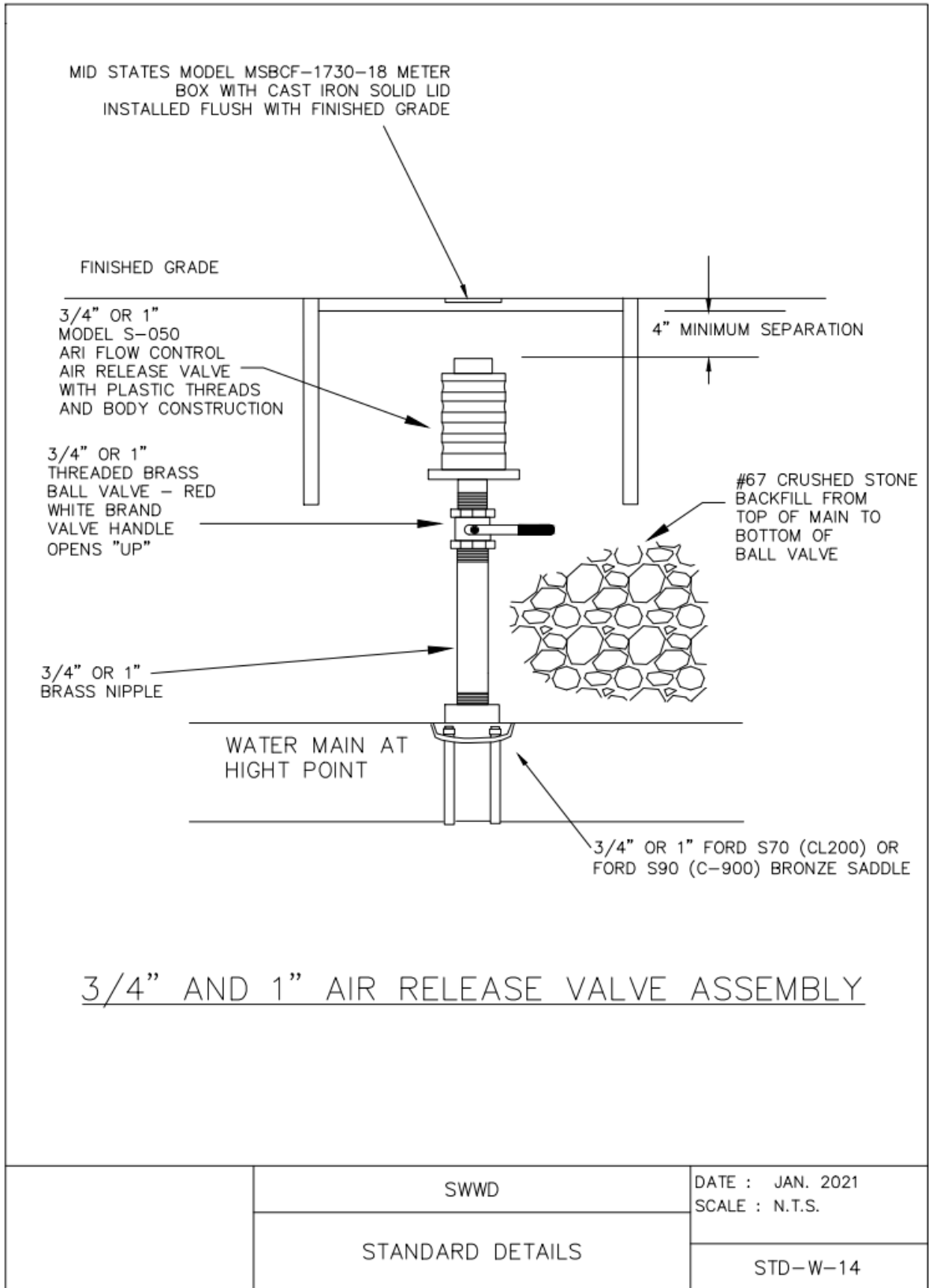
**STD-W-13 EXTENSION STEM**



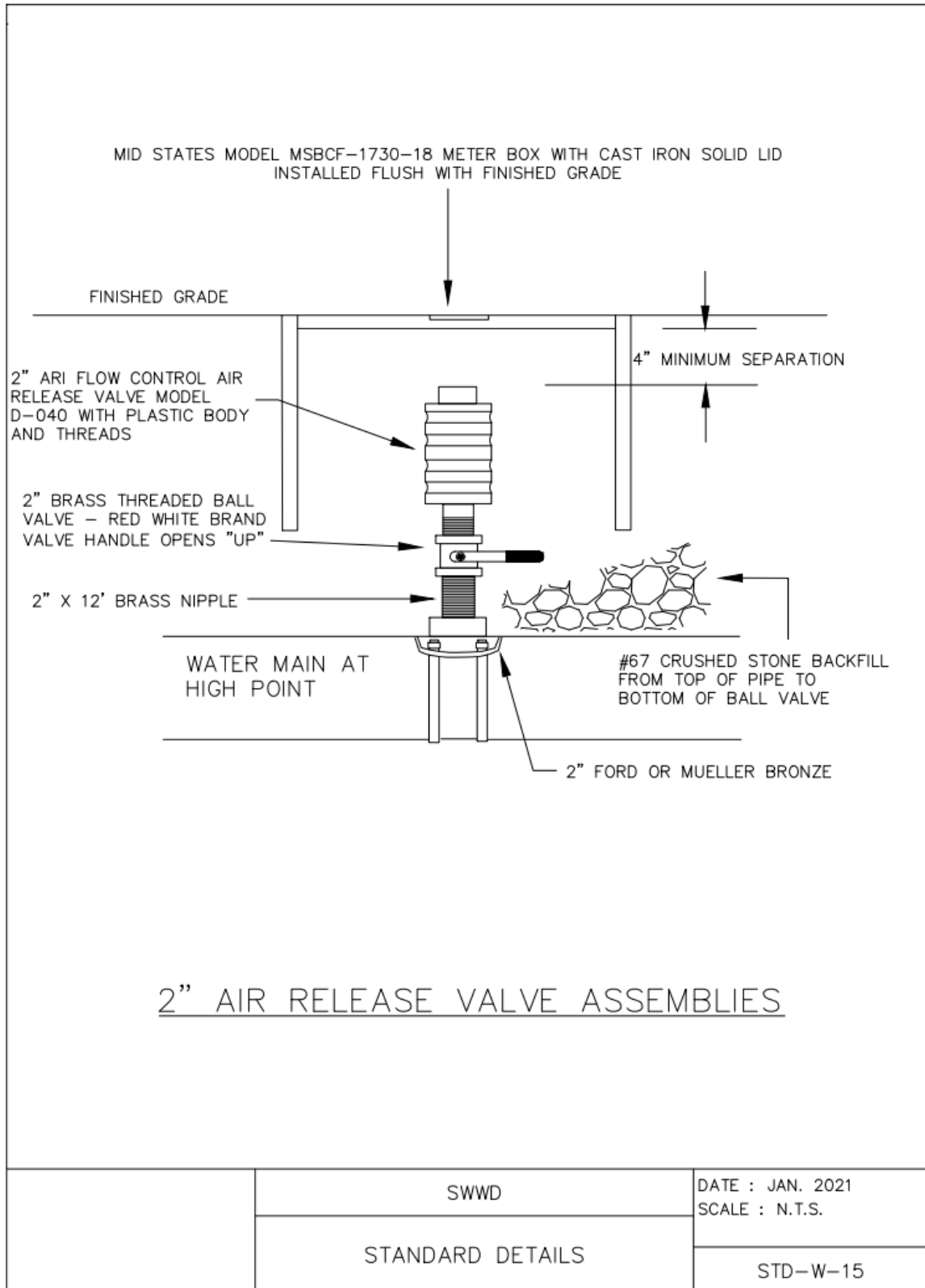
EXTENSION STEM  
DETAIL

	SWWD	DATE : JAN. 2021 SCALE : N.T.S.
	STANDARD DETAILS	STD-W-13

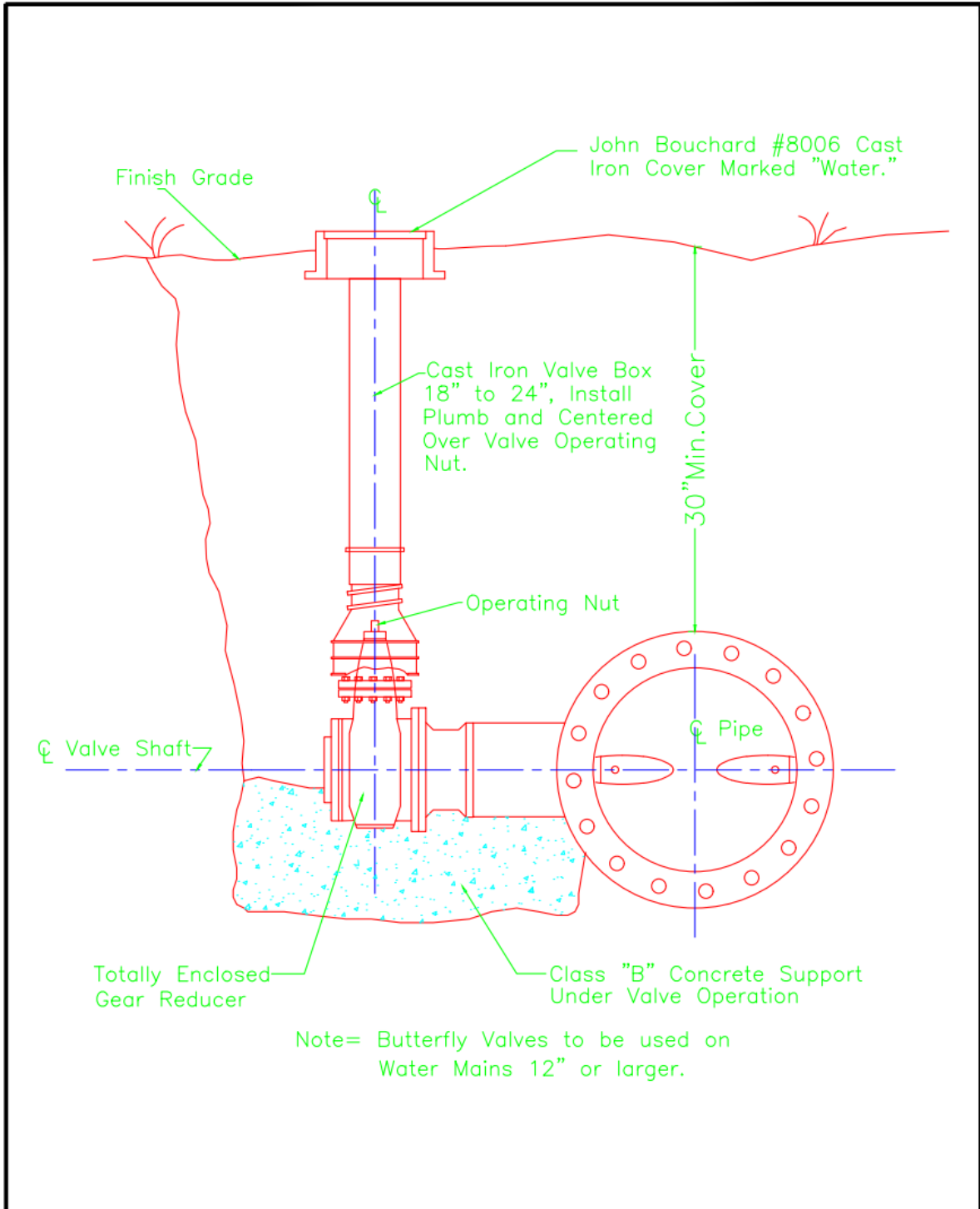
**STD-W-14 AIR RELEASE**



**STD-W-15 2 INCH AIR RELEASE**



**WD-2 BUTTERFLY**



Note= Butterfly Valves to be used on Water Mains 12" or larger.

SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

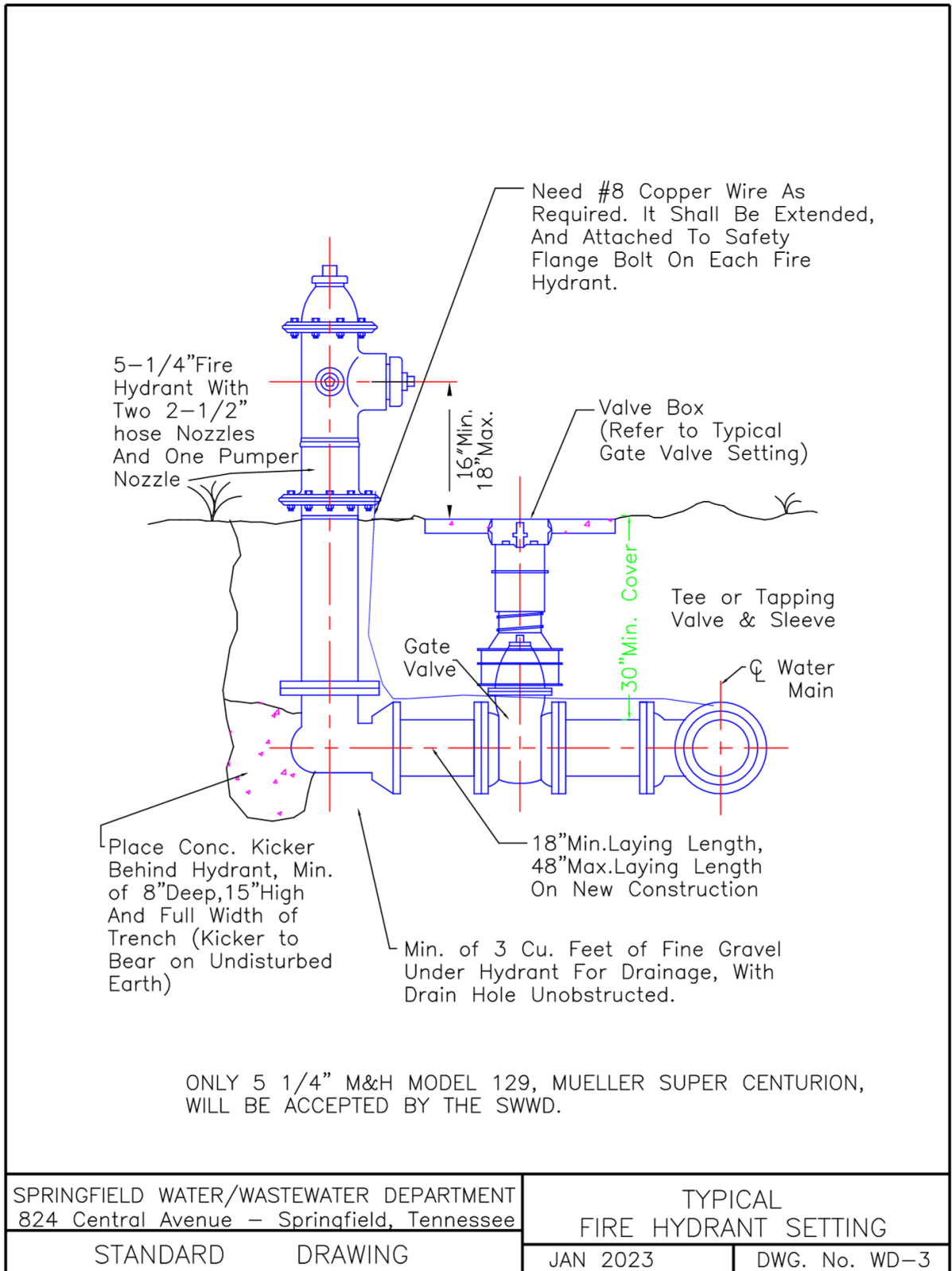
TYPICAL SETTING FOR  
BURIED BUTTERFLY VALVE

