

**STANDARD SPECIFICATIONS FOR
CONSTRUCTION OF WATER MAINS
AND APPURTENANCES**

For

**Borough of Doylestown
Bucks County, Pennsylvania**

October 2020

Ref: #1100-86

BOROUGH OF DOYLESTOWN

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BOROUGH OF DOYLESTOWN

PART 1 – GENERAL INFORMATION

A. Definitions

Wherever the following words or terms are used in these Specifications, the intent and meaning shall be interpreted as follows:

1. **BOROUGH** – The Borough of Doylestown (BOROUGH) Bucks County, Pennsylvania. The term also includes any agent, employee or representative of the BOROUGH. The term OWNER shall be synonymous with the word BOROUGH.
2. **BUILDING SERVICE** – The extension from any structure to the public water service.
3. **CONTRACT** – The written agreement executed by and between the DEVELOPER or BOROUGH and the CONTRACTOR, covering the performance of the WORK and the furnishing of labor, materials and service in the construction of the water additions and extensions (including appurtenant facilities) to the BOROUGH'S water system(s).
4. **CONTRACTOR** – The Individual, group, partnership, or corporation undertaking to do the WORK herein specified (including his or their heirs, legal representatives, successors or assigns) and is the party of second part of the CONTRACT contained herein. The term DEVELOPER, except as otherwise noted, shall be synonymous with the term CONTRACTOR.
5. **DEVELOPER** – Any landowner, agency of such landowner, or tenant with the permission of such landowner, who makes or who causes to make a subdivision of land or land development, or who constructs, or causes to be constructed a water main extension/water facilities.
6. **DRAWINGS** – Collectively, all plans, details and construction notes which show the character and scope of the WORK to be performed, and which have been reviewed by the ENGINEER and approved by the BOROUGH. These shall include the Standard Details contained herein, and may also include drawings of the ENGINEER, the DEVELOPER, the CONTRACTOR, the BOROUGH, or others.
7. **ENGINEER** – The appointed Registered Professional Engineering consultant whose services are retained by the BOROUGH for the

performance of engineering services, including the construction observation of the WORK.

8. **INSPECTOR** - An authorized representative of the **ENGINEER** and/or **BOROUGH** assigned to inspect the **WORK** performed and the materials supplied by the **CONTRACTOR** as to compliance with the Contract Documents.
9. **MUNICIPALITY** – Any Borough or Township, including the Borough of Doylestown, in which Work may be performed by the **DEVELOPER** and/or **CONTRACTOR**.
10. **PENNDOT** – The Commonwealth of Pennsylvania, Department of Transportation.
11. **PROJECT** – The entire construction to be performed as provided in the **DRAWINGS** and **SPECIFICATIONS**.
12. **SPECIFICATIONS** – The Standard Materials, Installation and Testing Specification(s) and Standard Detail(s) adopted by the **BOROUGH**, and as may be amended from time to time.
13. **SOLICITOR** – The appointed chief legal council whose services are retained by the **BOROUGH**, for legal advice pertaining to **BOROUGH** matters.
14. **STANDARD SPECIFICATION ABBREVIATIONS** – All standard specifications referred to herein, such as **ACI**, **ASTM**, **AWWA**, and the like, shall have the meaning set forth opposite each below and shall be the latest revision thereof at the time of bidding.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
IPC	International Plumbing Code

NCSA National Crushed Stone Association

15. WORK – Any and all obligations, duties, and responsibilities necessary for the successful completion of the PROJECT assigned to or undertaken by the DEVELOPER and/or the CONTRACTOR under the DRAWINGS and SPECIFICATIONS, including the furnishing of all labor, materials, equipment and other incidentals.

B. Scope

These SPECIFICATIONS cover the requirements for additions and extensions to the Borough of Doylestown's water systems. All additions and extensions shall be completed in accordance with the requirements of the *Borough of Doylestown's Code of Ordinances, Chapter 26 – Water, Part 1 – General Regulations, as amended* and these SPECIFICATIONS. The WORK shall include the furnishing of all plans, labor, new materials, equipment, supplies, transportation, fuel and power and performing all WORK as required by the SPECIFICATIONS and including such detail drawings as may be required to prosecute the WORK. The WORK shall be executed in the best and most workmanlike manner by qualified, careful and experienced workman.

Should any incidental WORK or materials be required, but are not specifically described in the DRAWINGS/SPECIFICATIONS, which are necessary for the proper implementation and good workmanlike execution of the scope of work, the CONTRACTOR shall understand same to be implied and required, and shall furnish, install and perform such work as necessary.

Borough of Doylestown reserves the right to establish special supplemental requirements for any given addition or extension based upon unique features of the specific PROJECT, recent changes in standard water systems operating and construction practices which may not be reflected within the SPECIFICATIONS as herein contained, or for other legal or administrative reasons which the BOROUGH may identify.

C. Submittals

Prior to the start of construction, the DEVELOPER shall submit DRAWINGS for the PROJECT to the BOROUGH for review. The BOROUGH will approve requests for water service additions and/or extensions only after approval of these DRAWINGS.

The DRAWINGS may be part of subdivision or land development plans prepared to meet regulatory requirements pertaining to land development activities, or the DRAWINGS may be specifically prepared to meet the requirements of the

Borough of Doylestown. Four (4) copies of each set of DRAWINGS, including any supporting submission documents, will be submitted to the BOROUGH. The DRAWINGS, and any supporting documentation, will be reviewed by the ENGINEER, SOLICITOR, and BOROUGH staff, as required. When the DRAWINGS describing the proposed Work are found to be acceptable for construction, six (6) copies of the DRAWINGS, stamped "Approved for Construction", shall be submitted to the BOROUGH for its use during observation of construction. As necessary, additional sets of DRAWINGS may be required for attachments to legal agreements which address the provisions throughout which the extension or addition to the system may be constructed. The DEVELOPER shall also furnish additional copies of the "Approved for Construction" DRAWINGS as needed for the construction of the PROJECT.

All DRAWINGS shall show the location of the water mains, water valves, fire hydrants and other necessary sewer and water appurtenances required for the completion of the WORK. All DRAWINGS shall incorporate both a plan view and a profile drawing which shall contain the proposed location of the proposed water mains, along with the location of the existing water mains, and existing and proposed water mains, and other underground utilities within the PROJECT site.

All DRAWINGS shall contain details for the proposed water facilities. Details should be sufficient for construction of the facilities and should include, but not necessarily be limited to, restoration details, utility crossing details, standard installation details for valves, fire hydrants and other appurtenances, standard casing and concrete encasement details, and details of connections to the existing system(s).

In the case of submissions which are clearly incomplete or which are significantly non-responsive to the BOROUGH'S standards for the system additions and extensions, the BOROUGH will reject the proposed submission without extensive review, pending the receipt of DRAWINGS which reasonably address the BOROUGH'S requirements. It shall not be the BOROUGH'S responsibility to design such extensions or additions.

In addition to DRAWINGS, the DEVELOPER shall also submit such product data, product samples, manufacturer's operating and maintenance instructions, etc., as may be required by the Borough.

Shop Drawings. All materials to be incorporated in the WORK shall be subject to approval by the ENGINEER. The CONTRACTOR shall obtain manufacturer's certified shop drawings and other pertinent data and shall submit them to the ENGINEER for review. All shop drawings must be reviewed and approved by the CONTRACTOR prior to submittal to the ENGINEER. All shop drawings not stamped with the CONTRACTOR'S approval will be returned to the

CONTRACTOR. A minimum of six (6) copies of each shop drawing must be submitted. The ENGINEER will retain four copies for his dispersal and return all remaining copies to the CONTRACTOR after review. Shop drawings shall be submitted for all materials. Detailed shop drawings shall be submitted to the ENGINEER for approval prior to installation of any equipment/material. The CONTRACTOR shall not install any material until the shop drawings have been approved and the CONTRACTOR has received written notification from the ENGINEER. The CONTRACTOR shall schedule his work so as to allow sufficient time for review of all shop drawing submittals by the ENGINEER.

D. Borough Review Costs

The DEVELOPER shall agree to pay all engineering, legal and administrative costs incurred by the BOROUGH in the review of the DRAWINGS, including shop drawings. These costs may be in addition to and separate from any costs which may be required elsewhere by the Borough of Doylestown, or the County Planning Agency.

E. Developer's Agreement

In all cases involving additions or extensions to water mains, the DEVELOPER shall enter into an agreement with the Borough before commencing any WORK on the PROJECT. This agreement will be prepared by the BOROUGH and will address the specific circumstances of each specific project.

F. Construction Completion Security

The DEVELOPER shall provide the BOROUGH with security to insure completion of the water additions and extensions. This security shall be in the amount of one hundred ten percent (110%) of the estimated construction cost of the water additions and extensions. Said security shall be in the form of a letter of credit drawn on a lending institution acceptable to the BOROUGH, in the form and manner approved by the BOROUGH SOLICITOR; or a cash payment to be maintained by the BOROUGH in a non-interest bearing escrow account.

G. Construction Observation of the Work

The DEVELOPER shall establish with the Borough of Doylestown, an escrow account in the amount sufficient to cover the established cost of construction observation, engineering expenses, administrative expenses, legal expenses, and other charges related to the proposed construction. The amount of the escrow fund for construction-related activities shall be established by the BOROUGH. The DEVELOPER, acting through its CONTRACTOR, shall notify the Borough of Doylestown three (3) days in advance of the commencement of

construction WORK, so that appropriate construction observation time may be scheduled. Where WORK is to be performed in a state highway or county road, advance notice shall be given as required by the respective regulatory agency. No WORK may be prosecuted in the absence of construction observation, and any WORK performed without construction observation shall be re-excavated, exposed and observed by the Borough of Doylestown's representatives as ordered by the BOROUGH. Any defective WORK, or WORK not conforming to the SPECIFICATIONS, is to be replaced to the satisfaction of the BOROUGH at no expense to the BOROUGH. No WORK shall be performed on Saturdays, Sundays, Holidays or at night, except with the written permission of the BOROUGH. Should the escrow account be depleted prior to the completion of the construction, additional escrow funds shall be deposited by the DEVELOPER with the BOROUGH prior to continuing with any additional WORK. Any unused escrow funds shall be returned to the DEVELOPER upon completion and acceptance of the construction.

H. Record Plans

Before acceptance of the water system extensions and additions, the DEVELOPER shall prepare and deliver to the BOROUGH, record as-built plans, including one (1) set of reproducible mylars, three (3) sets of paper prints and two (2) digital copies in both pdf and AutoCAD formats, which delineate the water facilities actually installed. The record plans shall clearly show the location of all water facilities and shall be free of extraneous markings which may obscure the water facilities. The material, size and location of all facilities shall be shown. The adequacy of the record plans will be determined by the BOROUGH, in its sole discretion.

I. Acceptance of System Additions and Extensions

After any water facilities have been added to or extended from the existing system(s), and have been satisfactorily tested and approved by the BOROUGH'S representatives, and have been placed in operation, the BOROUGH will notify the DEVELOPER of its intention to accept dedication of the facilities. No water facility shall become the responsibility of Borough of Doylestown until a deed of dedication shall have been fully executed by the DEVELOPER and accepted by the BOROUGH. For a period of eighteen (18) months after the date of dedication, the DEVELOPER shall guarantee the stability of all materials and equipment and the workmanship of all labor, and shall correct and/or replace all defective materials, equipment and WORK at its own expense and to the satisfaction of the BOROUGH when notified in writing by the BOROUGH to do so. The DEVELOPER shall provide the BOROUGH with security for the aforesaid guarantee in the amount of fifteen percent (15%) of the BOROUGH'S ENGINEER'S opinion of construction cost. The security shall be not less than \$5,000.00. Said security

shall be in the form of a letter of credit from a commercial banking institution acceptable to the BOROUGH and approved by the BOROUGH'S SOLICITOR as to form and manner of execution; or a cash payment to be maintained by the BOROUGH in a non-interest bearing escrow account. Should the DEVELOPER not promptly address any defects in the WORK, the BOROUGH will invoke its security guarantee to provide funds for the repairs.