STANDARD DRAWING

JAN, 2021

DWG. NO. WD-2

**WD-3 FIRE HYDRANT**

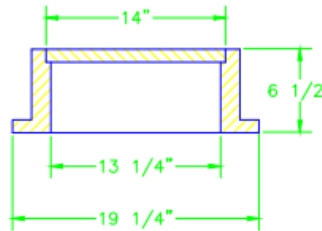
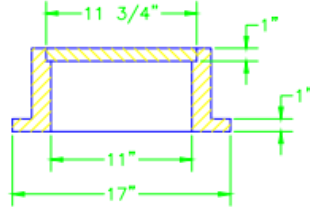
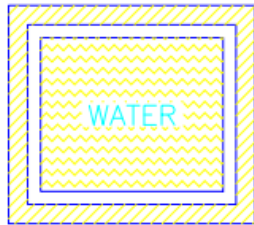


**WD-4 VALVE BOX**

JOHN BOUCHARD & SONS CO.

NO. 8006  
ROADWAY TYPE  
NASHVILLE STANDARD

NO. 8006  
FRAME \_\_\_\_\_ 150 LBS.  
COVER \_\_\_\_\_ 45 LBS.  
TOTAL \_\_\_\_\_ 195 LBS.



SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

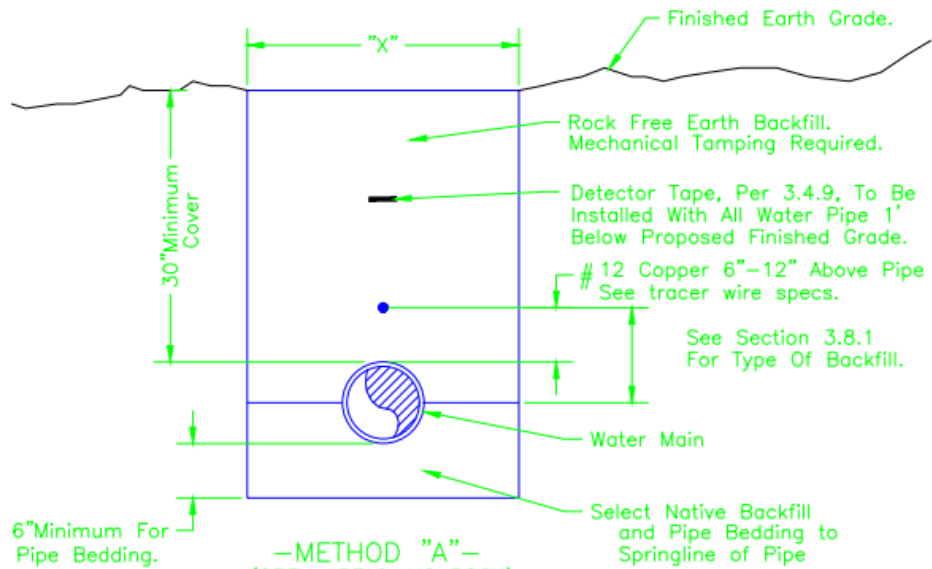
TYPICAL VALVE BOX

STANDARD DRAWING

JAN 2021

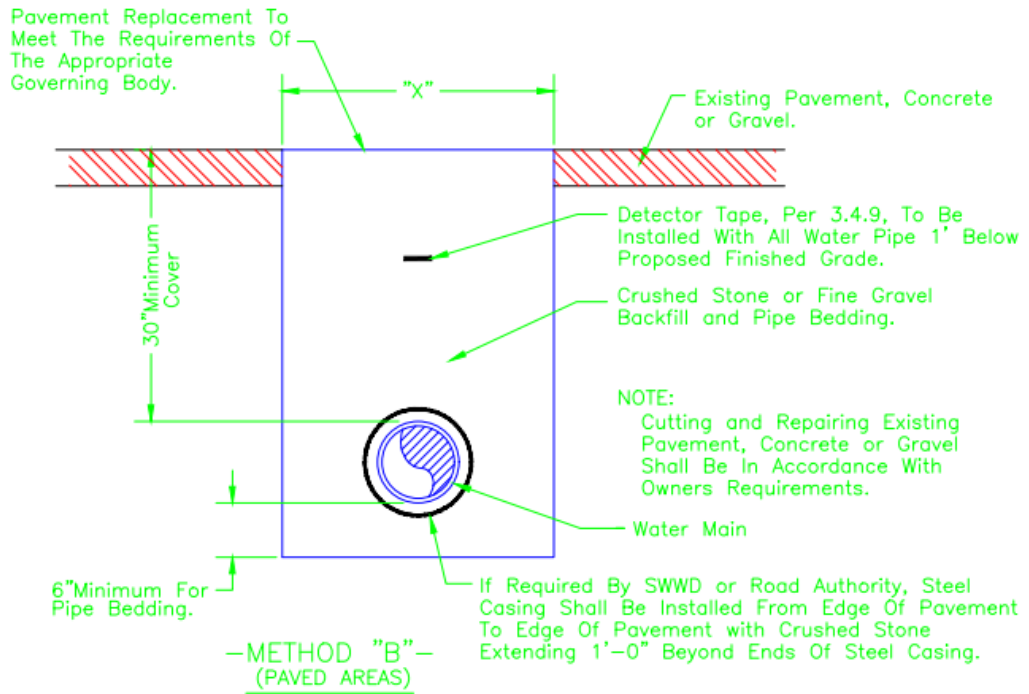
DWG. NO. WD-4

**WD-5 BACKFILL**



**-METHOD "A"-**  
(OPEN AREAS, NO ROCK)

TRENCH WIDTH	
PIPE SIZE	BUCKET WIDTH-X
4" Thru 12"	30"
14" Thru 18"	36"
20" Thru 24"	42"
26" Thru 36"	54"



SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue - Springfield, Tennessee

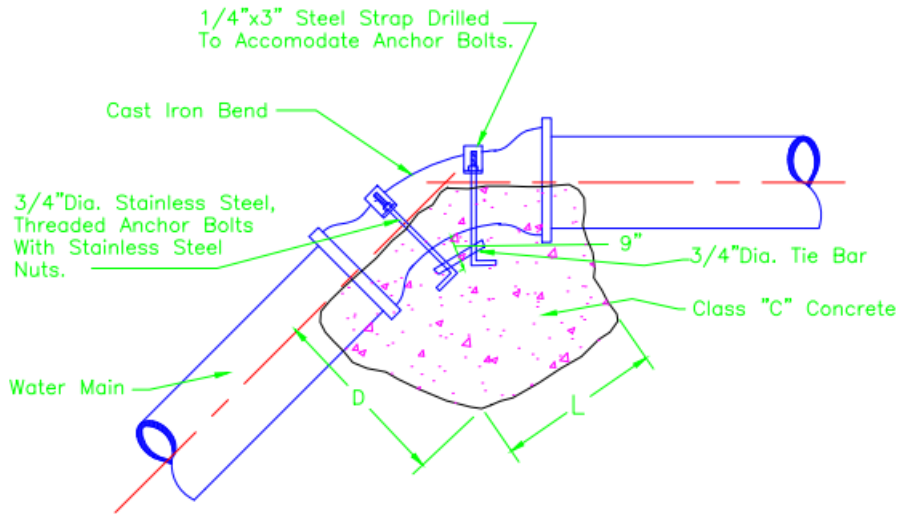
TYPICAL  
BACKFILL AND BEDDING METHODS

STANDARD DRAWING

JAN 2021

DWG. NO. WD-5

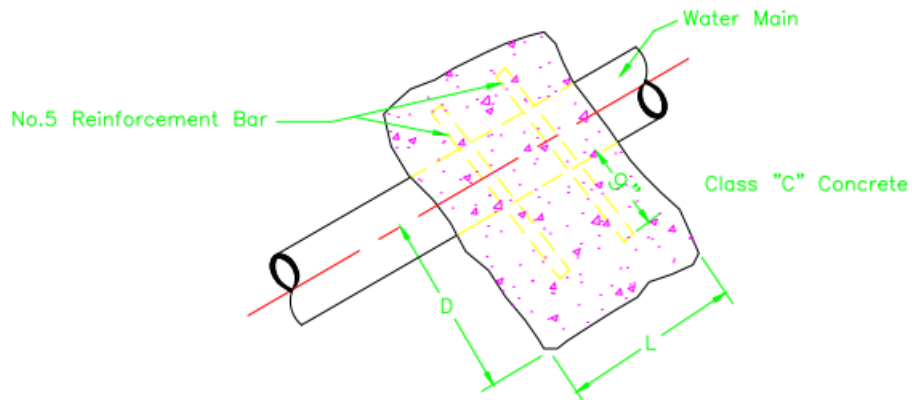
**WD-6 ANCHOR BLOCKS**



VERTICAL BENDS

VERTICAL BEND & STRAIGHT PIPE							
SIZE	2"	3"	4"	6"	8"	10"	12"
"D"	10"	12"	12"	15"	15"	18"	18"
"L"	12"	18"	18"	24"	24"	30"	30"

NOTE: Anchors To Be Full Width Of Trench.  
Anchors Must Be Placed Against Undisturbed Earth.



STRAIGHT PIPE

SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

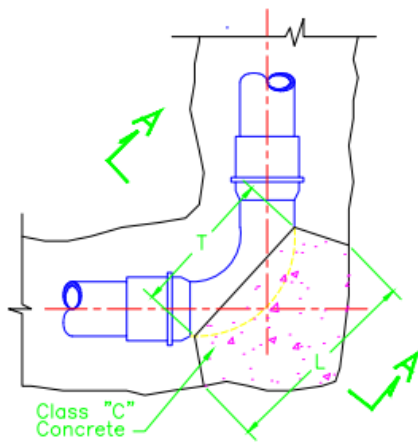
TYPICAL  
CONCRETE ANCHOR BLOCKS

STANDARD DRAWING

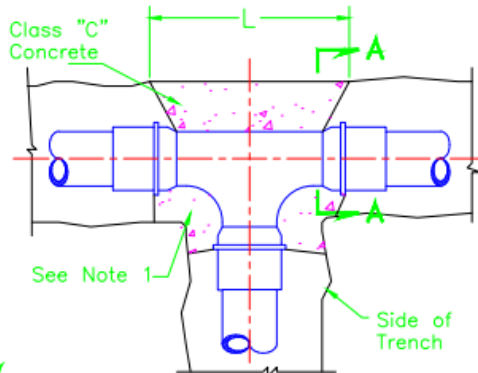
JAN, 2021

DWG. NO. WD-6

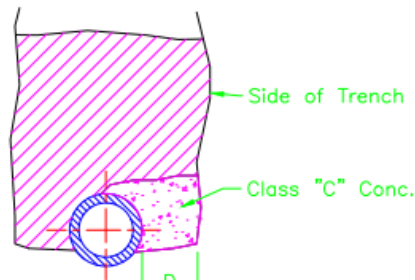
**WD-7 THRUST BLOCK**



45° & 90° BENDS



TEES



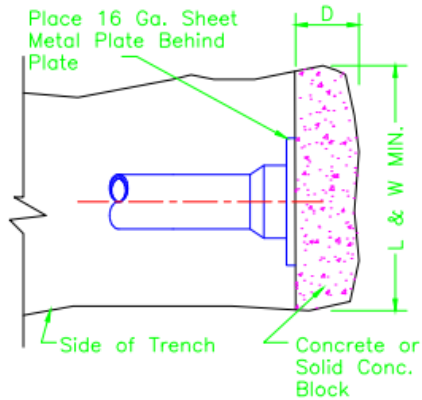
SECTION A-A

NOTE 1:

Restrained Joints Required:  
Concrete Thrust Blocks May  
Be Used In Addition To  
Restrained Joints, Per 3.3.1  
And 3.3.2.

NOTE 2:

Felt Paper Or Plastic Sheet  
Shall Be Installed Around Tee  
Before Kicker Is Poured  
To Protect Hardware.



PLUGS

PLUGS & TEES							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L&W	14"	16"	18"	20"	22"	24"	24"

(45°) EIGHTH BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L	12"	14"	16"	18"	20"	22"	24"
T	10"	12"	14"	16"	16"	18"	18"

(90°) QUARTER BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	8"	10"	12"	12"
L	15"	18"	21"	24"	27"	30"	34"
T	10"	12"	14"	16"	18"	20"	22"

SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

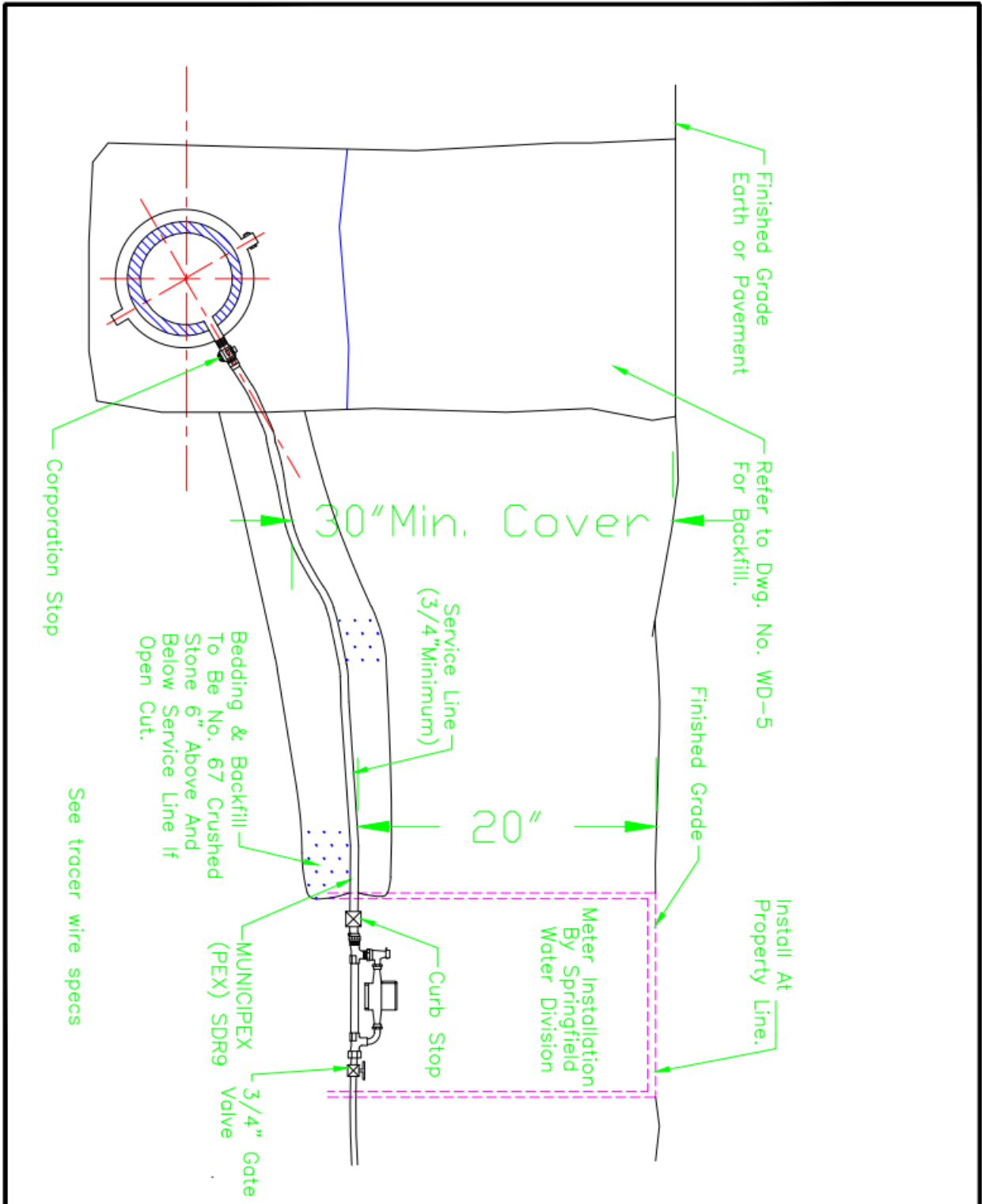
CONCRETE THRUST BLOCK

STANDARD DRAWING

JAN, 2021

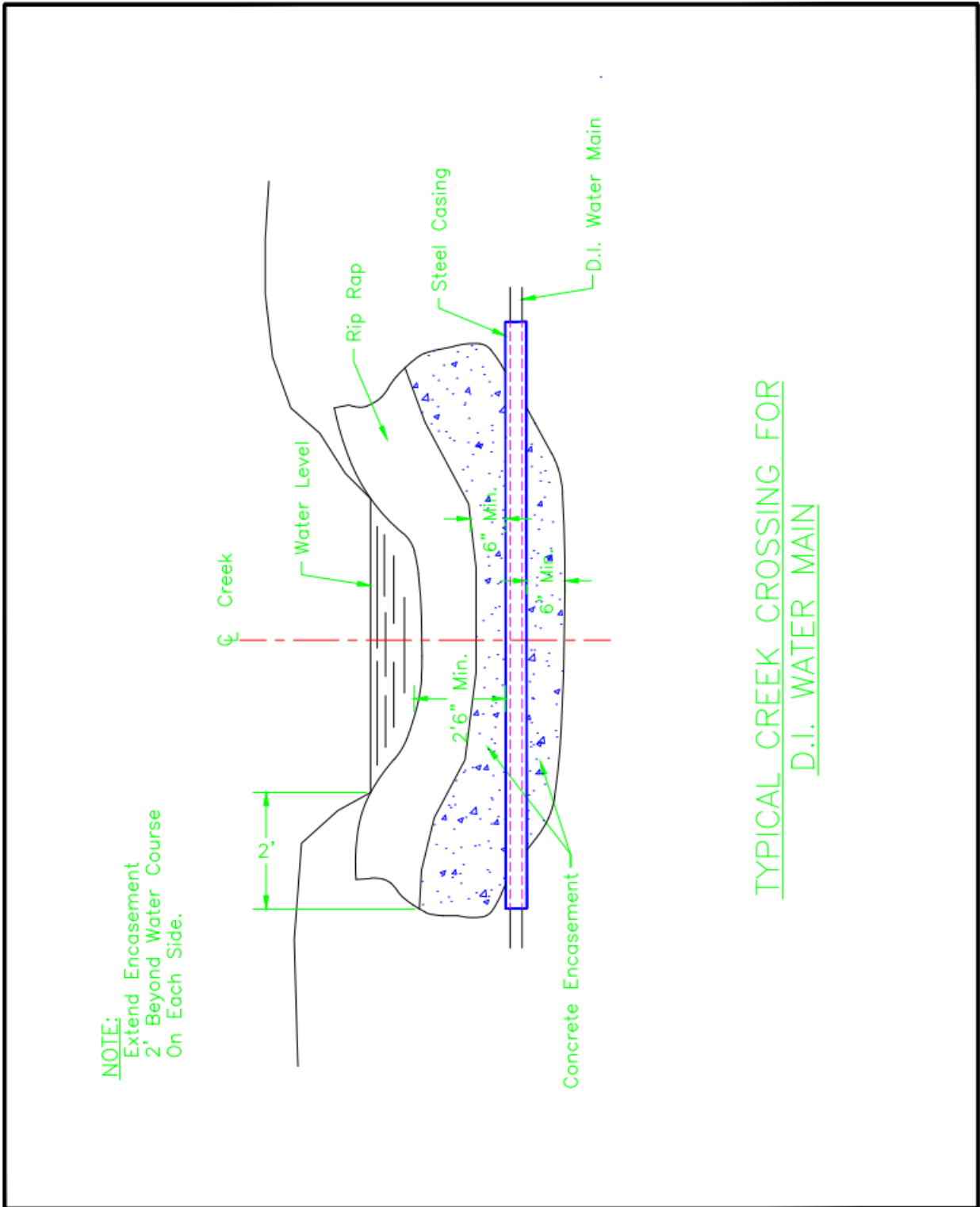
DWG. NO. WD-7

**WD-8 SERVICE**



SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		TYPICAL 3/4" AND 1" SERVICE CONNECTION	
STANDARD DRAWING		JAN, 2021	DWG. NO. WD-8