J. Government Regulations and Agencies

The DEVELOPER will be responsible for meeting all requirements of the various governmental agencies, including applying for and obtaining all necessary permits, licenses, approvals, and paying all applicable fees, taxes, etc. Agencies include, but are not limited to, the Department of Environmental Protection, the Bucks County Conservation District, the Borough of Doylestown, and the Pennsylvania Department of Transportation.

All water system appurtenances shall comply with the requirements of the Department of Environmental Protection's Public Water Supply Manual, latest edition.

All construction shall comply with the requirements of Title 25, Chapter 102, Erosion and Sediment Control Rules and Regulations, as set forth by the Pennsylvania Department of Environmental Protection.

All construction within State Highways and Shoulders shall meet the requirements of the Pennsylvania Department of Transportation. State and local highway and shoulder restoration details provided in Part 3 – Standard Details of these SPECIFICATIONS are provided as a reference only. Actual restoration requirements shall be confirmed with the Department of Transportation, the Borough of Doylestown, or other applicable local municipal government prior to submission to the BOROUGH for review.

K. Design Standards

All water mains and appurtenances shall conform to the following applicable design standards:

1. Wherever possible and/or reasonable, water mains shall be installed within existing or proposed public rights-of-way or BOROUGH easements. The use of private easements is to be avoided.
2. Individual water services and curb stops are to be installed in unpaved areas except where otherwise specifically approved by the BOROUGH.

3. No water transmission main shall extend in excess of 1,000 feet without the installation of a gate valve and no water distribution piping within existing and/or proposed developments shall extend in excess of 500 feet without the installation of a gate valve.
4. A gate valve and one length of capped water pipe shall be provided at the end of any water main that could potentially be extended in the future. Water mains shall extend to the boundary of any existing and/or proposed development and a hydrant shall be located prior to the terminal gate valve.
5. The final location of all fire hydrants shall be subject to the approval of the Fire Marshal. Fire hydrants not located at street corners shall be located at property lines or a minimum of 10 feet from a driveway or access drive.
6. All new or replaced water service lines exceeding 100 feet in length shall include a meter pit installed by the customer within three feet of the curb box on the customer's side of the service line.

L. Steel Products

For any CONTRACT involving the construction, reconstruction, alteration, repair, improvement or maintenance of "public works" as defined by the Pennsylvania Municipalities Planning Code, CONTRACTOR agrees to comply with the "Steel Products Procurement Act of March 3, 1978" (P.L. 6, No. 3, 73 P.S. § 1881 et seq.).

CONTRACTOR shall provide to the BOROUGH, certification of the source of steel products used before payments are made under the CONTRACT.

END OF SECTION

BOROUGH OF DOYLESTOWN

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BOROUGH OF DOYLESTOWN

PART 2 – MATERIALS, INSTALLATION AND TESTING

SECTION I

TRENCH EXCAVATION, PROTECTION, BACKFILL AND MAINTENANCE

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SECTION I

TRENCH EXCAVATION, PROTECTION, BACKFILL AND MAINTENANCE

1.01 GENERAL

- a. The CONTRACTOR shall excavate, protect, backfill, and maintain all trenches that may be necessary for completion of the WORK. All excavation shall be in open trenches except where, and to such extent, as otherwise shown on the DRAWINGS, or as the BOROUGH may authorize or direct. The use of excavation machinery will be permitted, except in places where operation of same will cause damage to trees, buildings, or existing utilities and structures above or below ground; in which case, hand methods shall be employed. No tunneling, boring, or forcing will be allowed without approval from the BOROUGH. Excavated material must be piled so as not to encroach on private property, endanger the WORK, obstruct sidewalks or roadways, nor interfere with proper drainage. The CONTRACTOR shall have no claim for compensation due to the fact that hand excavation instead of machine excavation may be necessary for whatever cause.
- b. The CONTRACTOR shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the DRAWINGS, as specified herein, or as directed by the BOROUGH. All excavated materials not required or suitable for backfill shall be removed and wasted or otherwise disposed of by the CONTRACTOR as directed or specified.
- c. The CONTRACTOR'S attention is directed to the regulations of the PA Department of Labor and Industry relating to trenches and excavations, tunnel construction, equipment, materials, labor, safety, sanitation, and other regulations on which the CONTRACTOR shall be fully informed and with which he shall fully comply. Attention is also directed to the U.S. Department of Labor, Occupational Safety and Health Administration, Occupational Safety and Health Standards/Safety and Health Regulations for Construction (29CFR Part 1910/1926), latest revision.
- d. It is the CONTRACTOR'S responsibility and obligation to contact all utility companies, through the PA One Call System, Inc., (1-800-242-1776), for utility location verification and mark-out three (3) working days prior to any and all excavation.

- e. The CONTRACTOR shall solely be responsible for the condition of all excavations made by him. All slide and cave-ins shall be removed by the CONTRACTOR at whatever time and under whatever circumstances they may occur.
- f. The term "subgrade" as used herein shall mean the bed of the trench, and the term "grade" shall mean the surface on which the pipe is laid.

1.02 REMOVAL OF PAVEMENT AND STORAGE OF MATERIALS

- a. The CONTRACTOR shall remove all pavement, materials, road surfaces, curbing, driveways, and sidewalks within the lines of excavation. Concrete and asphalt pavements shall be saw cut to neat straight lines using equipment suitable to furnish a clean cut in the pavement and base without undue shattering. The edges of all paved surfaces shall be protected and maintained by the CONTRACTOR until repaving is completed. All concrete curbing, driveways, or sidewalks within the lines of excavation shall be broken up and removed by the CONTRACTOR. All such WORK shall be done in accordance with the rules and regulations of the governmental agencies having jurisdiction. The use of weights dropped on pavement for breaking will not be allowed except by written permission of the BOROUGH.
- b. The CONTRACTOR shall clear and grub through wooded areas and shall remove all surface materials, of whatever nature, over the line of the trench; and shall properly separate and classify the materials removed, and shall store, guard, and preserve such quantities of said materials as may be required for use in backfilling, resurfacing, repaving, seeding, landscaping, or for other purposes. All excavated materials suitable for fill or backfill shall be stored in such parts of the street or roadway, or such other suitable places, and in such manner, as shall be approved or directed by the BOROUGH. All excavated materials unsuitable or not required for backfill and all perishable and objectionable material including, but not limited to boards, fences, trees, brush, vines, shrubs, bushes, logs, stumps, roots, weeds, rubbish, and other organic matter shall be removed from the construction site and properly disposed of by the CONTRACTOR. Burning or burying of refuse or other debris will NOT be permitted. The CONTRACTOR shall be responsible for any loss of, or any damage to materials through careless removal or neglectful or wasteful storage, disposal, or use.
- c. The CONTRACTOR shall remove paving to the widths as shown on the Standard Details. In case the paving is removed for a greater width, or in case any paving is removed or disturbed on account of settlement, slides, or cave-ins, or in making excavation outside the lines of the WORK without

the written order of the BOROUGH, the CONTRACTOR shall pay all cost of permanently replacing the paving so removed or damaged.

- d. When it is necessary to haul soft or wet material over roadways or driveways, the CONTRACTOR shall use lined or otherwise sealed vehicles for this purpose. The CONTRACTOR is responsible for any deposition of excavated materials onto area roadways and driveways.

1.03 SHEETING, BRACING, AND SHORING

- a. Wherever it is necessary, to prevent injuries or to avoid damage to existing structures, pavement or foundations, or to prevent excessive trench loads on the pipe, due to caving or sliding of banks of excavations, the CONTRACTOR shall sheet, brace, or shore such excavations.
- b. In all cases, trenches shall be protected in accordance with the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration, the State Department of Labor and Industry, and any other regulatory agencies having jurisdiction.
- c. All sheeting, sheet piling, bracing, and shoring, including trench boxes, shall be installed by personnel skilled in such WORK. Timber or steel members used shall be sound, straight, and free from defects.
- d. Sheeting and sheet piling shall remain in place within the pipe zone, which is the area of trench from the top of the pipe to the subgrade. Sheeting, sheet piling, bracing, and shoring above the pipe zone shall be withdrawn and removed as the trench is being backfilled; except where and to such extent as the BOROUGH shall order, in writing, that the same be left in place; or where the BOROUGH shall permit the CONTRACTOR to leave the same in place, at the request and expense of the CONTRACTOR.
- e. In withdrawing sheeting and sheet piling, special care shall be taken to ensure that all voids or holes are filled with satisfactory material and thoroughly compacted, so as to prevent injury to the pipe and its appurtenances and injury or settlement of adjacent structures and pavement.
- f. The neglect, failure, or refusal of the BOROUGH to order the use of sheeting or sheet piling, to order better quality or larger sizes of timber or steel members, or to order sheeting, sheet piling, bracing, or shoring to be left in place, or the failure to give any orders or directions as to the manner of methods of driving or placing sheeting, sheet piling, bracing, or shoring

shall not in any way or to any extent relieve the CONTRACTOR of any or all obligations under this CONTRACT.

1.04 PROTECTION OF PROPERTY AND STRUCTURES

- a. The CONTRACTOR shall protect from direct or indirect damage, all pipes, conduits, poles, tracks, walls, buildings, and other structures or property in the vicinity of the WORK, whether above or below the surface of the ground. At all times the CONTRACTOR shall have a sufficient quantity of timber, plank, steel members, trench boxes, chains, ropes, and other necessary equipment and materials available and shall use them as required for sheeting the excavation and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.
- b. The CONTRACTOR shall assume all risks resulting from the presence or proximity of pipes, conduits, poles, tracks, walls, buildings, and other structures and property of every kind and description, in, under, or over trenches, or in the vicinity of the WORK, whether above or below the surface of the ground. The CONTRACTOR shall be responsible and assume all expenses for all damages to the above-described items or injury to any person, caused directly or indirectly by performance of the WORK, whether the above are or are not shown on the DEVELOPER'S drawings.
- c. Where necessary, or when ordered by the BOROUGH, in order to keep one side of the street or roadway free from any obstruction, or to keep material piles alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the trench.
- d. If groundwater or other potentially dangerous conditions are encountered or where passing especially heavy structures which, by their construction or position may bring significant pressure upon the trenches, the BOROUGH may direct that such buildings or structures shall be underpinned, or supported and protected, or that special sheeting shall be driven in such a manner and to such depth, as may be directed, or that only a short length of trench shall be opened at one time. Any WORK done as above directed shall be at the cost and expense of the CONTRACTOR.
- e. All trees which are indicated on the DRAWINGS to be saved, shall be protected by tree protection fencing. Where tree branches hang over the trench or construction area, such branches shall be neatly sawed off at the tree trunk or otherwise protected to prevent breaking of the limb at the tree trunk. All cuts or scars on trees shall be painted with an approved material.

1.05 REMOVAL OF OBSTRUCTIONS

- a. Should the position of any obstruction (pipe, conduit, pole, or other structures) above or below the ground, whether or not shown on the DRAWINGS, be such as, in the opinion of the BOROUGH, to require its removal, realignment, or change due to the WORK to be done under the CONTRACT, the removal, realignment, or change will be done by, or in a manner approved by the owner of the obstruction. The CONTRACTOR shall uncover and sustain the obstruction before such removal and before and after such realignment or changes.
- b. The CONTRACTOR shall not interfere with any persons, firms, or corporations, or with the BOROUGH in protecting, removing, changing, or replacing the obstruction, but shall allow them to take all such measures as deemed necessary or advisable for the above purpose. At railroad or highway crossings, any expense incurred in shoring or in maintaining traffic shall be borne by the CONTRACTOR or DEVELOPER.