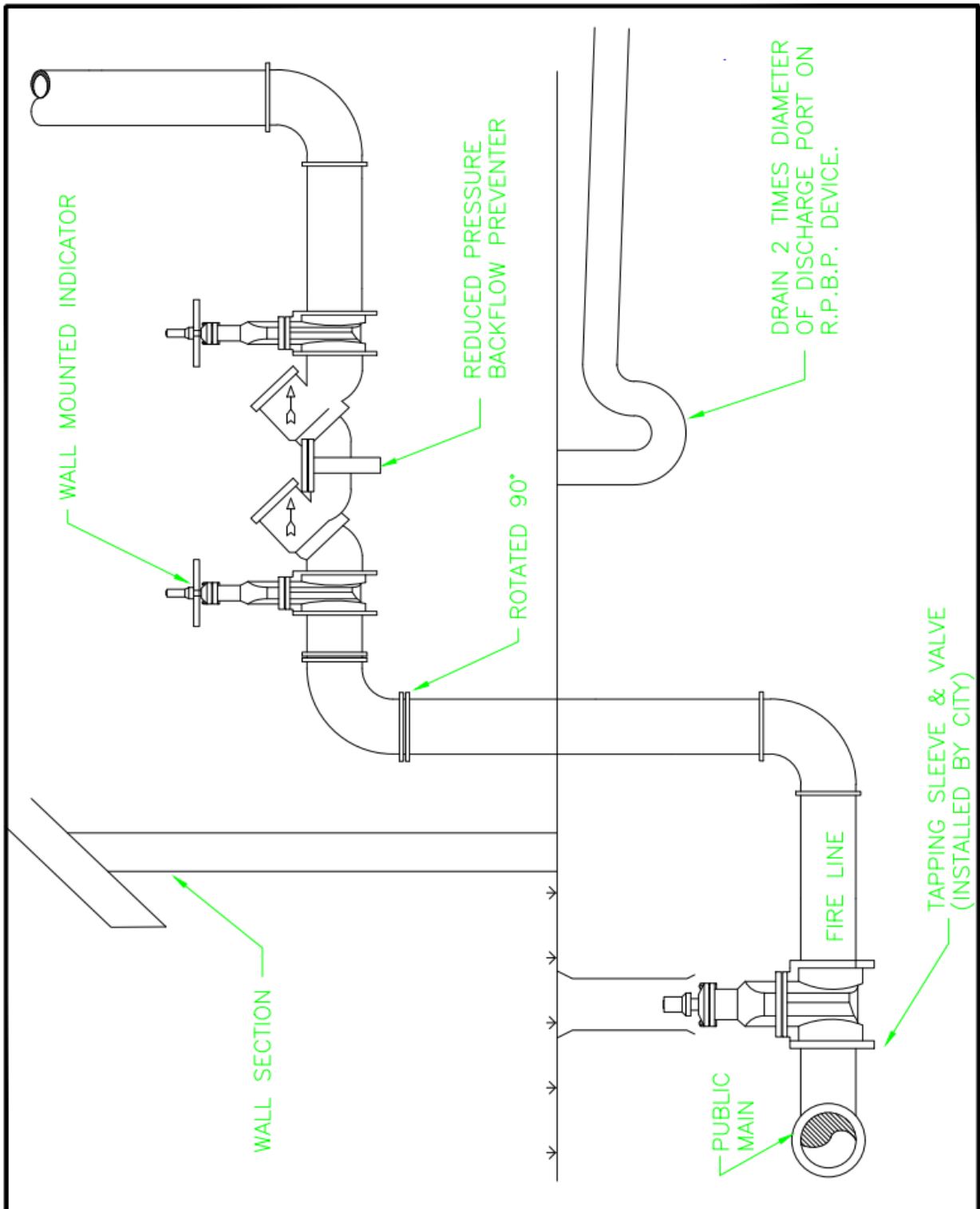
**WD-9 CASING**



TYPICAL CREEK CROSSING FOR  
 D.I. WATER MAIN

SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		WATER LINE ENCASEMENT	
STANDARD DRAWING		JAN, 2021	DWG. NO. WD-9

**WD-10 FIRE LINE**



SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

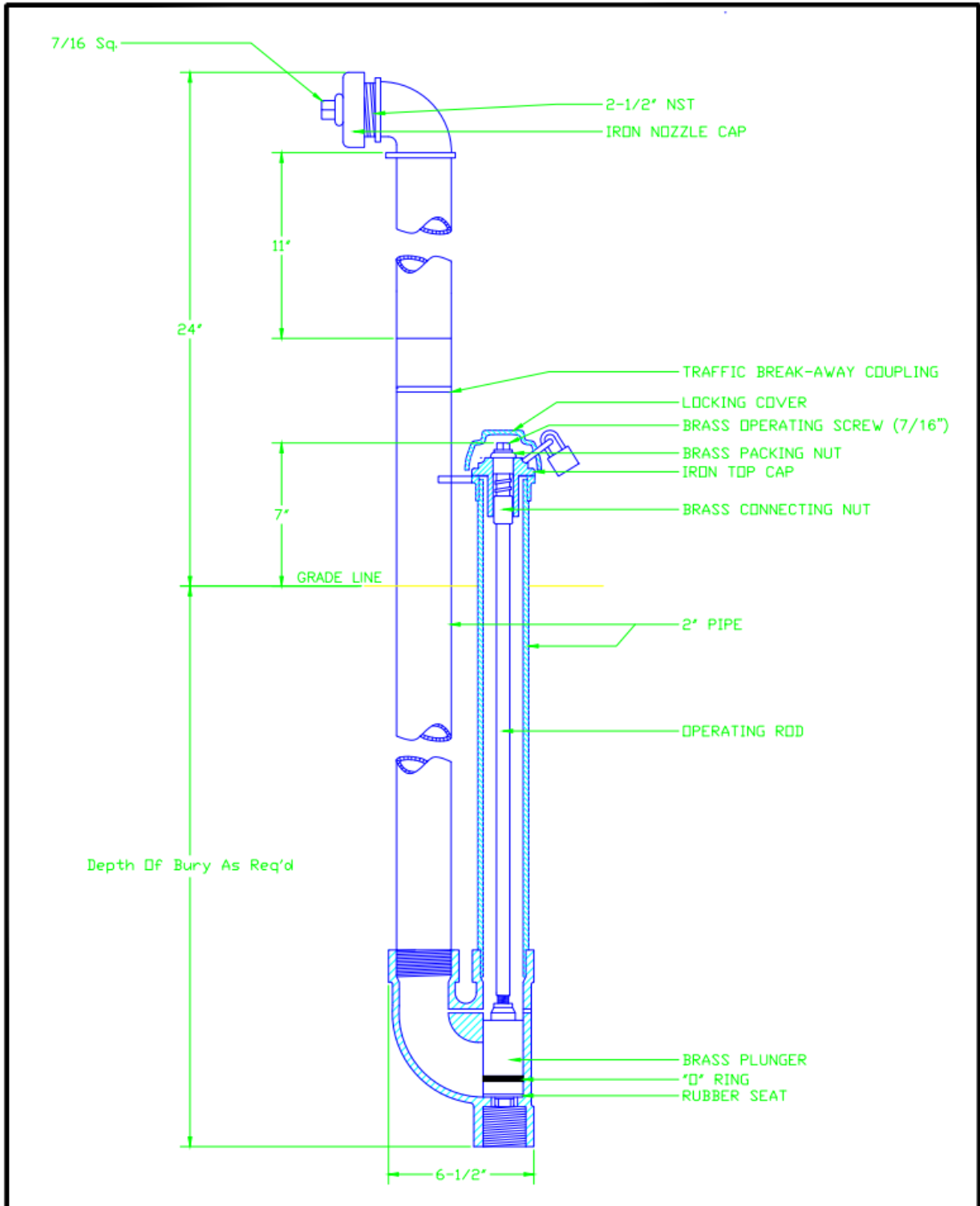
FIRE SPRINKLER  
CONNECTION DETAIL

STANDARD DRAWING

JAN, 2021

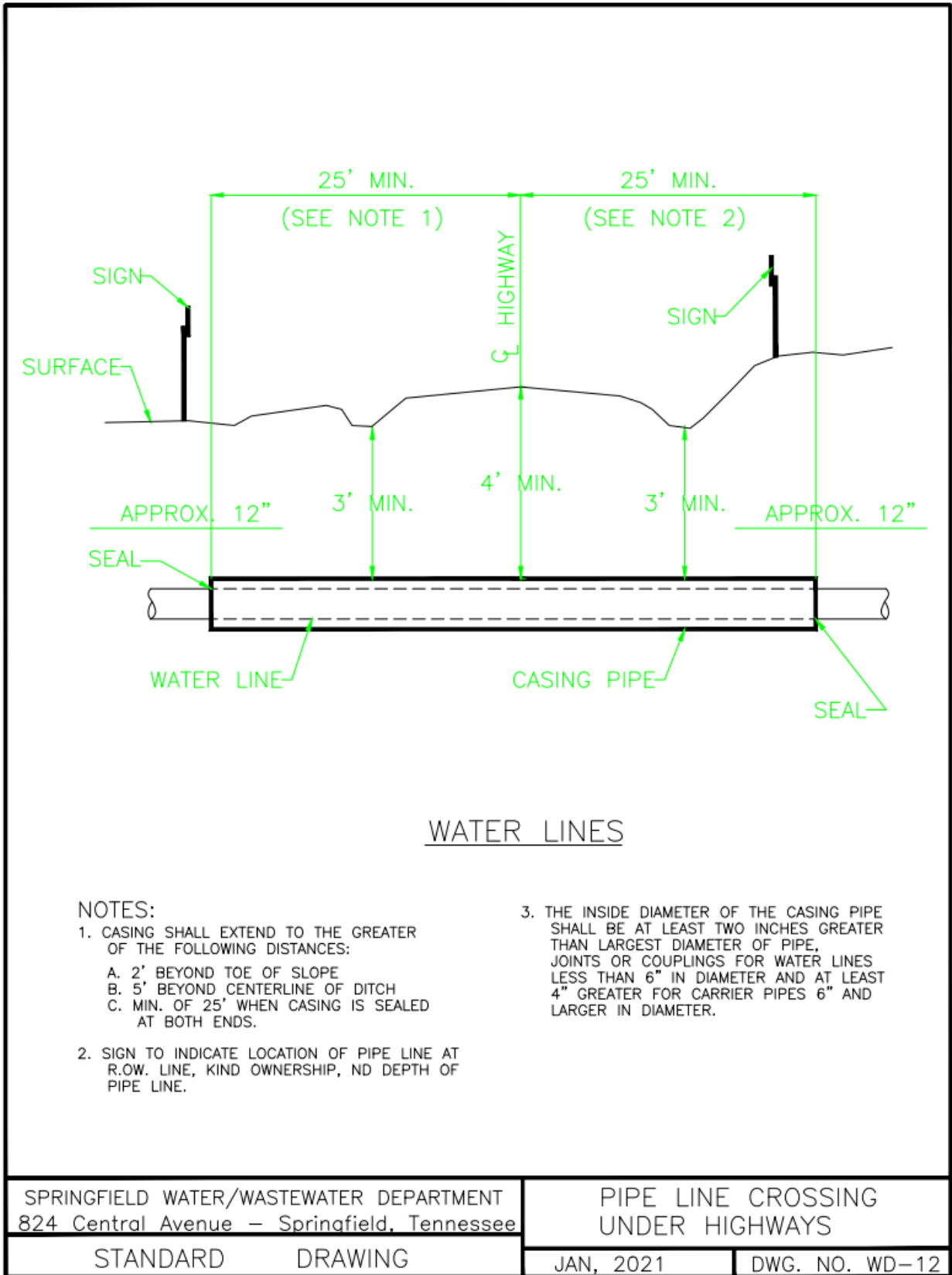
DWG. NO. WD-10

**WD-11 MANGUARD HYDRANT**

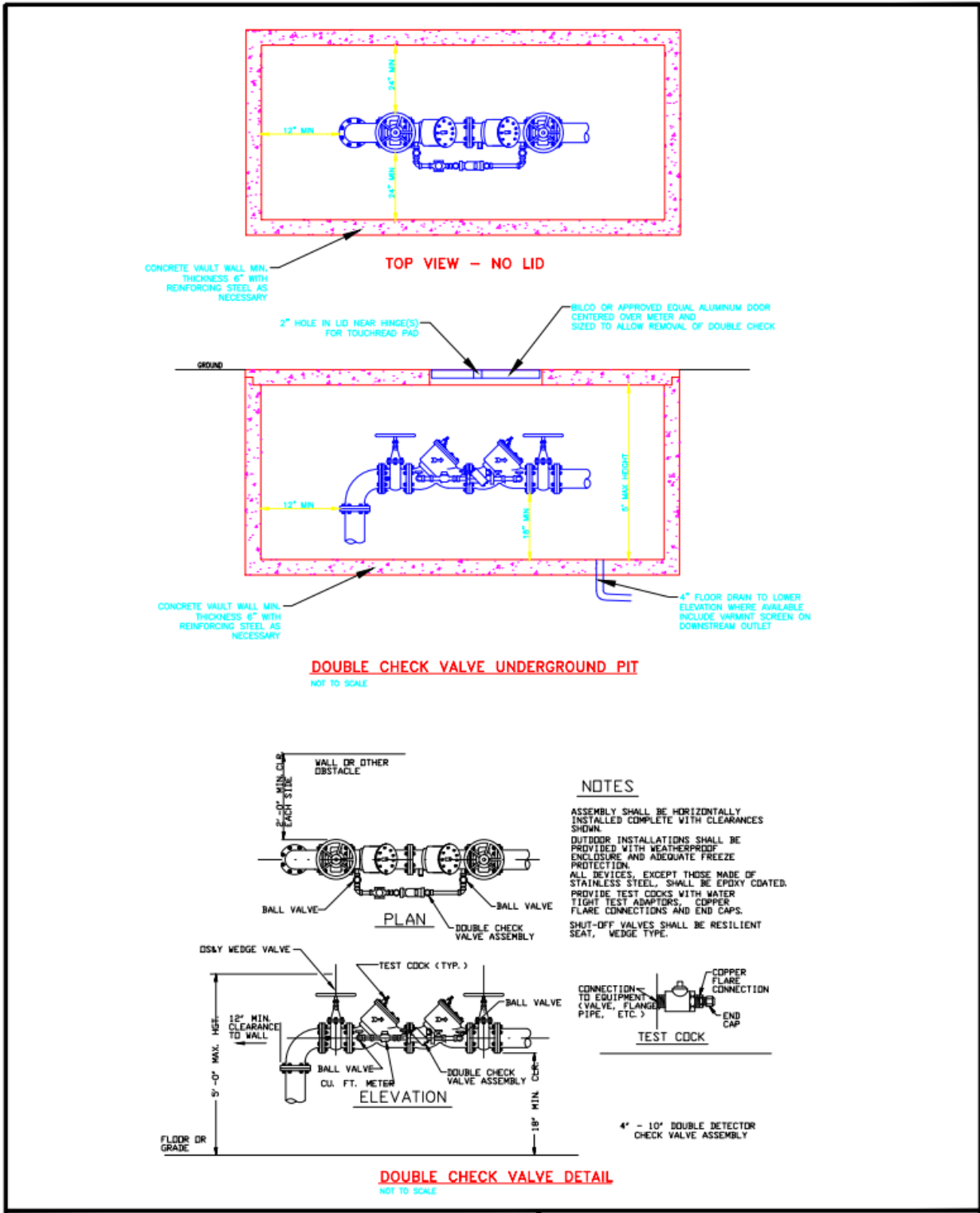


SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		MANGUARD KUPFERLE #77 HYDRANT	
STANDARD DRAWING		JAN, 2021	DWG. NO. WD-11

# WD-12 HIGHWAY CROSSING



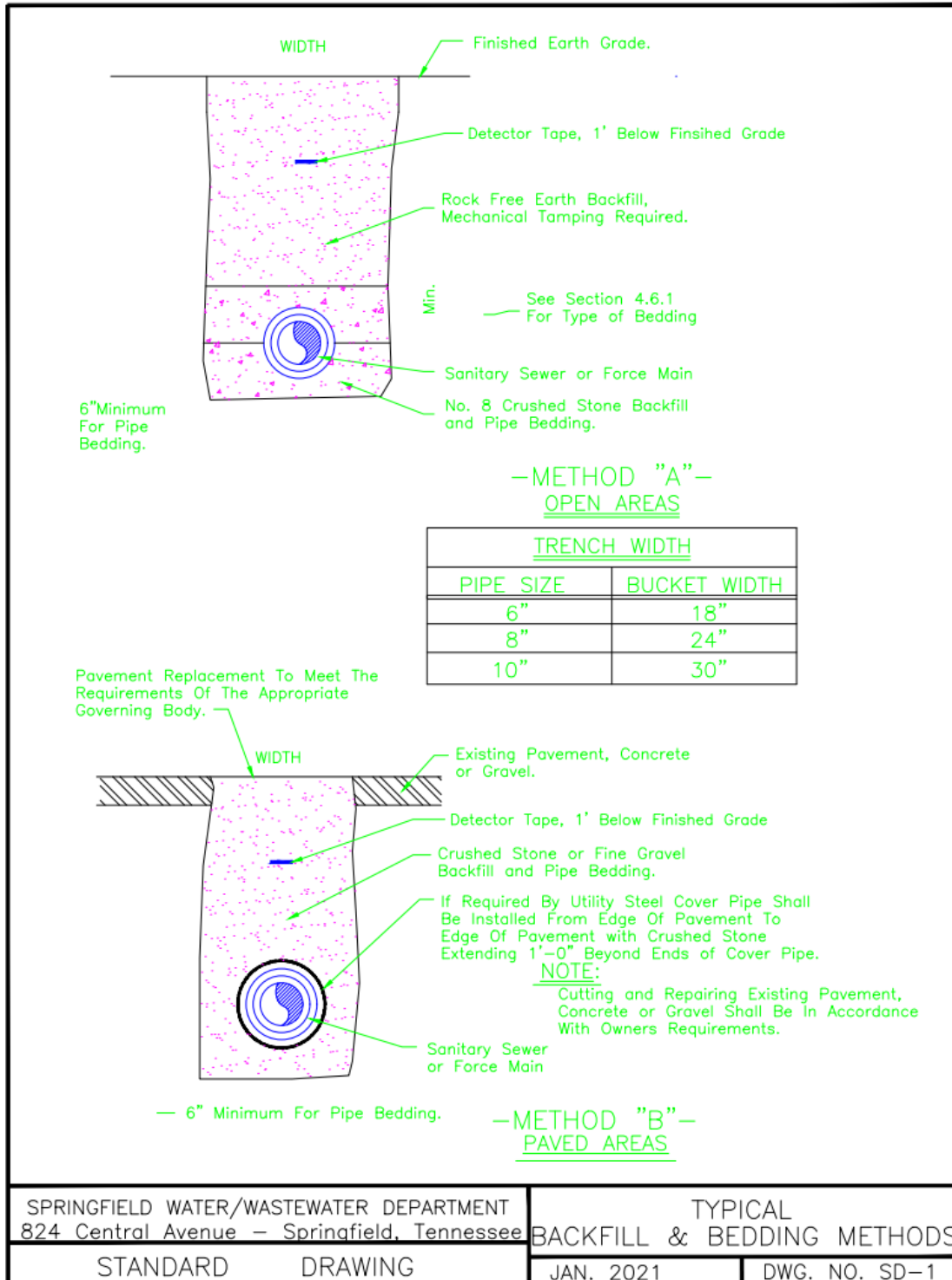
# WD-13 DOUBLE CHECK ASSEMBLY



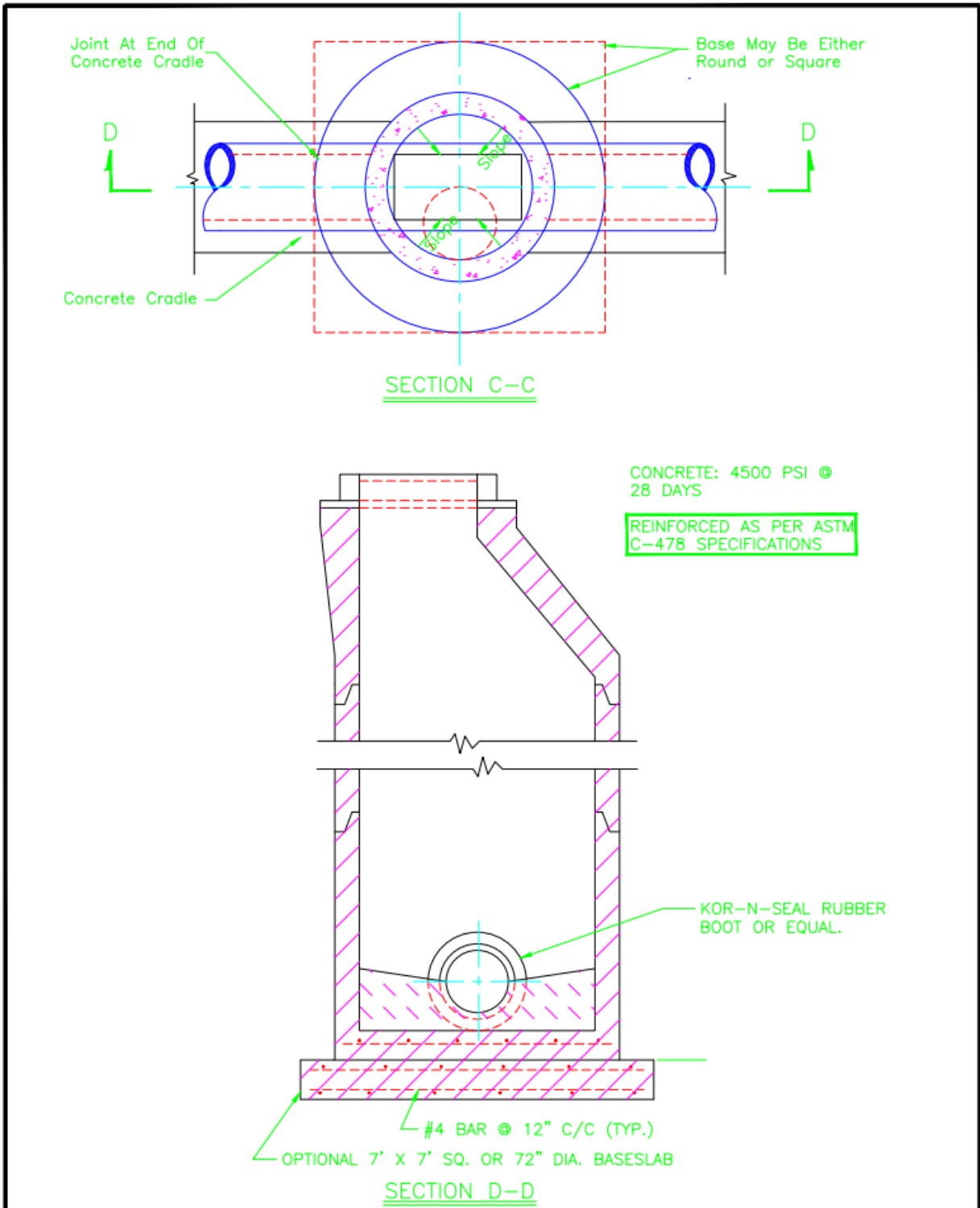
SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue - Springfield, Tennessee		DOUBLE CHECK ASSEMBLY	
STANDARD DRAWING		JAN, 2021	DWG. NO. WD-13

# SECTION 10 SEWER DRAWINGS

## SD-1 BACKFILL

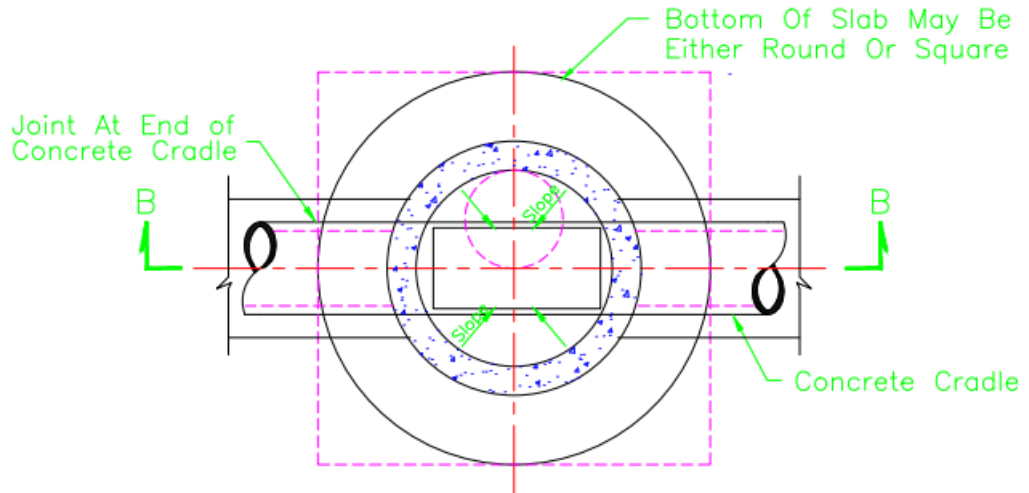


**SD-2 FLANGE MH**

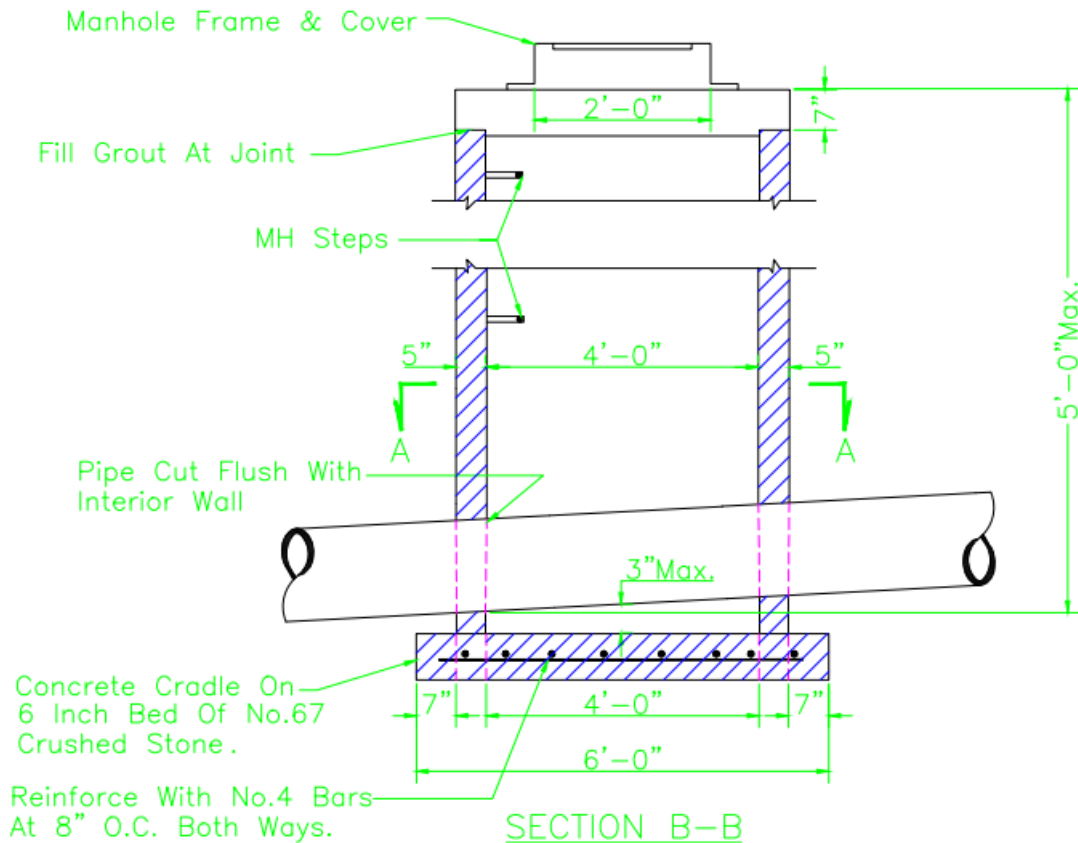


SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue - Springfield, Tennessee		TYPICAL STANDARD 4' DIA. FLANGED BASE MANHOLE	
STANDARD	DRAWING	2021	DWG. NO. SD-2

**SD-3 SHALLOW MH**



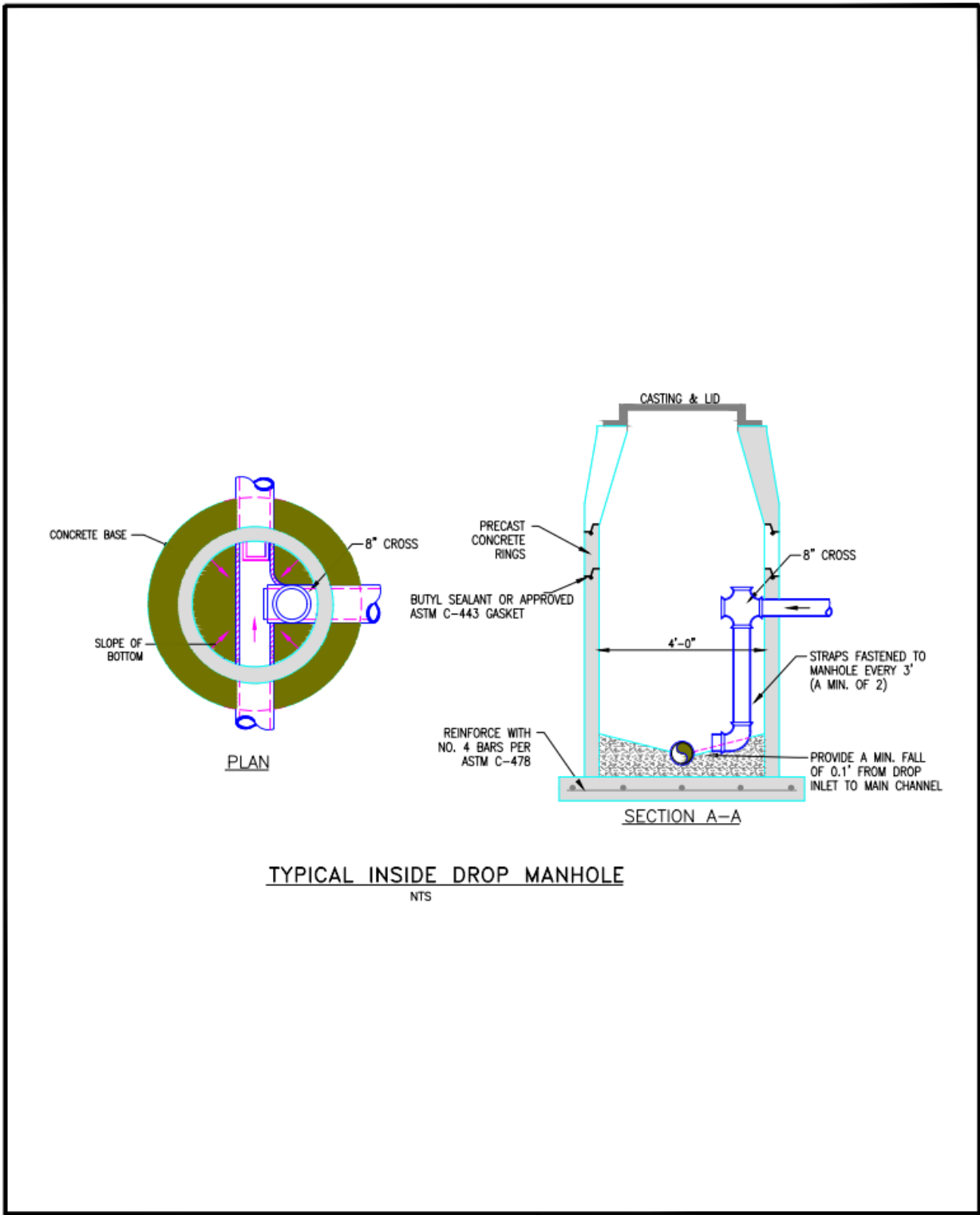
SECTION A-A



SECTION B-B

SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue - Springfield, Tennessee		TYPICAL SHALLOW MANHOLE	
STANDARD DRAWING		JAN 2021	DWG. NO. SD-3