1.06 WIDTH AND DEPTH OF TRENCHES

- a. Trench Widths
 1. The trench subgrade shall be excavated true to line so that a clear space of eight inches (8") in width is provided on each side of the barrel of the pipe to a height not less than one foot (1') above the top of the pipe. If sheeting is required at the level of the pipe, the dimensions in the foregoing sentence shall be applicable to the inside faces of the sheeting. In the case of flexible pipe material, which can be joined outside the trench, a trench of less width may be permitted by the BOROUGH.
 2. From a point twelve inches (12") above the top of the pipe to the surface, the trench walls shall be kept as vertical as possible. In all streets, roads, highways, driveways, sidewalks, parking lots or other improved areas, the trench width at the surface grade shall be of sufficient width to provide adequate room for the construction and installation of the pipe, including any sheeting, bracing and shoring which may be required.
 3. Where trench widths exceed the above requirements, pipe of greater crushing strength and/or other bedding may be required by the BOROUGH.

b. Trench Depths

1. The depth of the excavation for the pipe and appurtenances shall be such that they can be constructed to proper grade. All crushed stone used for pipe bedding shall be 2B coarse aggregate (AASHTO No. 57). In earth excavation, the trench shall be excavated as follows:
 - (a) The depth to the trench subgrade shall be a minimum of six inches (6") or $\frac{1}{4}$ outside diameter of pipe, whichever is greater, below the bottom of the pipe. The bedding shall be constructed in accordance with Standard Detail No. SD-G-03. The bedding material shall be PennDOT No. 2B coarse aggregate (AASHTO No. 57). The bedding shall be placed to a minimum depth of one foot (1') above the pipe and compacted by hand or mechanically to at least 90% of the Standard Proctor Density, as determined in accordance with AASHTO T99. Care shall be taken to assure that sufficient bedding material is worked under the haunching of the pipe to provide adequate side support.
 - (b) Where concrete easement of the pipe is required, either on the DRAWINGS, or by order of the BOROUGH, trench subgrade and encasement shall be as shown on Standard Detail No. SD-G-04.

c. Unstable Subgrade

1. When the material encountered at trench subgrade is determined by the BOROUGH to be unstable, it shall be removed to a minimum depth of one foot (1') below the invert of the pipe and one foot (1') on either side of the pipe, or as otherwise directed by the BOROUGH. The trench shall then be backfilled with PennDOT 2A aggregate material to within four inches (4") of the bottom of all pipe. The remaining four inches (4") shall be backfilled to the bottom of all pipe with the appropriate bedding material, as specified herein. If earth trenches are excavated beyond the specified depths, without the approval of the BOROUGH, the CONTRACTOR shall backfill the excavation below subgrade with 2A aggregate material.

d. Unyielding Subgrade

1. When any unyielding material, such as rock, is encountered at subgrade, it shall be removed to the depth of the trench subgrade and the trench shall be backfilled with bedding material, or concrete

if encasement is required, so that the pipe is supported along its entire length.

2. If trenches are shattered by blasting below or beyond the lines of excavation specified herein, the trench shall be refilled to specified lines of excavation with concrete, as directed by the BOROUGH.

1.07 LENGTH OF OPEN TRENCH

- a. The BOROUGH shall have the right to limit the amount of trench opened in advance of pipe laying and the amount of pipe laid in advance of backfilling. Unless otherwise approved by the BOROUGH, no more than 100 hundred feet (100') of trench shall be opened at any one place in advance of the completed pipe. The trench shall not be opened for a distance of more than four hundred feet (400') at any one time.
- b. Trench excavation shall be fully completed, except for the forming of the trench subgrade, at least twenty five feet (25') in advance of the pipe placement, and shall be kept free from obstruction; except that at the close of the workday, or at the discontinuance of WORK, the pipe-laying may be completed to within five feet (5') of the end of the opened trench. The amount of pipe laid in advance of backfilling shall not exceed one hundred feet (100'). In state highways, all trenches in roadway areas must be closed and not more than forty feet (40') of trench may remain open in shoulder areas at the close of the workday or discontinuance of WORK.
- c. The BOROUGH may, at any time, require the backfilling of open trenches over completed pipelines. No trench shall be left open at the end of each work day.
- d. If WORK is discontinued on any trench, and the excavation remains open for an extended length of time, in the opinion of the BOROUGH, the CONTRACTOR shall backfill such trench, if so directed by the BOROUGH.

1.08 ACCOMMODATION OF TRAFFIC

- a. The WORK in all streets and highways shall be governed by the regulations of the governmental agency having jurisdiction. Traffic control on all State Highways, county roads and municipal streets shall be maintained and protected in accordance with PennDOT Publication 213 (latest edition) and Section 901 of PennDOT Specifications, Publication 408 (latest edition).
- b. Streets shall not be unnecessarily obstructed. Unless the BOROUGH has, in writing, authorized or ordered the complete or partial closing of a street,

the CONTRACTOR shall take such measures as may be necessary to keep the street or road open and safe for traffic and at least one travel lane, alongside of the trench, shall be kept open at all times.

- c. The CONTRACTOR shall construct and maintain bridges over excavations as may be necessary or required for the safe accommodation of pedestrians or vehicles. The bridge shall be extended a minimum of eighteen inches (18") of either side of the excavation and shall be tied into the existing cartway. The CONTRACTOR shall furnish and erect illuminated barricades at crossings of trenches, or along the trench, to protect the traveling public. Access to driveways shall be bridged across trenches. The CONTRACTOR shall not obstruct fire hydrants.
- d. Where WORK is to be performed at sidewalks or other walkways, a straight and continuous passageway, at least three feet (3') in width and clear from all obstructions, shall be provided. Additional passageway, as may be directed by the BOROUGH, shall be maintained free from obstruction.
- e. In narrow or congested streets or alleys, when so directed by the BOROUGH, the CONTRACTOR shall complete the WORK to a location designated by the BOROUGH before starting additional WORK, in order to give access to driveways, garages and other places.
- f. The CONTRACTOR shall, in all cases, so arrange the WORK to cause the least inconvenience to property owners and the general public consistent with the proper execution of the WORK, as determined by the BOROUGH.

1.09 ACCOMMODATION OF DRAINAGE

- a. The CONTRACTOR shall keep all trenches and other excavations free from surface or subsurface water while the WORK is in progress. The CONTRACTOR shall remove by pumping, bailing or other means, any water which may accumulate or be found in the trenches or other excavations and shall form all dams, flumes, or other works necessary to keep them entirely clear of water while the water mains and other structures are being constructed. The CONTRACTOR shall have sufficient pumping machinery available at all times on the site ready for immediate use. At no time is water to run through the pipes or its bedding material.
- b. The CONTRACTOR shall provide for the disposal of the water removed from excavations in such manner as will not cause injury or a public health nuisance or injure public or private property, to the work of other contractors, to any portion of the WORK completed or in progress, or produce any impediment to the use of highways, streets, and sidewalks by the public.

- c. Gutters, storm sewers, drains, ditches and watercourses shall be kept open at all times to accommodate surface drainage. The CONTRACTOR shall not direct any flow of water across pavements or sidewalks, except through pipes or other drainage facilities as approved by the BOROUGH.
- d. All pipes shall be tightly closed at the open ends at the completion of each workday. The CONTRACTOR shall, when ordered by the BOROUGH, remove any water which may be encountered or which may accumulate in trenches.
- e. In open watercourses, ditches, or pipes, encountered during the progress of the WORK, the CONTRACTOR shall provide for and accommodate the continuous flow in such courses or pipes and shall repair any damage that may be done to them, in the course of the WORK.
- f. All WORK shall be conducted in accordance with the recommendations and regulations of the Pennsylvania Department of Environmental Protection with respect to soil erosion and sedimentation control. Discharge from dewatering operations which is sediment laden, shall not be allowed to leave the construction site without first passing through filter media or a sediment trap/basin to remove all suspended sediment.

1.10 EXCAVATION OF UNYIELDING MATERIALS

- a. Unless otherwise directed by the BOROUGH, unyielding material, such as rock, shall be removed at least twenty-five feet (25') in advance of pipe laying, to the depths and widths as specified in Section 1.06, herein.
- b. Unyielding material appearing in miscellaneous excavations, or where future pipes are to connect with those installed under this CONTRACT, shall be excavated in accordance with the directions of, and to the lines prescribed by the BOROUGH.
- c. Where manholes or other structures are excavated in unyielding material, they shall be excavated twelve inches (12") outside the exterior lines of the structure and to depths as shown on the Standard Details and the DRAWINGS.

1.11 EXPLOSIVES AND BLASTING

- a. Blasting will be permitted only upon the written approval of the BOROUGH, which approval will fix the time during which blasting may be done. In the event that any blasting is required for any reason, during the course of WORK, the CONTRACTOR shall obtain any and all required permits from

the appropriate State, Township and/or Municipal officials prior to the commencement of any blasting. All adjacent property and utility owners shall be notified, in writing, by the CONTRACTOR, of the CONTRACTOR'S intentions to blast at the time of filing for the necessary permits. The CONTRACTOR shall once again notify the adjacent property and utility owners, in person, at least three days prior to the date of the commencement of blasting activities. Adjacent property owners shall be those persons living within 500 feet of the blasting site.

- b. The use of explosives shall be governed by the "Regulations for the Storage, Handling, and Use of Explosives" of the Pennsylvania Department of Labor and Industry.
- c. All blasting shall be field monitored using seismographic type equipment and shall be performed under the supervision of a Professional Engineer or Geologist, licensed to practice in the Commonwealth of Pennsylvania.
- d. No blasting shall be permitted adjacent to existing utility lines or structures which may be damaged through blasting operations, and under no circumstances shall blasting be done on the site during, or for, a period of at least 48 hours after the placement of concrete.
- e. The excavation of unyielding materials, including rock, within ten feet (10') of water or gas mains shall be done by hand and with light charges of explosives, and the utmost care shall be exercised to avoid disturbance of the main. All exposed sewers and special structures shall be carefully protected from the effects of blast, and any damage to them by blasting shall be promptly repaired by the CONTRACTOR. In no case shall the blasting be done within forty feet (40') of newly laid water mains.
- f. All shots shall be covered with cable or rope mats placed in accordance with governing regulations, and special care shall be exercised in areas where high tension power lines are located. Prior to blasting, sufficient warning shall be given all persons in the vicinity and traffic shall be stopped at the proper distance from the site and controlled by watchmen.
- g. The CONTRACTOR shall use the utmost care in the use of explosives necessary for the completion of the WORK and not to endanger life or property. All blasting operations shall be done by experienced men who have proper certificates or licenses issued by the Commonwealth of Pennsylvania. The handling and use of explosives shall be done strictly in accordance with the specifications issued by the United States Bureau of Mines and with any Federal or State regulations now in affect or that might become effective in the future; and in compliance with the Local and State

laws. All explosives shall be transported and stored in a secure manner in accordance with the Local and State laws. All vehicles and such storage places shall be marked clearly "Dangerous-Explosives", and shall be in care of a competent watchmen at all times. No larger quantity of explosives shall be kept in any one place than will be required for the next ensuing twelve (12) hours of work. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The location of magazines or the storage of explosives and the separate storage of detonators shall be subject to the approval of the BOROUGH and applicable State agencies.