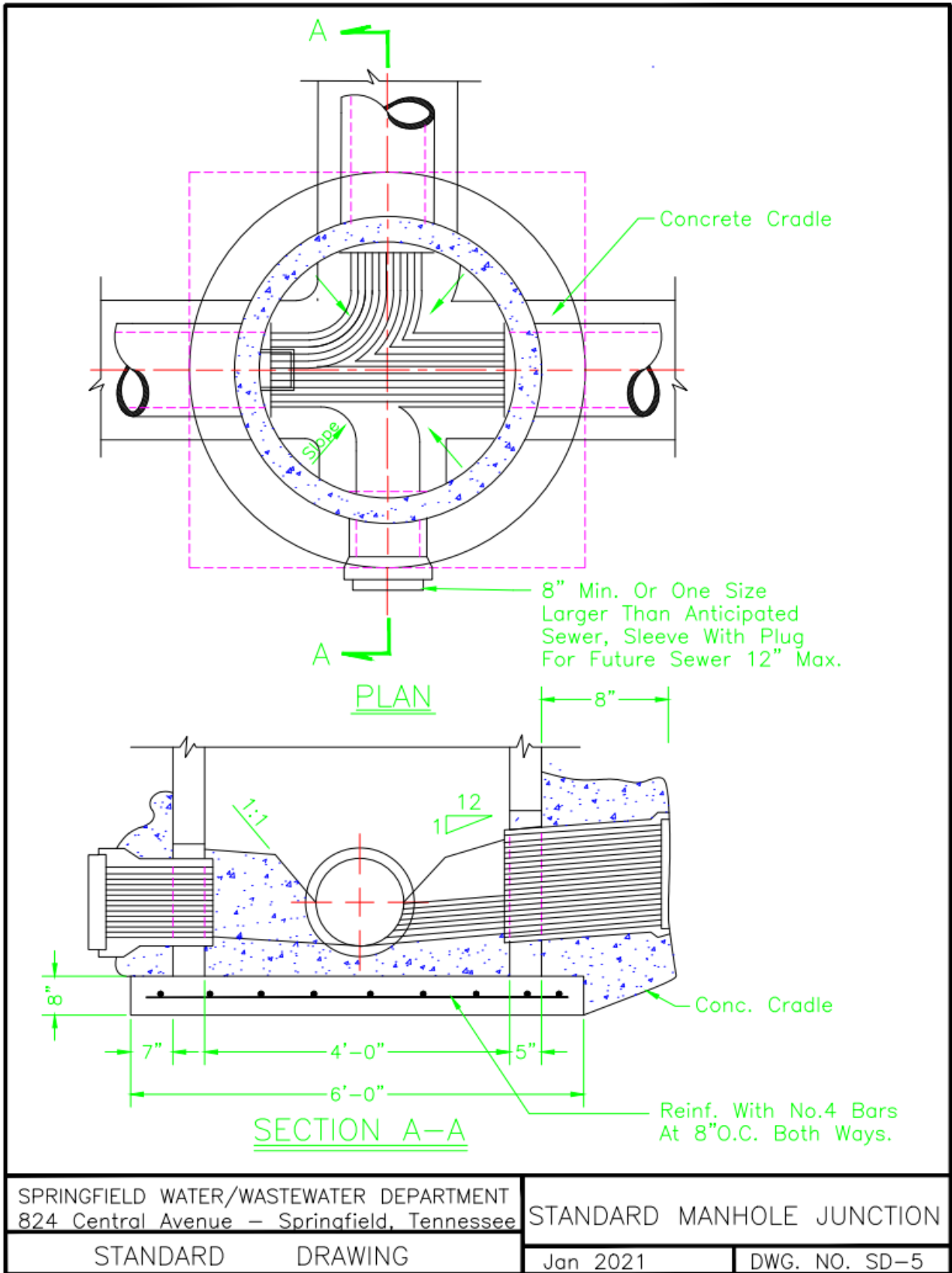
**SD-4 DROP MH**



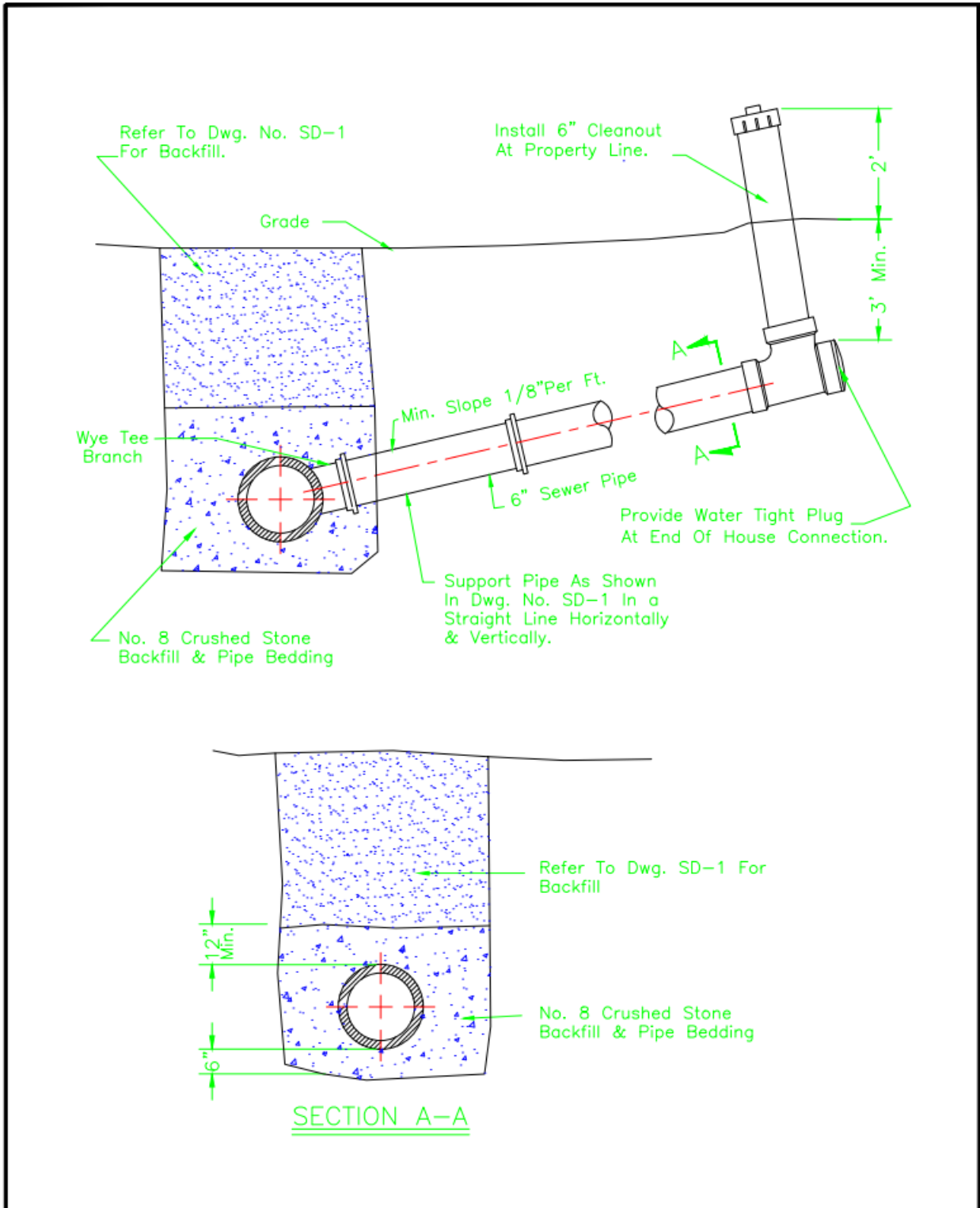
**TYPICAL INSIDE DROP MANHOLE**  
NTS

SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		TYPICAL INSIDE DROP MANHOLE	
STANDARD	DRAWING	2021	DWG. NO. SD-4

**SD-5 MH JUNCTION**

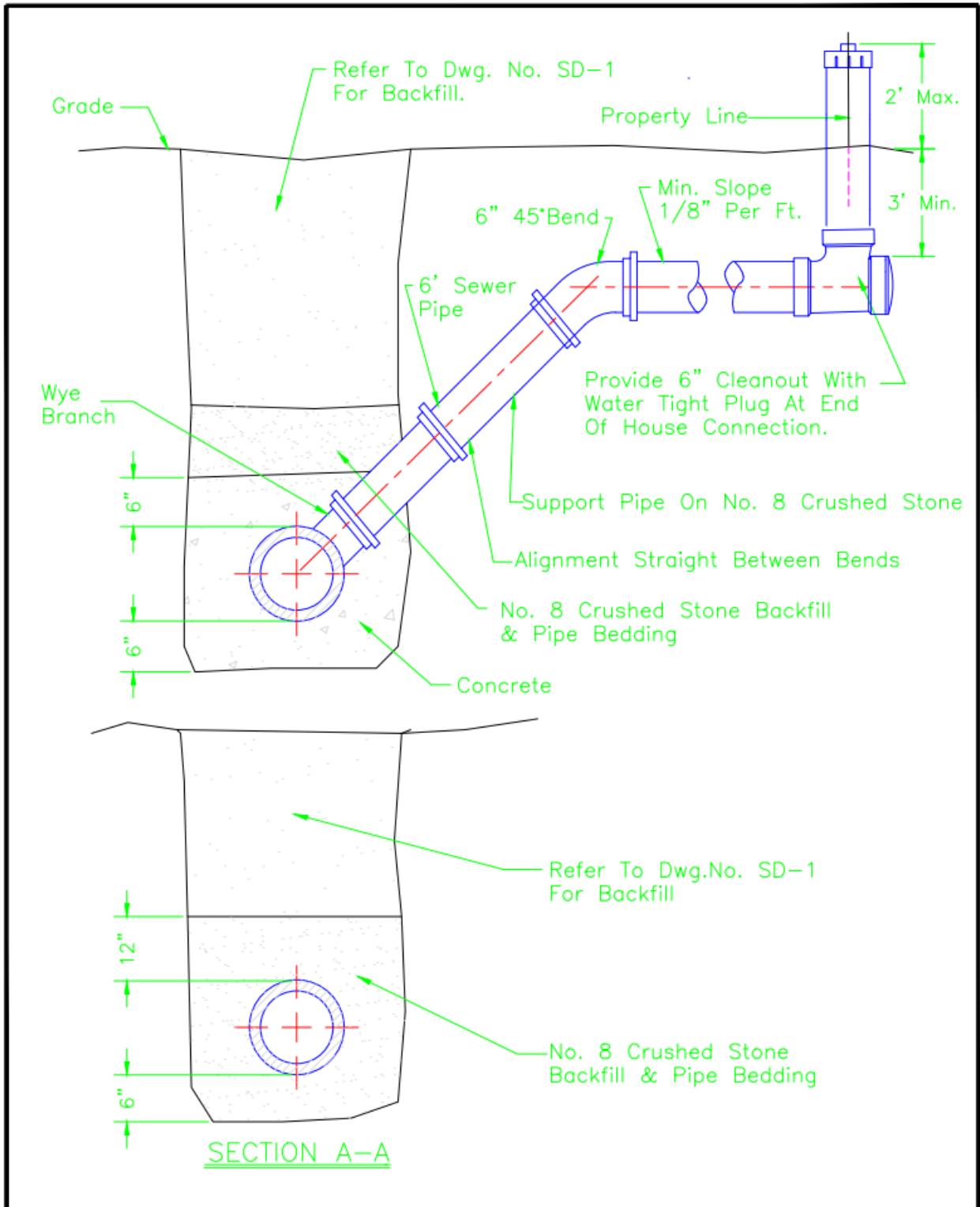


**SD-6 SHALLOW SERVICE CONNECTION**



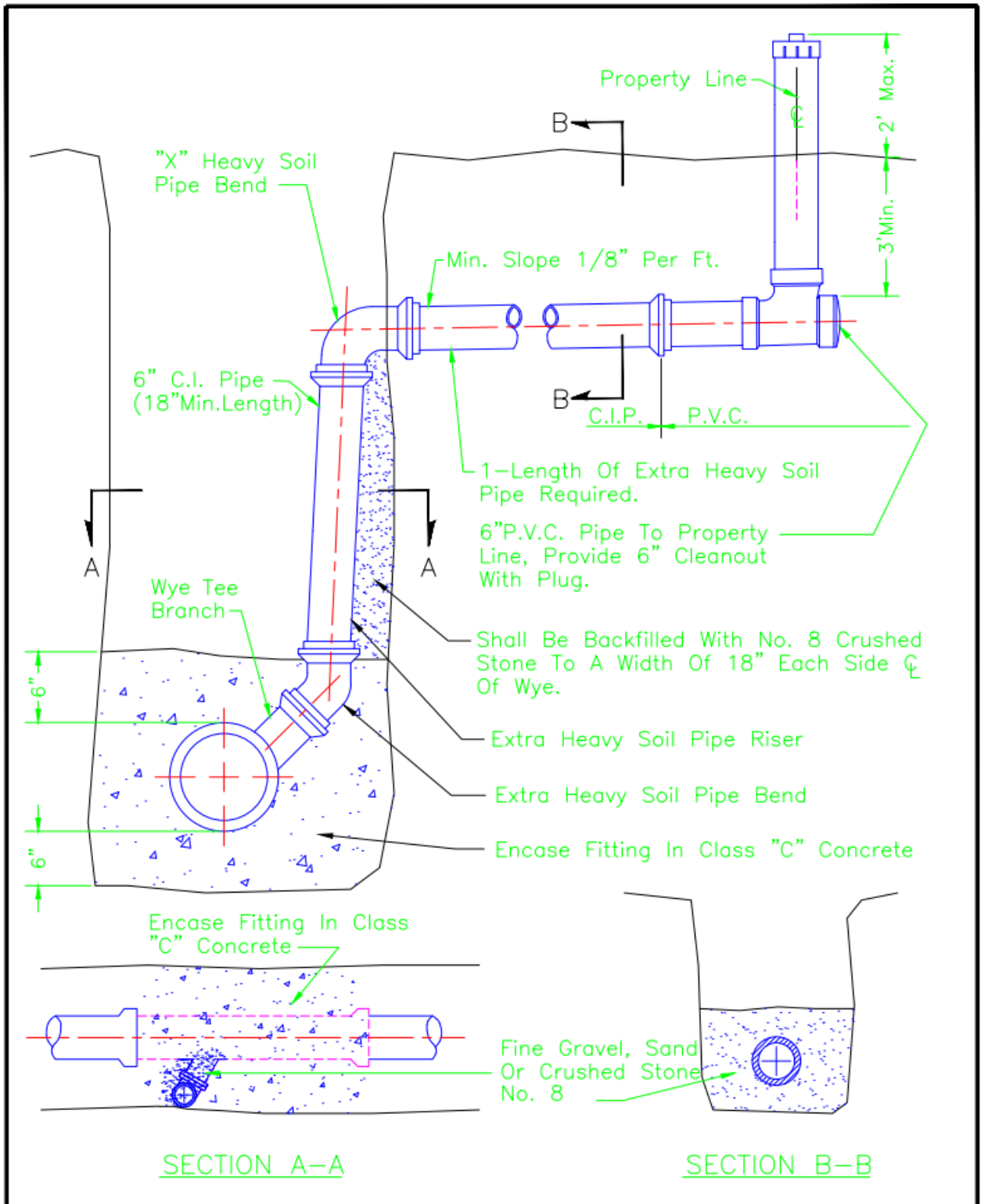
SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		SERVICE CONNECTION FOR SHALLOW SEWER IN EARTH OR ROCK	
STANDARD DRAWING		JAN, 2021	DWG. NO. SD-6

**SD-7 DEEP SERVICE CONNECTION**



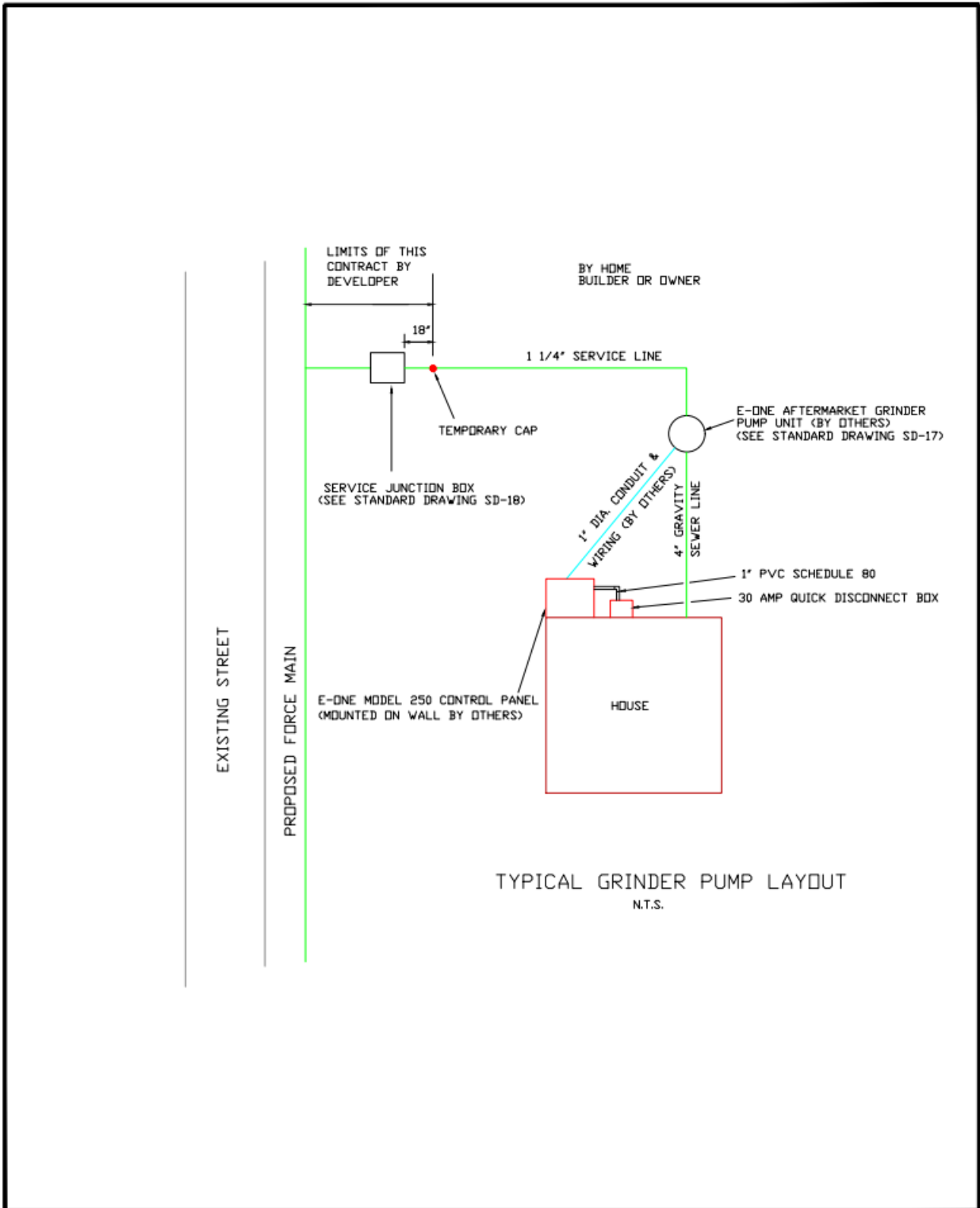
SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		SERVICE CONNECTION FOR DEEP SEWER IN EARTH	
STANDARD DRAWING		JAN, 2021	DWG. NO. SD-7

**SD-8 DEEP CONNECTION IN ROCK**



SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		SERVICE CONNECTION FOR DEEP SEWER IN ROCK	
STANDARD DRAWING		JAN, 2021	DWG. NO. SD-8

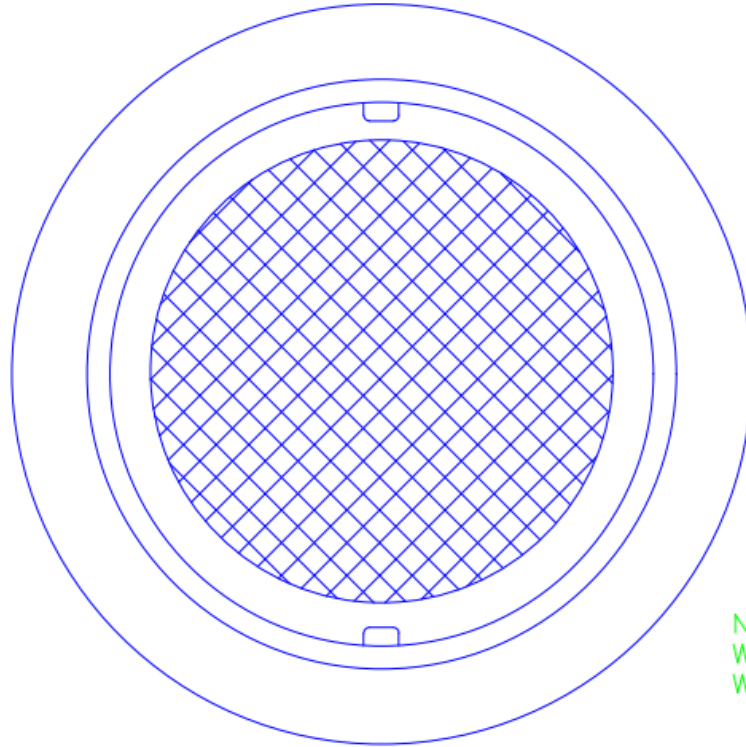
**SD-9 GRINDER PUMP**



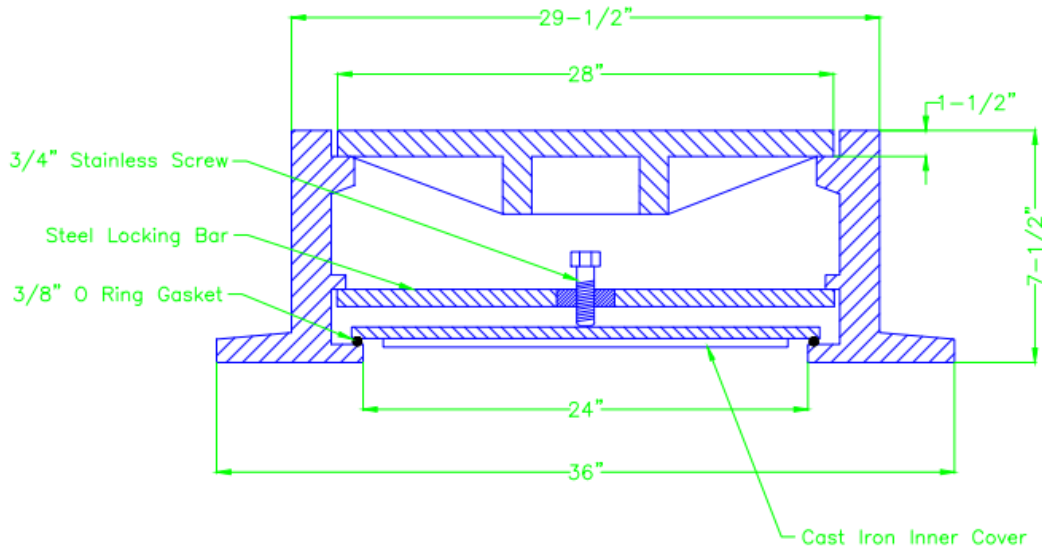
SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		GRNDER PUMP/SERVICE JUNCTION BOX DETAILS & LAYOUT	
STANDARD DRAWING		Jan 2021	DWG. NO. SD-9

**SD-10 WATER TIGHT COVER**

JOHN BOUCHARD NO. 1123



No. 1123  
Water Tight  
Weight 535 lbs.