- h. All blasts shall be properly matted and securely covered. The CONTRACTOR shall bear and hereby assumes sole responsibility for any injury to persons and/or property arising from his use of explosives.
- i. Prior to any blasting, the CONTRACTOR shall obtain any necessary permits or approvals from the BOROUGH and/or the MUNICIPALITY and shall deposit with the BOROUGH, a certificate of insurance, naming Borough of Doylestown as its additional insured with a specific reference to blasting activities and in amount of \$1,000,000.00. In addition to the CONTRACTOR shall indemnify and hold the BOROUGH and the ENGINEER harmless from any liability arising from the use of explosives.

1.12 TUNNELING AND JACKING

- a. Tunnels for the installation of pipelines shall be of sufficient size to allow, at all points, the proper joining of pipes, and the proper compacting of the backfill around them. Tunnels shall be braced where and to such extent as may be necessary. Where unyielding material is encountered in a tunnel, it shall be removed from the pipe zone, as described in Section 1.06, herein. All methods of tunneling proposed for use shall be subject to the approval of the BOROUGH and/or the ENGINEER.
- b. Where tunneling or jacking is performed under state highways or railroads, the WORK shall be performed in accordance with the regulations of the applicable agency.
- c. Where casing pipe is to be installed for the PROJECT, the construction shall be as specified in Section IV, SPECIAL CONSTRUCTION, of these SPECIFICATIONS.

1.13 PIPE LAID IN EMBANKMENTS

- a. When pipe is to be installed in fill, the embankment shall be initially constructed at least one foot (1') above the proposed top of the pipe. The

embankment shall then be excavated to the proper width and subgrade, in accordance with Section 1.06, herein, and the pipe and bedding material installed. The embankment shall then be constructed to provide a minimum cover of four feet (4') above the top of the pipe.

1.14 BACKFILLING

a. Extent of Backfill

1. Backfilling shall include all filling, compacting or rolling, the regrading of adjacent disturbed areas, the replacing of drains and other surface and subsurface structures, the placing and maintaining of temporary roadway, sidewalks and driveways, the furnishing of additional suitable backfill materials, if necessary, the reseeding or resodding of lawns and other unimproved areas, and the replacing of trees and shrubbery damaged by the CONTRACTOR, together with all appurtenant work.
2. In all unpaved areas where such areas are not used as a traffic way, the CONTRACTOR shall crown to such a height as determined by the BOROUGH, the top of all backfilled excavation. This crown is to be constructed after the trench backfill material has been compacted. As the trenches are filled in, and the WORK completed, the CONTRACTOR shall cart away, remove or otherwise dispose of all surplus material, or shall make use of such surplus material at such points as the BOROUGH may designate.
3. When the trenches in unimproved areas do not furnish sufficient material of suitable quality for refilling, the CONTRACTOR shall procure and supply acceptable materials. Frozen material shall not be used for backfilling.
4. All trenches must be backfilled at the end of the day. If the CONTRACTOR does not backfill the trenches at the end of the day, with approval of the BOROUGH, all open trenches must be enclosed with snow fences, securely staked. Blinking barricades must also be placed around the area to the satisfaction of the BOROUGH.

b. Backfill Material

1. Only bedding material approved by the BOROUGH shall be used for backfilling under and along the sides of the pipe and to a height of one foot (1') over the top of the pipe or for backfilling around structures and appurtenances. The bedding material shall be

thoroughly tamped with a light tamper in layers not to exceed four (4") in thickness. For water mains, the bedding material shall consist of 2B stone in accordance with Section 1.06.b., herein, and as shown on Standard Detail No. SD-G-03.

2. For trenches located within Borough or Municipal streets, street rights-of-way, sidewalk areas or potential future street rights-of-way (as determined by the MUNICIPALITY), the remainder of the trench shall be backfilled with PennDOT 2A aggregate material as shown in Standard Detail No. SD-G-05 and No. SD-G-06. Also, stone other than 2A aggregate material may be used if a responsible municipal official representing the MUNICIPALITY in which the WORK will take place or the respective MUNICIPALITY'S consulting engineer provides written confirmation permitting an alternative material.
3. For trenches located in State highways, shoulders or highway rights-of-way, the remainder of the trench shall be backfilled with PennDOT Select Granular Material (2 RC).
4. For trenches located in unimproved areas such as yards and lawns, the remainder of the trench shall be backfilled with clean select material consisting of good earth, sand and gravel, free of stones larger than six inches (6") in size and free of wet, frozen, or organic materials, as shown on Standard Detail No. SD-G-07. Excavated material meeting the same requirements may be used.

c. Method of Backfilling

1. Unpaved Municipal Streets or Private Rights-Of-Way

- (a) For rigid pipe, after the pipe and bedding have been installed, the trench shall be backfilled to the ground surface with material, as specified in Section 1.14.b., herein, compacted in eight inch (8") layers and in such a manner as not to disturb the pipe. The bedding material shall be solidly compacted around the pipe and carefully placed by hand with shovels to a level at least one foot (1') above the top of the pipe.
- (b) For flexible pipe, after the pipe, including the bedding material under the pipe, has been installed, bedding material shall be carefully placed by hand with shovels and solidly compacted in the haunching area (the area around the lower half of the pipe and horizontally in both directions to the undisturbed trench walls) until the trench has been backfilled to the spring

line of the pipe. Additional bedding material shall then be carefully placed by hand with shovels to a level at least one foot (1') above the top of the pipe. The trench shall then be backfilled to the ground surface and compacted in eight inch (8") layers and in such a manner as not to disturb the pipe.

- (c) Trenches in unpaved municipal streets, street rights-of-way, sidewalk areas, or potential future street rights-of-way (as identified by the municipality) shall be backfilled to the existing surface with PennDOT 2A aggregate material as shown on Standard Detail No. SD-G-05.

2. Paved Municipal Streets

- (a) After the pipe and bedding have been installed to a height of one foot (1') above the top of the pipe, the trench shall then be backfilled with 2A aggregate material, compacted in layers not to exceed eight inches (8"), to a level two inches (2") below finished grade as shown on Standard Detail No. SD-G-05.

3. State Highways and Shoulders of State Highways

- (a) The CONTRACTOR shall determine the specific backfilling requirements of PENNDOT. In the absence of any specific requirements from PENNDOT, the CONTRACTOR shall comply with Section 1.14.c.3(b), herein.
- (b) After the pipe and bedding have been installed to a height of one foot (1') above the top of the pipe, the trench shall then be backfilled with PennDOT select granular material (2 RC) compacted in layers not to exceed four inches (4") to a level two inches (2") below finished grade, as shown on Standard Detail No. SD-G-05.

4. General Backfill Requirements

- (a) As the trenches are backfilled and the WORK completed, the CONTRACTOR shall remove and dispose of all surplus material from the PROJECT. The CONTRACTOR shall leave all roads, driveways, sidewalks, and other places free, clear, clean, and in good order.
- (b) No backfilling shall be performed until the WORK has been inspected and approved by the BOROUGH. All backfill shall

be placed in compacted layers (lifts) as specified herein and in such manner as not to disturb or damage the WORK. Each layer of backfill shall be compacted, and, if requested by the BOROUGH or ENGINEER, the CONTRACTOR shall demonstrate by actual tests that the method of compacting proposed will produce an in-place density of at least ninety-five percent (95%) of the materials maximum dry density as determined by ASTM D 698 ("standard proctor test").

- (c) All in-place density tests on compacted fill shall be performed in accordance with "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by the Nuclear Methods", ASTM D 2922.

d. Compaction Requirements

1. If tests indicate WORK does not meet the specified requirements, it shall be removed, replaced, and retested until compliance is achieved.
2. Maintain moisture content of backfill materials, within the range of two percentage points (plus or minus) of optimum as determined by laboratory analysis in accordance with ASTM D1557 ("modified proctor test").
3. Compact materials to the following percentages of maximum lab density as determined by ASTM D1557.
 - (a) Bituminous or concrete roadways (other than PennDOT highways); driveways, and parking areas (except within public highway rights-of-way): 95% of laboratory determined maximum dry density.
 - (b) Bituminous or concrete walkways: 95% of laboratory determined maximum dry density.
 - (c) Within public highway rights-of-way: per PennDOT Specifications, Pub 408 (latest edition).
 - (d) Unimproved Areas: 90%.

1.15 TOPSOIL, SEEDING, AND LANDSCAPING

- a. Methods and materials for placing topsoil, seeding, and landscaping shall be as specified in SECTION II – TRENCH REPAVING AND RESTORATION, of these SPECIFICATIONS.

1.16 TEMPORARY PAVING AND MAINTENANCE OF TRENCH SURFACES

- a. In paved portions of highways, streets, alleys, driveways, sidewalks, or shoulders, after the trench has been properly backfilled and compacted to the proper depths below the street grade, the trench shall be temporarily paved in accordance with Section II – TRENCH REPAVING AND RESTORATION. After the trench has been temporarily paved, no dirt or loose material shall be allowed on the trench. Any sinking of the trench shall be repaired by constructing to grade as described in Section II.
- b. The CONTRACTOR shall maintain the surfaces of all trenches, which have been temporarily paved, a minimum of forty-five (45) calendar days for Municipal streets and a minimum of ninety (90) calendar days for State highways, or longer, as directed by PENNDOT or the BOROUGH, until permanent pavement is placed.
- c. Along unimproved private rights-of-way, the trench shall be properly backfilled and compacted to the original ground surface. After the trench has been backfilled, no course material or debris shall be allowed in the trench. Any settlement of the trench shall be repaired with clean select material constructed to finished grade.

END OF SECTION

BOROUGH OF DOYLESTOWN

PART 2 – MATERIALS, INSTALLATION AND TESTING

SECTION II

TRENCH REPAVING AND RESTORATION

INDEX

<u>Item</u>	<u>Title</u>
2.01	General
2.02	Temporary Paving
2.03	Permanent Paving
2.04	Topsoil, Seeding and Soil Stabilization
2.05	Maintenance and Restoration

SECTION II

TRENCH REPAVING AND RESTORATION

2.01 GENERAL

- a. The CONTRACTOR shall maintain the surface of all trenches and shall repair all depressions, settlements, washouts or other potential hazards, as determined by the BOROUGH, until such time as the CONTRACTOR is notified by the BOROUGH, in writing, that the trench surfaces are satisfactory for permanent repaving or restoration.
- b. The CONTRACTOR shall replace all guiderails, fences, sidewalks, curbs and gutters, driveways, signs, mailboxes, retaining walls, or other items as directed by the BOROUGH, which have been damaged or removed in the course of the WORK. All replacements shall conform in size and shape, and be of equal quality of material and workmanship to the original structures prior to being disturbed.
- c. All materials specified in this Section shall be in accordance with PennDOT Specifications, Pub.408 (latest edition).
- d. Maintenance, temporary and permanent paving and restoration of trenches in State Highways and Municipal Streets shall be in accordance with PennDOT Specifications, Pub.408 and 67 PA Code, Chapter 459, "Occupancy of Highways by Utilities" (latest edition).
- e. Where permanent repaving of sidewalks, paved municipal streets or driveways occurs in a MUNICIPALITY other than the Borough of Doylestown, the DEVELOPER shall provide written confirmation from that MUNICIPALITY that Section 2.03.a. Sidewalks, Section 2.03.b. Paved Municipal Streets– Bituminous and/or Concrete Paving, and Section 2.03.d. Paved Driveways–Municipal Streets and State Highways, are acceptable. If these SPECIFICATIONS are not acceptable to the MUNICIPALITY, the DEVELOPER shall provide written documentation as to what is acceptable to the applicable MUNICIPALITY.
- f. The CONTRACTOR shall be responsible for the adjustment of all manhole and valve box covers and any other such facility in advance of any paving operations. All adjustments shall be in accordance with the requirements of the respect owners of such facilities.
- g. The CONTRACTOR shall be responsible for the restoration of all lawns, grassed areas, shrubs, bushes and other plantings. All shrubs, bushes and

other plantings that were disturbed during construction or die during construction or before the end of the guarantee period shall be replaced in kind by the CONTRACTOR.

2.02 TEMPORARY PAVING

- a. The CONTRACTOR shall immediately, upon completion of trench backfilling and compacting, place and roll a 2 inch layer of Superpave binder course temporary paving in all paved roads, streets, State highways, driveways, parking lots (all paved areas), etc., as shown on Standard Detail No. SD-G-05. When weather conditions do not permit the use of Superpave binder, a 2 inch layer of Type 2P bituminous paving (cold patch) shall be placed. The CONTRACTOR shall not proceed to excavate additional trench, until this WORK is completed and approved, unless specifically directed otherwise by the BOROUGH.

2.03 PERMANENT PAVING

- a. Sidewalks and Curbs

Unless otherwise ordered by the BOROUGH, or required by local regulations, the CONTRACTOR shall install and compact four inches (4") of aggregate material and a concrete sidewalk four inches (4") thick shall be constructed to replace sidewalk removed as a result of the WORK. Sidewalk width shall match the width of the sidewalk replaced. In addition, the CONTRACTOR shall replace all curbing, removed as a result of the WORK. All materials and construction for sidewalk and curb replacements shall conform to the specifications of the applicable MUNICIPALITY.

- b. Paved Municipal Streets – Bituminous Paving and/or Concrete Paving

The temporary pavement restoration shall be removed to the depths required and the existing paving shall be cut, sawed, or removed in such a manner as to provide a clean cut in the roadway surface and base without undue disturbance to subgrade or fragmentation of surrounding areas for a distance of twelve inches (12") on each side of the trench area. Prior to the placement of permanent materials, the area shall be thoroughly rolled and compacted. The permanent pavement replacement for both bituminous and concrete pavement shall be as shown on Standard Detail No. SD-G-06.

c. State Highways

The CONTRACTOR shall determine the specific temporary and permanent surface restoration requirements of the Pennsylvania Department of Transportation for WORK occurring in State Highways. In the absence of any specific requirements from PENNDOT, the CONTRACTOR shall comply with Standard Detail No. SD-G-08 and No. SD-G-09, as applicable.

d. Paved Driveways – Municipal Streets and State Highways

For paved driveways along municipal streets or State highways, the temporary pavement restoration shall be removed to the depths required and the existing driveway paving shall be saw cut for a distance of twelve inches (12") on each side of the trench area. Prior to the placement of permanent materials, the area shall be thoroughly rolled and compacted. The permanent pavement replacement for driveways along municipal streets shall be as shown on Standard Detail No. SD-G-06 and the permanent pavement replacement for driveways along State highways shall be as shown on Standard Detail No. SD-G-08 or No. SD-G-09, as applicable.

e. Bituminous Sealer

Where the new wearing course joins existing bituminous pavement or is placed adjacent to curbs, or upon existing bituminous material, or adjacent to structures, utilities, etc., it shall be sealed with a bituminous sealer for a distance of twelve inches (12") from curbs, structures, utilities, etc., or six inches (6") on both sides of a bituminous joint in order to prevent accelerated deterioration caused by natural elements. The bituminous sealer shall be Performance Grade Asphalt PG 64-22, conforming to PennDOT Bulletin 25, Specifications for Bituminous Materials.

2.04 TOPSOIL, SEEDING AND SOIL STABILIZATION

a. Temporary Seeding

1. All areas shown on the DRAWINGS, all disturbed areas where construction activity has or will cease for more than four (4) days, and where otherwise directed by the BOROUGH, shall be seeded as follows:

- (a) Fertilizer – 10-20-10 at a rate of 25 pounds per 1,000 square feet.

- (b) Limestone – Pulverized Dolomitic at a rate of 90 pounds per 1,000 square feet.
- (c) Seed – Annual Ryegrass at a rate of one pound per 1,000 square feet.
- (d) Mulch – Hay or small grain straw at a rate of 60 pounds per 1,000 square feet.

b. Permanent Seeding and Soil Stabilization

1. Whenever the surface of the ground has been disturbed in the course of the WORK, the final grade surface shall be stabilized by seeding, sodding, planting or other methods approved by the BOROUGH to prevent erosion and control sedimentation.
2. A minimum of six inches (6") of topsoil shall be spread over areas to be seeded. Topsoil shall be free of stones, sticks, plants, roots, waste material and similar debris. Frozen ground shall not be spread as topsoil, and topsoil shall not be spread on frozen ground. All topsoil that was removed and stockpiled shall be used provided that it is suitable. Topsoil furnished from off-site areas may also be used provided that it is typical or topsoil of the locality and is suitable. Topsoil shall be spread only when the CONTRACTOR is prepared to follow up with fertilizing and seeding. Fine grading to finished lines, grades and contours, fertilizing and seeding shall be done at such times as approved by the BOROUGH.
3. The topsoil shall be spread and brought to finished grade, then leveled through the use of straight edges and finally rolled, but not compacted, the topsoil to have a depth of not less than 6 inches after final rolling. The surface shall be rolled with a 200 pound roller. The surfaces, when finished and settled, shall conform to the finished grade and shall be free of hollows or other inequalities and from stones, sticks and other debris.
4. After spreading, raking and rolling the topsoil, the CONTRACTOR shall apply limestone and commercial fertilizer, worked in to depths of three inches (3") to four inches (4"), as follows:
 - (a) Dolomitic Limestone at a rate of 135 pounds per 1,000 square feet.
 - (b) 10-20-10 Fertilizer at a rate of 25 pounds per 1,000 square feet.

5. Seeding shall be done during periods from April 15th to June 1st and/or from September 1st to October 15th, unless otherwise directed by the BOROUGH.
6. Grass seed shall not be planted after a heavy rain nor when the velocity of the wind exceeds a gentle breeze of about 5 miles per hour and not sooner than two (2) days after applying lime and fertilizer, as specified herein.
7. All seed used shall be labeled in accordance with the U.S. Department of Agriculture General Provisions under the Federal Seed Act in effect at the time of purchase, which shall be later than the date of the CONTRACT. Seed, which has become wet, moldy, or otherwise damaged in transit or in storage, will not be acceptable. Seed shall not be more than two (2) years old and shall be retested for germination rate no more than ninety (90) days prior to planting.
8. Seeding and planting shall be as follows:

(a) Sloped Areas less than 25% (4 horizontal to 1 vertical)

<u>Seed Mix</u>	<u>% Mix</u>	<u>Germination</u>
Kentucky Bluegrass	50	80%
Red Fescue	30	80%
Perennial Ryegrass	20	90%

Seed Spreading Rate – 8.0 lbs per 1,000 square feet (4.0 lbs in one direction and 4.0 lbs in direction at right angle to first direction.)

(b) Sloped Areas 25% (4 horizontal to 1 vertical) and greater

<u>Seed Mix</u>	<u>% Mix</u>	<u>Germination</u>
Creeping Red Fescue	29.11	92
Timothy	19.99	93
Tetraploid Annual Ryegrass	19.95	91
Red Top	17.10	91
Alsike Clover	11.97	80
Other Crop	0.12	--
Inert Matter	1.74	--
Weed Seed	0.02	--

Spreading rate – 7.0 lbs. per 1,000 square feet

Seed mix shall be “Right-of-Way Woods Mixture” by Ernst Conservation Seeds or BOROUGH approved equal.

9. The CONTRACTOR shall maintain the seeded and planted areas until all of the WORK under the CONTRACT has been completed and accepted by the BOROUGH.
10. The maintenance shall consist of refilling erosion gullies, reseeding, replanting, mowing and watering during periods of drought and removal of large and obnoxious weeds, all as directed by the BOROUGH.

c. Mulching – Sloped Areas less than 25% (4 horizontal to 1 vertical)

After the permanent seeding of sloped areas less than 25%, the CONTRACTOR shall furnish, place, anchor and maintain mulch at the locations shown on the DRAWINGS and as directed by the BOROUGH. Mulching material shall be either hay, unrotted salt hay or weed-free straw, or a combination of each, free from any seed-bearing stalks and roots of noxious weeds. Mulch shall be placed within forty-eight (48) hours after seeding and shall be applied at a rate of one hundred forty (140) pounds per one thousand (1,000) square feet.

d. Erosion Control Blankets – Sloped Areas 25% (4 horizontal to 1 vertical) and Greater

1. Erosion control blankets shall be placed as shown on the DRAWINGS or as otherwise directed by the BOROUGH. In addition to the permanent limestone, fertilizer and seeding specifications noted herein, the CONTRACTOR shall furnish, place, anchor and maintain erosion control blankets in all disturbed areas with slopes 25% and greater, as follows:
 - (a) The erosion control blanket for areas with slopes of 25% to 50% shall be “North American Green – S150 BN” biodegradable blanket or BOROUGH approved equal.
 - (b) The erosion control blanket for areas with slopes of 50% and greater shall be “Maccaferri, Mac-Mat R8” blanket or BOROUGH approved equal.

2. The erosion control blankets shall be secured in place with pegs or staples in accordance with manufacturer's recommendations. All permanent seed, fertilizer and limestone applications performed in conjunction with the erosion control blanket installation shall be performed as per manufacturer's recommendations.
3. The CONTRACTOR shall maintain all erosion control blankets until all WORK has been completed and accepted by the BOROUGH.

e. Sodding

1. Where designated on the DRAWINGS, or where otherwise directed by the BOROUGH, the CONTRACTOR shall furnish, place and maintain cultivated sod in accordance with these SPECIFICATIONS.
2. Sod.
 - (a) Sod shall be predominantly K-31 Fescue and shall not contain more than ten (10%) percent of other acceptable fine turf species. It shall be entirely free of weeds, harmful insects and disease and be of mineral soil origin. All sod shall meet the certification requirements of the Pennsylvania Department of Agriculture.
 - (b) A sample of the sod to be installed shall be supplied to the BOROUGH for approval prior to delivery.
3. Installation.
 - (a) Sod shall be cut in rectangular sections measuring 12 inches to 24 inches in width by 2 feet to 6 feet in length to permit handling without tearing or breaking. The section of sod shall be approximately $\frac{3}{4}$ inch in thickness and the height of the grass shall be approximately $1\frac{1}{2}$ inches.
 - (b) All sod shall be placed within 48 hours after being cut and shall be in a well-moistened condition when delivered to the site. Should temporary storage be required, the sod shall be protected from direct sunlight and drying. Dried-out sod will not be accepted.
 - (c) All grading and soil preparation shall be completed prior to the placement of the sod. The soil shall be moist prior to placing sod and when moisture and temperature conditions are

suitable. Sod shall not be cut or placed when the temperature is lower than 35°F.

- (d) Sod shall be carefully placed by hand with tight joints and no overlap. Care shall be taken to not damage the sod during installation. Transverse joints shall be broken or staggered. All sod shall be thoroughly watered to the point of saturation immediately after placement.
- (e) After watering, the sod shall be sufficiently tamped with an approved tamper to close all joints and ensure a close contact between the sod and sod bed. After tamping, the sod shall be free from bumps and depressions and shall present a smooth even surface.
- (f) On all slopes, the sod shall be placed with the long axis parallel to the contour starting at the bottom of the slope. On slopes and in ditches, each strip of sod shall be securely staked with at least one for each two square feet of sod. Stakes shall be driven flush with the top of the sod and with the long face parallel to the slope contour.