SPRINGFIELD WATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

WATERTIGHT MANHOLE  
FRAME AND COVER

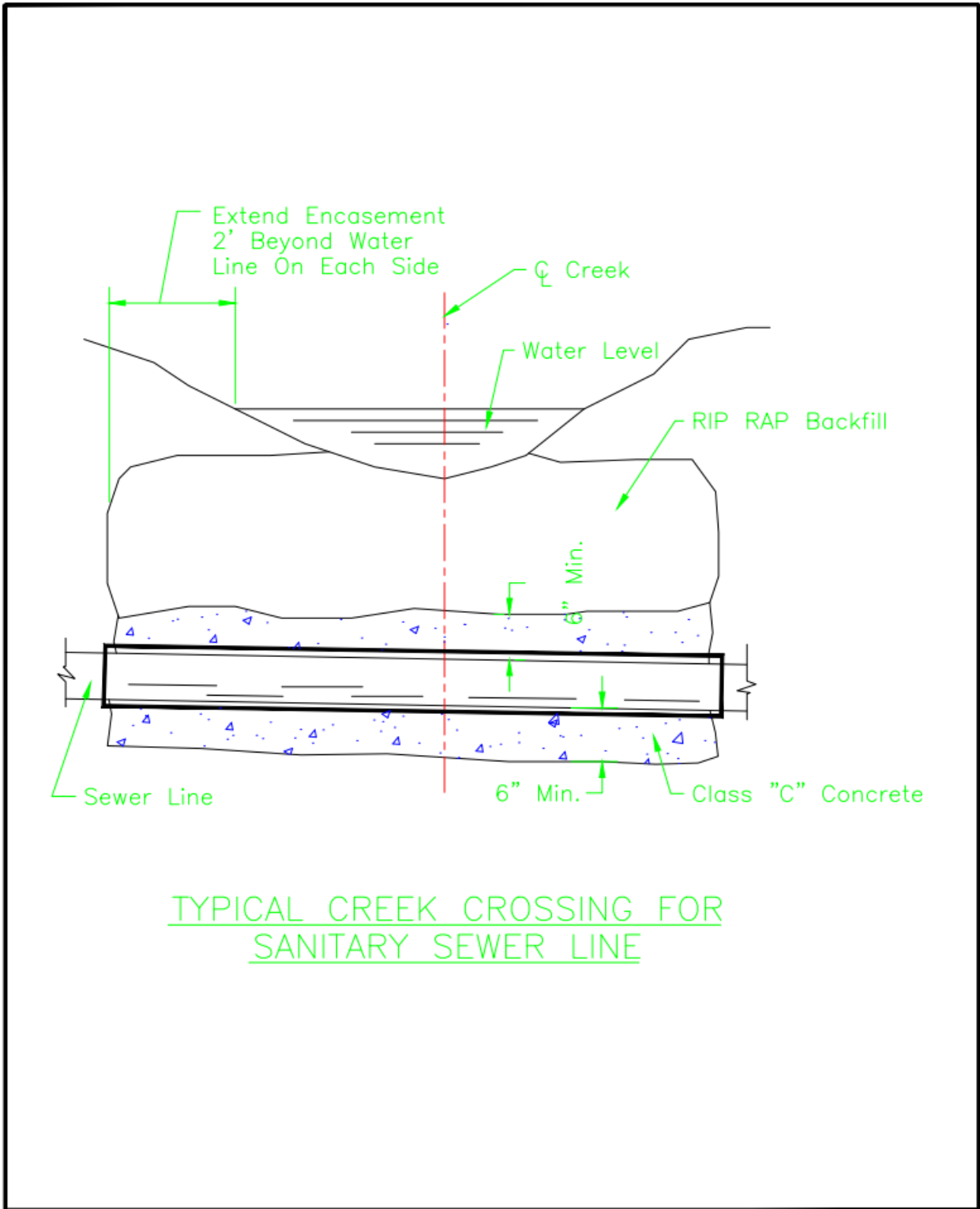
STANDARD DRAWING

JAN, 2021

DWG. NO. SD-10



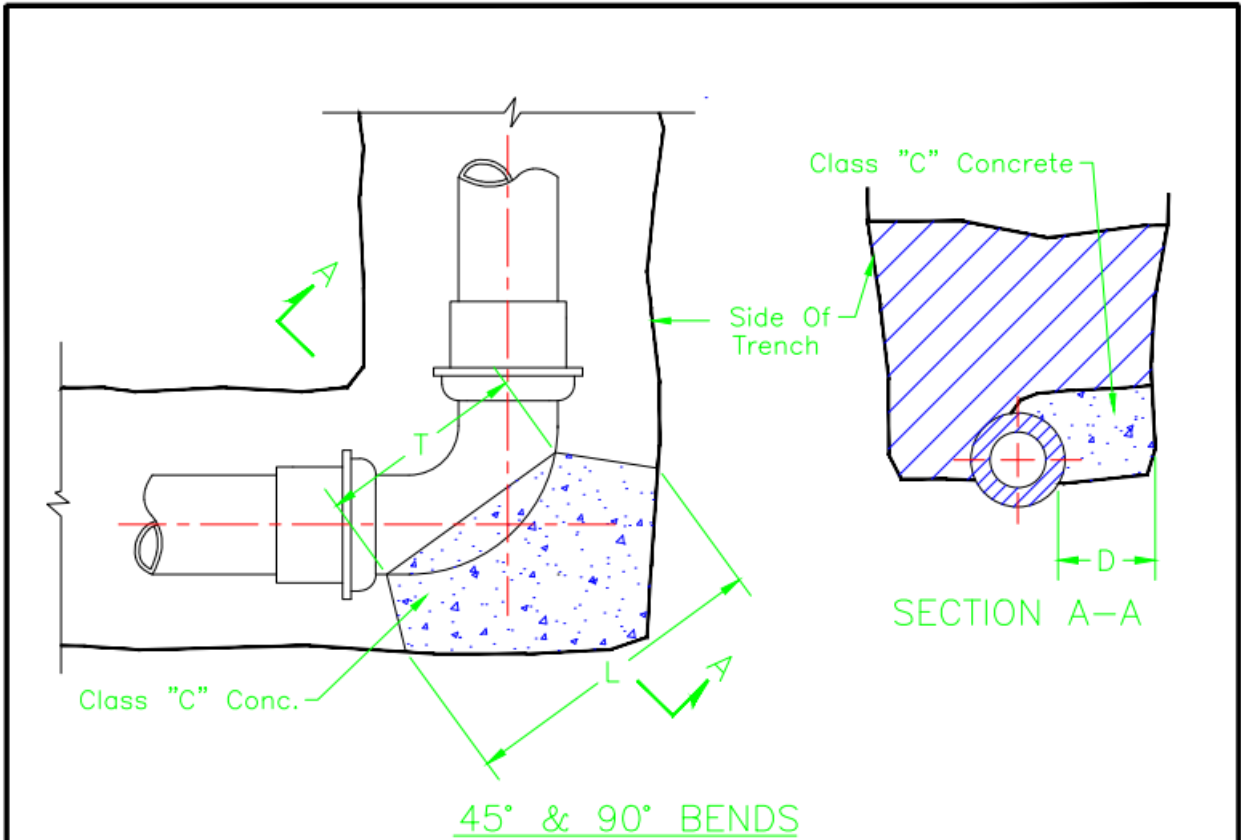
**SD-12 ENCASEMENT**



TYPICAL CREEK CROSSING FOR  
SANITARY SEWER LINE

SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		SEWER LINE ENCASEMENT	
STANDARD	DRAWING	JAN, 2021	DWG. NO. SD-12

**SD-13 FORCE MAIN THRUST BLOCKS**



**NOTE:**

Restrained joints are required; concrete thrust blocks may be used in addition to restrained joints.

PLUGS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L&W	14"	16"	18"	20"	22"	24"	24"

(45°) EIGHTH BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L	12"	14"	16"	18"	20"	22"	24"
T	10"	12"	14"	16"	16"	18"	18"

(90°) QUARTER BENDS							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	8"	10"	12"	12"
L	15"	18"	21"	24"	27"	30"	34"
T	10"	12"	14"	16"	18"	20"	22"

SPRINGFIELD WATER/WASTEWATER DEPARTMENT  
824 Central Avenue – Springfield, Tennessee

FORCE MAIN THRUST BLOCKS

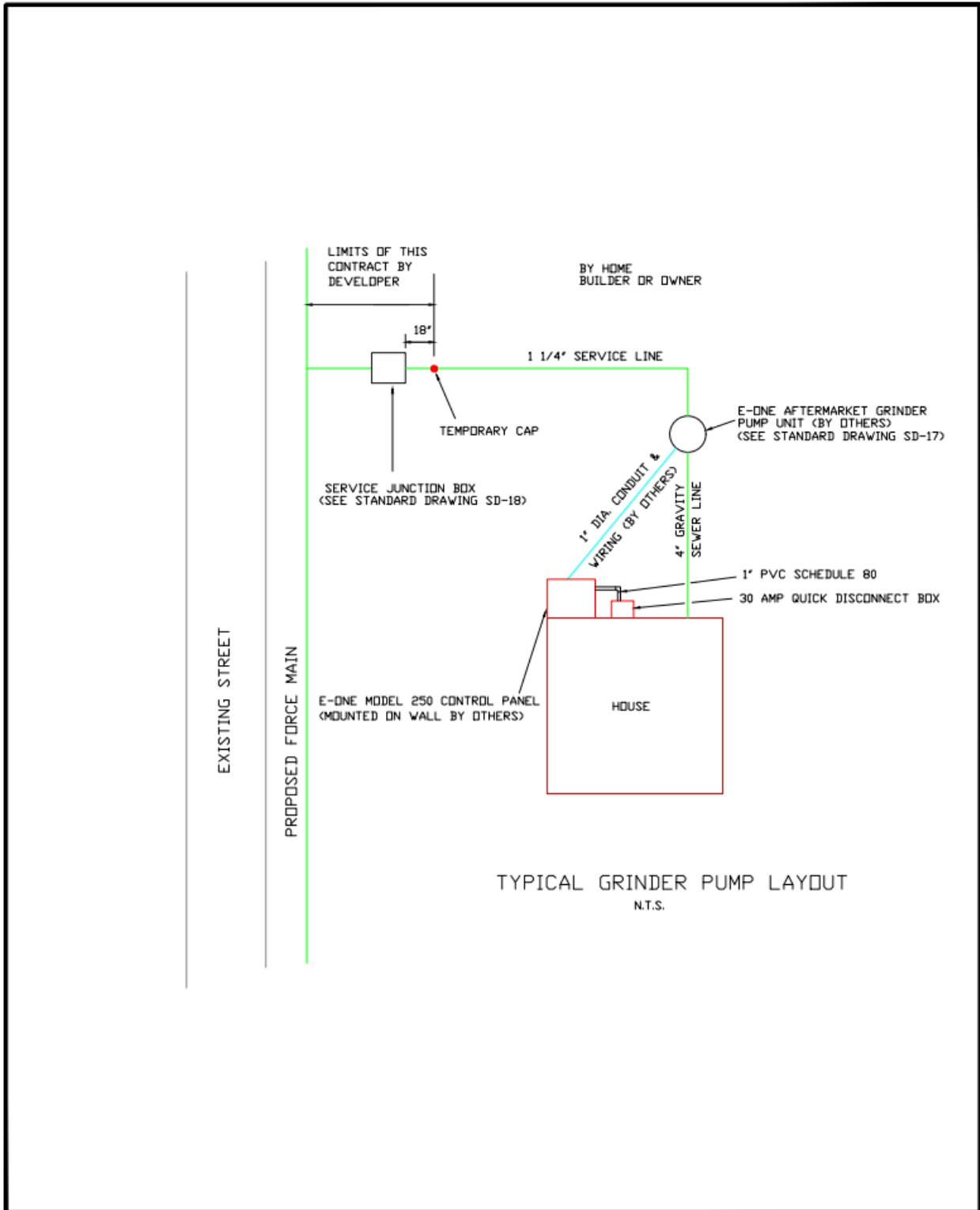
STANDARD DRAWING

JAN, 2021

DWG. NO. SD-13

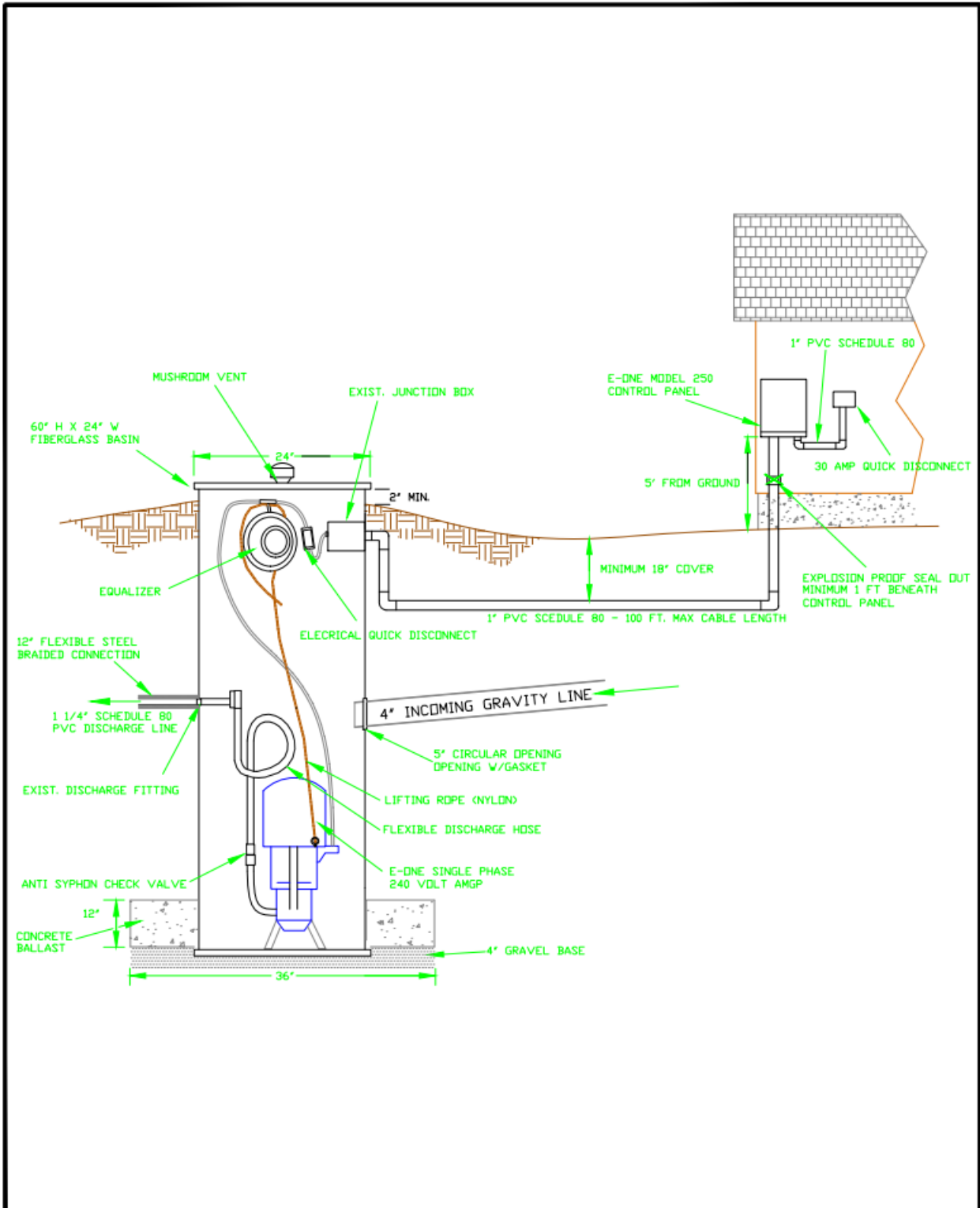


**SD-16 GRINDER PUMP**



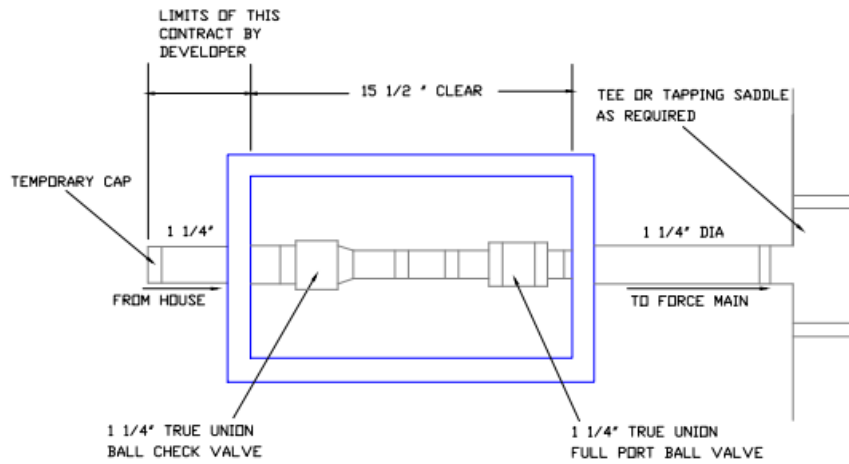
SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		GRINDER PUMP/SERVICE JUNCTION BOX DETAILS & LAYOUT	
STANDARD DRAWING		2021	DWG. NO. SD-16

# SD-17 GRINDER PUMP LAYOUT

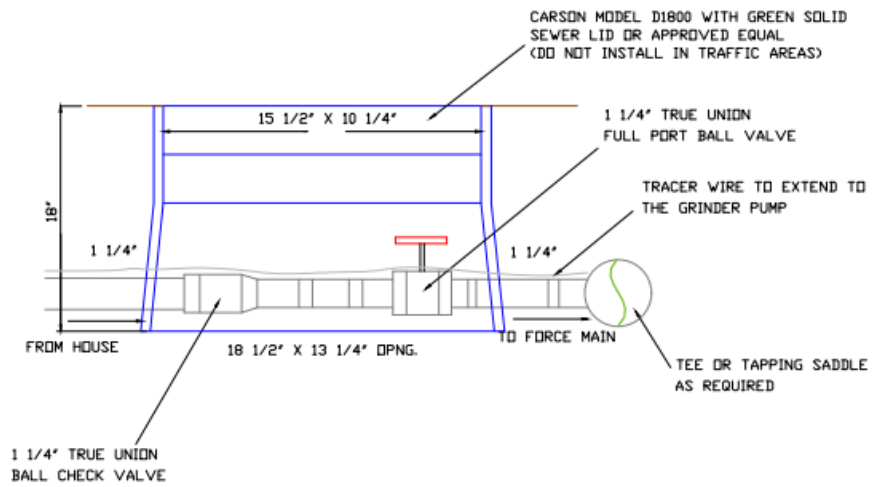


SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		E-ONE AFTER/MARKET GRINDER PUMP LAYOUT SHEET	
STANDARD DRAWING		AUG. 08, 2021	DWG. NO. SD-17

**SD-18 GRINDER VALVES**



PLAN



NOTE: THIS ASSEMBLY MUST ALLOW FOR EASE OF REPLACEMENT OF THE CHECK VALVE

SPRINGFIELD WATER/WASTEWATER DEPARTMENT 824 Central Avenue – Springfield, Tennessee		GRINDER PUMP/SERVICE JUNCTION BOX DETAILS & LAYOUT	
STANDARD DRAWING		2021	DWG. NO. SD-18