2.05 MAINTENANCE AND RESTORATION

- a. In paved highways, streets, alleys, sidewalks, driveways and shoulders, temporary paving shall be maintained in accordance with Section 1.16.b., herein, or as otherwise directed by the BOROUGH, before permanent paving is installed. During this period, any settlement or other deterioration of the trench shall be repaired in accordance with the requirements of Section 1.16, herein. No dirt or loose material will be allowed on the trench.
- b. Along private rights-of-way, trenches shall be maintained for a minimum of ninety (90) calendar days after backfilling, or as otherwise directed by the BOROUGH before permanent restoration is made. During this period, any settlement of the trench shall be repaired by constructing to grade with clean, approved fill material.
- c. Trench areas shall be restored as specified herein or, with the approval of the BOROUGH, to the condition existing prior to the start of WORK; and shall include, but not be limited to, reseeding or resodding lawns, replacing trees and shrubbery damaged by the CONTRACTOR, and replacement of pavement, curbing, driveways, walkways, guiderails or fences.

- d. The CONTRACTOR shall repair any settled or defective trench, in a manner approved by the BOROUGH, occurring during the maintenance period as required by the Agreement between the CONTRACTOR and the BOROUGH.

END OF SECTION

BOROUGH OF DOYLESTOWN

PART 2 – MATERIALS, INSTALLATION AND TESTING

SECTION III

MATERIALS, INSTALLATION AND TESTING – WATER SYSTEMS

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SECTION III

MATERIALS, INSTALLATION AND TESTING – WATER SYSTEMS

A. MATERIALS

3.01 GENERAL

- a. Unless otherwise specified, all materials used in the WORK shall conform to the requirements of ASTM International (formerly the American Society for Testing and Materials) (ASTM), the American Water Works Association (AWWA), the American National Standards Institute (ANSI), and the International Plumbing Code (IPC), which are current as of the date of these SPECIFICATIONS, unless otherwise noted herein.
- b. No material shall be used until it has been inspected and approved by the BOROUGH at the job site of the WORK. When required by the BOROUGH, any or all materials entering into the construction of any WORK shall be tested by a testing laboratory acceptable to the BOROUGH. Such inspection shall not relieve the CONTRACTOR from any obligation in this respect and any defective material or workmanship which may have been passed by the BOROUGH shall be at all times liable to rejection when discovered, until completion of the maintenance period as required by the Agreement between the CONTRACTOR or DEVELOPER and the BOROUGH.
- c. Only materials called for on the DRAWINGS or specified herein will be permitted. The methods of installation of these materials are detailed in Section 3.22 of these SPECIFICATIONS.

3.02 CONCRETE AND CONCRETE WORK

- a. General
 - (1) All concrete shall conform to the Commonwealth of Pennsylvania Department of Transportation Specifications, Section 704 of Publication 408 (latest edition) for Class AAA, Class A and Class C concrete. All concrete shall be Class AAA, unless otherwise indicated on the DRAWINGS. Concrete shall be both watertight and chemical resistant. Class AAA concrete shall have a minimum compressive strength of 4,500 psi at 28 days, Class A concrete should have a minimum compressive strength of 3,300 psi at 28

days, and Class C concrete shall have a minimum compressive strength of 2,000 psi at 28 days.

- (2) The maximum allowable slump for all concrete shall be 4 (\pm 0.5) inches. Slump determination shall be in accordance with ASTM Specification C143.
 - (3) All concrete shall be plant mixed and air entrained ($5\% \pm 1\%$ by volume). The air entraining admixture shall conform to ASTM C 260. A water reducing admixture, conforming to ASTM C 494, shall be used and shall be either "WRDA with Hycol", by W.R. Grace & Co., or "Pozzolith" by BASF, or BOROUGH approved equal. The quantity to be added, the controlling temperatures, and the method of mixing shall conform to the written recommendations of the manufacturer. A copy of the proposed concrete mix shall be submitted to the BOROUGH before proceeding with the concrete work.
- b. All reinforcing mesh and bars shall conform to the requirements of "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement", ASTM A 515 for Grade 60 carbon-steel. Welded wire fabric shall conform to the requirements of "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete", ASTM A 185.
 - c. Loose material or backfill used to support fresh concrete shall be compacted sufficiently to maintain settlement within the dimensional requirements of ACI 347-04. If forms are used by the CONTRACTOR, they must be adequately constructed and supported to avoid bulging of, and/or deforming, the concrete. Forms are to be coated with cup grease, or an approved equal, in order to facilitate removal. All forms must be removed by the CONTRACTOR after the concrete has sufficiently hardened.
 - d. All exposed vertical surfaces shall receive a smooth rubbed finish. All exposed flat surfaces and exterior slabs shall receive a floated finish.
 - e. Thrust blocks and vertical anchor blocks shall be provided, as shown on Standard Detail No. SD-W-13 and SD-W-14, and as required to restrain either flanged, mechanical joint, or push-on joint pipe.
 - f. The BOROUGH reserves the right to have tests performed to ensure that the concrete, as furnished, meets the requirements of these Specifications. The CONTRACTOR shall furnish the services of an independent professional materials testing laboratory, as approved by the BOROUGH, to certify, as specified or required, all work and materials incorporated in the furnishing and installing of quality concrete work for the PROJECT. If the

strength tests fail to meet the concrete requirements, the BOROUGH may then require in-place and/or core tests. All tests shall be at the expense of the CONTRACTOR or DEVELOPER.

- g. Concrete work which fails to meet the Specification requirements, or which is not brought into compliance, may be rejected, in which case it shall be removed and replaced at the expense of the CONTRACTOR.

3.03 MASONRY UNITS

- a. Brick intended for uses in manholes and appurtenances shall conform to the requirements of ASTM C 32, Grades MS and MM. Lugged paving brick, cored brick, or brick having recesses or openings extending through the body of the brick shall not be used.

3.04 MORTAR

- a. The mortar for masonry work shall be either a prepared mortar conforming with the requirements of ASTM C 91, with Type II cement, or shall be made of one (1) part Portland cement, one (1) part lime, and five (5) parts sand in a damp loose condition. The cement shall conform to the requirements of ASTM C150 with Type I cement. The lime shall conform to the requirements of ASTM C207 with Type S special hydrated lime. The sand shall conform to the requirements of ASTM C144.

3.05 GROUT

- a. The grout mix shall be one (1) part Portland cement to two (2) parts sand, plus the minimum amount of water necessary for proper placement, which shall not exceed a water to cement ratio of 0.49 by weight. When permitted to stand until setting takes place, the grout should neither bleed nor segregate. Cement shall conform to the requirements of ASTM C150 with Type I cement, and the sand shall conform with the requirements of ASTM C144. Immediately before placing the grout, the area to be grouted shall be thoroughly cleaned and moisture applied. The grout shall be carefully placed to completely fill all voids. Exposed edges of the grout should be kept moist and at temperatures above 40°F for at least three (3) days after placement.

3.06 PRECAST CONCRETE CHAMBERS

- a. Precast concrete chambers or vaults, including steps, frames, covers, etc., shall be as specified under Section 4.05 of these SPECIFICATIONS, except the word "**WATER**" shall be cast in the cover.

3.07 DUCTILE IRON PIPE

- a. All buried water mains shall be ductile iron pipe, of the required size(s) as indicated on the DRAWINGS. The pipe barrel shall conform to ANSI A21.51/AWWA C-151-09. All pipe shall be gasketed push-on type and/or mechanical joints and all fittings must be mechanical joint. Mechanical joint/push-on joint pipe shall be minimum thickness Class 52 for sizes up to and including 12-inch pipe and minimum thickness Class 53 for sizes greater than 12-inch pipe, all with a 350 psi maximum working pressure as per ANSI A21.51/AWWA C151-09.
- b. All buried pipe and fittings shall be cement-mortar lined (double thickness per ANSI A21.4/AWWA C104-088) and shall have manufacturer's standard bituminous coating applied to exterior surfaces.
- c. Mechanical joint/push-on joint ductile iron pipe and mechanical joint ductile iron fittings shall conform to the following standards:

ANSI A21.51/AWWA C151-09 – Ductile Iron Pipe (Class 52)

ANSI A21.11/AWWA C111-07 – Rubber Gasket Type Joints

ANSI A21.10/AWWA C110-08 – Ductile Iron Mechanical Joint Fittings

3.08 GATE VALVES AND VALVE BOXES

- a. Gate valves shall be manufactured in full compliance with the content of these SPECIFICATIONS and with AWWA C509-09 for Resilient-Seated Gate Valves. The valves shall have iron body construction, bronze mounted, and resilient seated. The valve interior shall be free of ledges, pockets, or other areas which can collect debris or sediment. The valve body and bonnet shall be fusion bonded epoxy coated on all interior and exterior surfaces. The interior epoxy coating shall be AWWA approved for potable water applications. The waterway area shall be unobstructed and valve shall be capable of passing a full size shell cutter. The valve shall be provided with "O" ring stem seals and a lubricant reservoir for the purpose of lubricating the "O" rings and stem thrust collar when valve is operated. Stem seal design shall allow replacement of "O" ring seals while valve is in any position of service. The valve shall be the non-rising stem type, standard 2-inch square nut-wrench operated, and shall open when operated in the counter clockwise direction. The gate valve shall have a 250 psig working pressure and shall be certified to pass a 500cycle test at 250 psig unbalanced pressure without wearing away the interior epoxy coating to bare metal. Valve shall also seal after cycle test without leakage at the gate or the "O" ring stem seals.

- b. Gate valves shall be mounted vertically and shall be furnished with mechanical joint end connections.
- c. Gate valves shall be as manufactured by Waterous Company, U.S. Pipe Valve and Hydrant Division of Mueller Water Products, LLC, or BOROUGH approved equal.
- d. Valve boxes shall be cast iron and shall be installed at each buried gate valve. The minimum thickness of the metal of the box, at any point, shall be not less than 3/16 of an inch. The cover shall have cast thereon the word "WATER". The cast iron valve box and cover shall be given a heavy coat of bituminous paint. Valve boxes shall be adjustable two (2) piece sliding type for 12-inch diameter and smaller, and adjustable three (3) piece sliding type for pipe sizes greater than 12-inch diameter and all shall have an internal shaft diameter of 5¼ inches. The bell diameter of bottom section shall properly fit over the valve bonnet and be compatible with the various gate valve sizes specified for the WORK. Valve boxes shall be as manufactured by Bingham and Taylor, Model #5564-F or BOROUGH approved equal.

3.09 BUTTERFLY VALVES

- a. Butterfly valves may be approved by BOROUGH on lines sixteen inches (16") in diameter or larger. All butterfly valves shall be manufactured in accordance with AWWA C504 for Class 150B service, with mechanical joint ends for buried service.
- b. Cast iron body shall conform to ASTM A126 for Class B gray iron.
- c. Cast iron valve disc shall conform to ASTM A48 with Grade 316 stainless steel seating edge and Buna-N rubber valve seat.
- d. Valve actuators shall be fully grease packed and have stops in the open/close position.
- e. Butterfly valves shall be as manufactured by Henry Pratt Company for Groundhog Butterfly Valves or BOROUGH approved equal.
- f. Valve boxes for butterfly valves shall be as specified in Section 3.08.d, herein.

3.10 TAPPING SLEEVES AND VALVES

- a. Tapping valves shall be mounted vertically and shall be of the same construction and type as specified in Section 3.08, herein.
- b. Inlet ends of tapping valves shall have an ANSI, B16.1, Class 125 inlet flange for attaching to the sleeve; the outlet of the valve shall have a mechanical joint end.
- c. The tapping sleeves shall have an ANSI, B16.1, Class 125 outlet flange. The tapping sleeves shall be made in two halves and shall be designed for 250 psi working pressure. The sleeves shall be the mechanical joint type. The O.D. on the pipe upon which the tapping sleeves are to be placed shall be verified in the field by inspection by the CONTRACTOR prior to their installation.
- d. Tapping sleeves and valves shall be as manufactured by Mueller Company for mechanical joint tapping sleeve or BOROUGH approved equal.

3.11 COPPER SERVICE TUBING

- a. Copper service tubing shall conform with the requirements of ASTM B88-09 for Type K, heavy wall, soft temper seamless copper alloy water tubes. All water services shall be installed using the specified copper service tubing. The tubing diameter shall be either $\frac{3}{4}$ " diameter, 1" diameter, or 2" diameter as required by the BOROUGH for the specified WORK. The tubing diameter for combination residential fire and domestic services shall be 1" minimum diameter. All joints shall be of the compression type. Couplings, with nonmetallic O-ring seals, may be used, if permitted by the BOROUGH.
- b. Any alternate water service materials must be approved by the BOROUGH.

3.12 SERVICE CONNECTION APPURTENANCES

- a. Each water service connection of one inch (1") diameter and smaller shall be made by use of a corporation stop of the size and type indicated on Standard Detail No. S-W-03 for the pipe material and size being tapped. Each service connection will terminate at a curb stop with curb stop box as shown on Standard Detail No. S-W-03. Construction of two inch (2") diameter water service connections are as shown on Standard Detail No. SD-W-04. All service connection fittings shall be NO LEAD in compliance with the latest requirements of the Federal Safe Drinking Water Act. Service

tubing shall be continuous from corporation stop to curb stop and of the material noted.

1. Corporation Stops. Brass corporation stops shall be provided for service connections to the water mains at the locations as indicated on the DRAWINGS, or as directed by the BOROUGH. Corporation stops shall be designed and manufactured to conform with AWWA Standard C800-2012. The corporation stops shall have a 300 psi working pressure, and shall be individually inspected and tested for leaks by air pressure under water. Corporation stops shall be installed using tapping machines of current design. Buried corporation stops for ¾-inch and 1-inch diameter services shall be only Mueller Company, Model B25000 or Ford Meter Box Company, Model FB600-3-NL for ¾-inch services and Model FB600-4-NL for 1-inch services. Corporation stops for 2-inch diameter services shall be only Mueller Company, Model B25000 or Ford Meter Box Company, Model FB600-7-NL.
 2. Curb Stop Valves. Curb stops for ¾-inch and 1-inch diameter water services shall be only Mueller Company, Model P25209 or Ford Meter Box Company, Model B44-333-NL for ¾-inch services and Model FB44-444-NL for 1-inch services. Curb stops for 2-inch water services shall be only Mueller Company, Model P25209 or Ford Meter Box Company, Model B44-777-NL.
 3. Curb Stop Boxes. Curb stop boxes shall be 2½" cast iron curb service boxes, never with a rod, and shall be only Bingham and Taylor, Model 4901-B, sizes 93D or 93E. The lids shall be cast iron with new style flush fit covers. Lids shall have pentagon head bolt and be marked "WATER".
- b. Service connections for combination 1" (minimum) residential fire and domestic service lines shall be as shown on Standard Detail No. SD-W-09. Water service size is to be determined through customer's approved sprinkler design and, unless otherwise specified, shall conform to the requirements of Section 3.12.a, herein.
1. Corporation Stops. Brass corporation stops for 1" diameter services shall be only Mueller Company, Model B25000 or Ford Meter Box Company, Model FB600. Corporation stops for ¾-inch domestic lines shall be as specified in Section 3.12.a.1, herein.
 2. Curb Stop Valves. Curb stops for 1" diameter fire lines shall be only Mueller Company, Model P25209 or Ford Meter Box Company,

Model B44. Curb stops for $\frac{3}{4}$ -inch domestic lines shall be as specified in Section 3.12.a.2, herein.

3. Curb Stop Boxes. Curb stop boxes for 1-inch curb stop valves shall be only Bingham and Taylor, Model 4901-B, sizes 93D or 93E with flush lid, never with a rod. Curb stop boxes for $\frac{3}{4}$ -inch domestic lines shall be as specified in Section 3.12.a.3, herein.

3.13 FIRE HYDRANTS

- a. All fire hydrants shall be manufactured in accordance with AWWA C-502-05 for post-type, dry-barrel, compression type hydrant with valve opening against the pressure and closing with the pressure. All fire hydrants shall have a 250 psig rated working pressure.
- b. Inlet size and type shall be 6" mechanical joint with mechanical joint retainer gland accessories. Valve opening shall be five and one-quarter inches (5- $\frac{1}{4}$ ").
- c. All hydrants shall be equipped with two (2) 2- $\frac{1}{2}$ " hose nozzles, and one (1) 4- $\frac{1}{2}$ " pumper nozzle. The threads on the hose and pumper nozzles shall be National Standard unless otherwise required by the local Fire Company. All nozzles shall have a nozzle cap individually attached to the standpipe with rustproof/kinkproof keeper chain. Operating nozzle cap nuts shall be AWWA standard unless otherwise specified.
- d. All hydrants shall open counterclockwise (left). All internal operating parts shall be removable through the standpipe without digging or removing the barrel.
- e. Hydrants shall be provided with an O-ring type seal plate. The O-ring seal plate shall be so constructed that a moistureproof grease chamber integral with the seal plate shall be provided which shall enclose the operating threads, thereby automatically lubricating the operating threads and friction surfaces each time the hydrant is operated. The seal plate shall be fitted with at least two (2) O-rings, the lower O-ring shall serve as a pressure seal and the upper O-ring as a combined dirt and moisture seal to prevent foreign matter and moisture from entering the grease chamber. An oil bath chamber is acceptable for Waterous hydrants.
- f. The standpipe sections shall be connected two inches (2") above the ground line by a two-part traffic safety flange. Depth of bury shall be four and one-half (4- $\frac{1}{2}$ ') feet. The nozzles shall be a minimum of eighteen inches (18") above the ground line.

- g. A six inch (6") mechanical joint gate valve with valve box as specified in Section 3.08 shall be furnished and installed at each hydrant in accordance with Standard Detail No. SD-W-02.
- h. All external surfaces of the hydrant standpipe above grade (upper barrel) shall have a factory applied epoxy primer and polyurethane top coat. The hydrant standpipe below grade (lower barrel), together with all internal ferrous surfaces above grade, shall be given two (2) coats of black asphaltum varnish. The exposed surfaces above grade, including nozzle caps and bonnet, shall be primed and given two (2) finished coats of oil base paint. Color(s) shall be as specified by the Borough.
- i. Fire hydrants shall be Metropolitan/M-94, as manufactured by U.S. Pipe. No substitutions will be permitted.

B. INSTALLATION AND TESTING

3.14 GENERAL

The CONTRACTOR shall install all water mains, service connections and appurtenances of the size and type shown on the DRAWINGS in accordance with these SPECIFICATIONS and shall perform all testing in accordance with the requirements of ASTM International.

3.15 MATERIALS

All materials used in the installation of water systems shall be as specified in Section III.A., herein.

3.16 LAYING WATER MAINS

Water mains and service connections shall be laid in accordance with AWWA C600-10 (Installation of Ductile Iron Water Mains and their Appurtenances), recommendations of the manufacturer for storage, handling and installation and these SPECIFICATIONS.

a. Handling

Pipe and accessories shall be distributed at the PROJECT site and shall, at all times, be carefully handled to avoid damage. All pipes shall be rolled or lifted, with care being taken not to bump or drop pipe or fittings. In order to avoid damage to the interior of the pipe, lifting hooks or bars shall not be inserted therein. Before installing any pipe, care shall be taken that the interior and machined ends of all pipes shall be thoroughly cleaned and kept

free from dirt, cuttings and foreign matter. Tool marks and unnecessary pipe threads shall be avoided. Burrs formed when cutting pipe shall be removed by reaming. Valves and hydrants shall be protected from damage and dirt and kept drained of water, which could cause damage during freezing weather.

b. Trench Preparation

The trench shall be excavated to the proper subgrade and the bedding material shall be placed in the trench at a minimum thickness of 6 inches below the pipe. The bedding material shall conform to Section 1.06.b. of these SPECIFICATIONS. The pipe shall then be placed so that the entire length of the pipe is resting on the bedding, not on the bells. Each length of pipe shall be carefully handled, and accurately laid, by skilled workmen to line and grade with a minimum cover over the top of the pipe of 4'-0" or as otherwise shown on the DRAWINGS, without the use of any form of blocking. Each length shall be cleaned, the joint prepared in accordance with the manufacturer's recommendations, and be pushed home against previously installed pipe.

c. Alignment and Grade

1. All pipe shall be carefully laid to the lines and grades as shown on the DRAWINGS, without offsets or unevenness at the joints. The location and grade for all piping shall be staked out by a registered surveyor licensed in the Commonwealth of Pennsylvania or by personnel under the supervision of same.
2. Alignment and grade may be set by laser equipment, if desired by the CONTRACTOR. Operation of the equipment shall be as recommended by the manufacturer. Grade boards will not be required if a laser is used.
3. The CONTRACTOR may use batter boards instead of laser equipment. If batter boards are used, grades shall be taken from established baselines and "cut sheets", both of which are the responsibility of the CONTRACTOR. If the CONTRACTOR is using batter boards, there shall be a minimum distance between stakes of twenty-five feet (25'). If the grades are flat, and the AUTHORITY so orders, the CONTRACTOR shall place intermediate boards between those normally established to avoid sag in the working line.
4. Preparation of "cut sheets" or other requirements for construction are the responsibility of the CONTRACTOR.

5. Regardless of control used, the CONTRACTOR shall provide alternative verification of grade as work progresses. Pipe not laid to proper line and grade shall be removed and reconstructed at the CONTRACTOR'S expense.

d. Installation of Pipe

1. Any conflicts arising during the erection of piping shall be brought to the attention of the BOROUGH. No improvising or field changes will be permitted without the approval of the BOROUGH.
2. All piping shall be erected in such a manner as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending moments at joints or connections to equipment.
3. Full lengths of pipe shall be used whenever possible. Short lengths of pipe with couplings will not be permitted, except as may be approved by the BOROUGH to eliminate overstressing or misalignment. All pipe shall be cut to exact measurement and shall be installed without forcing or springing.
4. Where piping is pitched for drainage, an accurate grade shall be maintained. Piping shall be supported in such a manner as to prohibit deflection due to gravity that would be sufficient to pocket the lines when full of liquid. All changes in direction shall be made by using pipe fittings, unless otherwise shown on the DRAWINGS, or as approved by the BOROUGH.
5. Unions shall be installed in all piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and removal of valves and other items requiring maintenance. Flanges on equipment may be considered as unions. At least one union shall be provided in every straight run of pipe, when directed by the BOROUGH.
6. All buried bolts, nuts, lugs, rods, brackets, etc., except stainless steel, shall be given one heavy coat of coal tar epoxy coating prior to backfilling.
7. When pipe is cut in the field, the cut end shall be tapered back approximately 1/8 inch, at an angle of 30° with the centerline of the pipe, with a coarse file or grinder to remove any rough edges which might injure a gasket, where applicable.

8. Where it is necessary to join pipes of different types and/or sizes, the CONTRACTOR shall furnish and install the necessary transition sleeves, couplings, and/or reducers/increasers, approved by the BOROUGH. Transition sleeves, couplings, and/or reducers/increasers shall have ends conforming to specifications for the appropriate type of joint to receive the adjoining pipe.

Where approved by the BOROUGH, pipe transitions shall be made with solid cast ductile iron sleeve couplings as manufactured by Smith-Blair, Inc. or BOROUGH approved equal. Where transitions are made between pipes of same or different sizes and same or different materials, the connections shall be made with the use of OMNI Couplings, No. 441/442, as manufactured by Smith-Blair, Inc. or Engineer-Approved equal.

9. Pipe shall be carefully lowered into the prepared trench and bedding. The BOROUGH will inspect each length of pipe and all fittings prior to installation. Rejected pipe or fittings shall be promptly removed from the PROJECT site. For bell and spigot pipe, the WORK shall proceed with bells facing the direction of lying. On slopes greater than ten percent (10%), the pipe laying will proceed upgrade. The ends of pipe to be joined shall be carefully cleaned and gasket lubricant placed in accordance with the recommendations of the pipe manufacturer.
10. The spigot end shall be set into the bell for coupling in place, centered and pushed into place with a jack or other device approved by BOROUGH.
11. Field fabrication of make-up pieces shall be completed in accordance with recommendations of the pipe manufacturer and full use shall be made of the manufacturer's specialty pieces for this purpose.
12. Every precaution should be used to prevent foreign material from entering the pipe. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by BOROUGH.
13. After laying of pipe and installation of all appurtenances, the trench shall be completely backfilled in accordance with Section I of these SPECIFICATIONS.

3.17 INSTALLATION OF VALVES

Valves of the sizes and at the locations shown on the DRAWINGS shall be set in accordance with Standard Detail No. SD-W-01. All valves shall have mechanical joint ends with either retainer glands or mega-lugs. The connecting pipe shall be adapted, if necessary, to suit the mechanical joint fitting with at least one short make-up piece. The valve shall be uniformly bedded and supported in 2B stone bedding installed for support of the valve box base. The valve stem and valve box shall be set plumb and the box shall be centered over the opening nut.

3.18 INSTALLATION OF FIRE HYDRANTS

Fire hydrants shall be installed at the locations shown on the DRAWINGS and shall be installed in accordance with Standard Detail, SD-W-02. Unless otherwise noted, hydrant installation will be through a hydrant tee with six-inch (6") branch, six-inch (6") gate valve and six-inch (6") piping. Joints shall be mechanical joints with either retainer glands or mega-lugs. Hydrant and shut-off valve shall be set plumb, and thrust blocking and drainage bed shall be constructed as shown on the Standard Details. Drainage bed and drain holes shall not be encased by concrete.

3.19 THRUST BLOCKING AND JOINT RESTRAINT

- a. Cast-in-place concrete thrust blocking or anchors shall be provided on all lines at bends, tees, capped or valved end fittings and at all points of potential thrust or where otherwise directed by the BOROUGH. Blocking or anchors shall be poured against undisturbed earth and shall be in accordance with Standard Details No. SD-W-13 and No. SD-W-14. Soil bearing values used shall be as designated by the BOROUGH.
- b. CONTRACTOR shall use restrained joint ductile iron pipe and restraining elbows, tees, hydrants and plugs where indicated. Restrained joint pipe shall be used when one or more of the following conditions exist:
 1. Where indicated on DRAWINGS.
 2. Unsuitable trench conditions as directed by the ENGINEER.
 3. Unsuitable soil conditions as directed by the ENGINEER.
 4. Interference with, or close proximity to buried structures, pipelines or utility lines.

Restrained joint fittings, valves and piping shall be constructed in place, not preassembled, and then installed. This is to eliminate movement/damage to the restraint when installing.

- c. **Restrained Joint Pipe:** When thrust blocks cannot be used, restrained joints shall be placed at all points of potential thrust. The number of joints to be restrained on each side of a fitting shall be determined by the pipe manufacturer and submitted to the ENGINEER for review and approval. The length of restrained pipe shall be sufficient to resist the specified hydrostatic test pressures and shall also take into account such factors as the burial depth, soil types and backfill material used. Restrained joint ductile iron pipe shall be of the restrained mechanical or push-on joint type. Mechanical joint retainer glands are not acceptable. Restrained joint piping shall sustain the indicated test pressures, as a minimum.

3.20 INSTALLATION OF BLOW-OFF VALVES

Blow-off valves shall only be permitted when a fire hydrant cannot be utilized and must be approved by the BOROUGH. The discharge from the blow-off shall be to a drainage structure, a natural drainage course, or to a surface as directed by the BOROUGH. Blow-off valves shall conform in all respects to the requirements for gate valves as specified in Section 3.08 herein, and the installation shall conform to Section 3.18 and Standard Details No. SD-W-15, No. SD-W-16 and No. SD-W-17, as applicable.

3.21 LAYING SERVICE CONNECTIONS

- a. Service connections shall extend from the public water main to the structure or facility to be served and should be installed at the locations and of the sizes shown on the DRAWINGS or as directed by the BOROUGH. Service connections shall consist of a corporation stop, curb stop and box with interconnecting service tubing. The connecting ends of corporation stops and curb stops shall be consistent with the size and material of service tubing in accordance with Section 3.12 of these SPECIFICATIONS and with Standard Detail No. SD-W-03 and SD-W-04.
- b. Service connections at the main shall be made with a drilling and tapping machine by the approved manufacturer (Mueller). The corporation stop shall be installed with a minimum engagement of three (3) full threads. Under no circumstances shall the CONTRACTOR connect to the main without approval of the BOROUGH. When installing the corporation stop, the tap shall be made on the pipe crown at the 45° position. Larger taps (2" and greater) may come 90° off of the main with approval of the Borough and Engineer.
- c. Service tubing shall be loosely laid without kinking from the corporation stop to the curb stop in a single length without the use of intermediate couplings.

- d. The curb box shall be set plumb over the curb stop. The consumer side or the curb stop shall be suitable for receiving copper tubing unless instructed otherwise by the BOROUGH. All excavation and backfill for service connections shall be in accordance with Section I of these SPECIFICATIONS.

3.22 FIELD TESTING

a. General

1. During construction and at the completion of the WORK, the CONTRACTOR shall make tests, as directed by the BOROUGH, to ascertain if the pipe is properly aligned and the joints are tight. The BOROUGH will direct and witness all tests. The CONTRACTOR is responsible for providing a pressure gauge and a metering device if required for the test. The CONTRACTOR shall also furnish a suitable pump and all other apparatus required. Defective work shall be repaired or replaced immediately, at the CONTRACTOR'S expense.
2. All pipe lines shall be thoroughly flushed with water to obtain free flow through all lines. All obstructions and debris in lines shall be removed and any apparent defects corrected prior to testing.
3. Where any section of water main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until at least five calendar days after the installation of the thrust blocks, unless otherwise approved by the BOROUGH.

b. Testing of Buried Water Mains

Testing shall be in accordance with AWWA C600-10, Section 4, Hydrostatic Testing. Before the pipe is tested, concrete thrust blocks shall be in place and backfilling shall be completed. When the entire pipe line, or designated portion thereof, is completed, it shall be tested hydraulically as follows:

1. The pipe line or designated portion thereof shall be slowly filled by the CONTRACTOR with water from a source of supply made available by the BOROUGH, and shall be vented free from air or air pockets.
2. After the system has been full of water for 24 hours, the hydrostatic pressure shall be brought to 150 lbs./sq. in minimum and maintained for a period of 2 hours, or as directed by the BOROUGH. Test

pressure shall not vary by more than ± 5 psi for the duration of the test.

3. During the 2-hour period when the system is under the test pressure, no section of pipe of uniform diameter shall show a leakage in excess of 11.65 gallons per day per mile per inch of diameter. Allowable leakage is based on the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L =	allowable leakage, in gallons per hour
S =	length of pipe tested, in feet
D =	nominal diameter of pipe, in inches
P =	average test pressure during the leakage test, in pounds per square inch (gauge)

Any leaks shall be repaired in a satisfactory manner by the CONTRACTOR, at his own expense. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

4. Water service connections shall be tested and checked for visual leakage under normal system operating pressure, after installation and prior to backfilling, as specified herein.
5. All connections to existing piping shall be tested and checked for visual leakage under normal system operating pressure, after connections are completed and prior to backfilling, as specified herein.
6. A 1-inch diameter corporation stop shall be supplied and installed by the CONTRACTOR for the purpose of pressurizing the new main. The corporation stop for testing shall be installed at the point of highest elevation in the section of new main to be hydrostatically tested. Upon completion of the test, the corporation stop shall be removed and a threaded brass plug shall be installed by the CONTRACTOR.
7. Water mains not dedicated shortly after testing may be required to have a leak detection survey performed prior to dedication. The need

for a leak detection survey shall be determined by the BOROUGH or ENGINEER.

3.23 DISINFECTION

a. Potable Water Piping

1. Each unit of completed water supply lines and distribution system shall be thoroughly disinfected with chlorine before it is placed in operation. The disinfection shall conform to the requirements and standards set forth in AWWA C651-05, "Disinfecting Water Mains." All procedures for disinfection shall be approved by the BOROUGH prior to initiation of work. The form of chlorine to be used in the disinfection operation shall be only calcium hypochlorite granules. Liquid chlorine, sodium hypochlorite solution or calcium hypochlorite tablet forms of chlorine shall NOT be permitted. The standards for the calcium hypochlorite granular form of chlorine are defined in Section 4.1.3 of AWWA C651-05.
2. The continuous feed method for disinfection, utilizing calcium hypochlorite granules, shall be used. All procedures shall conform to Sections 4.2, 4.3, 4.4.3 and 4.5 of AWWA C651-05. The amount of chlorine applied shall be in accordance with Section 4.4.3 of AWWA C651-05. The methods and procedures for filling the water line for disinfection shall be approved by the BOROUGH. Following a contact period of not less than 24 hours, the heavily chlorinated water shall be flushed from the system as soon as possible with clean water until the residual chlorine content is no higher than that generally prevailing in the distribution system, as determined by the BOROUGH. Dechlorination of the heavily chlorinated water shall be performed prior to discharge.
3. The flushing procedures employed by the CONTRACTOR, and subsequent discharge location of the wasted water, shall be approved by the BOROUGH prior to implementation. All valves in water lines being sterilized shall be opened and closed several times during the test period. Only BOROUGH representatives shall operate valves.

b. Materials

1. The form of chlorine to be used for disinfecting the new water supply lines and distribution system shall be only calcium hypochlorite in granular form, containing 65% available chlorine by weight.

2. After sterilization, the BOROUGH will determine the bacteriological quality of the lines by laboratory testing. The test results must be certified by the laboratory that the water main/supply lines are free from coliform bacteria contamination. Failure of testing will require re-sterilization and testing.

3.24 FAILURE OF TESTS

If any of the above-referenced testing or sterilization procedures produces unsatisfactory results, as determined by the BOROUGH, the CONTRACTOR will be responsible to perform any required corrective work and to retest the subject line(s) until satisfactory results are obtained.

3.25 INTERRUPTION OF WATER SERVICE

During the course of the WORK, it may be necessary or advantageous to temporarily interrupt service to a customer or group of customers. If the CONTRACTOR wishes to interrupt service, written approval of the BOROUGH shall be obtained at least forty-eight (48) hours prior to such interruption of service; and it shall be the responsibility of the CONTRACTOR to notify all customers, whose service will be interrupted, at least twenty four (24) hours prior to such interruption of service. In all instances, the duration of interruption of service shall be kept to a minimum.

END OF SECTION

BOROUGH OF DOYLESTOWN

PART 2 – MATERIALS, INSTALLATION AND TESTING

SECTION IV

SPECIAL CONSTRUCTION

INDEX

<u>Item</u>	<u>Title</u>
4.01	General
4.02	Casing Pipe
4.03	Carrier Pipes
4.04	Bored Water Service Connections
4.05	Open Trenching

SECTION IV

SPECIAL CONSTRUCTION

4.01 GENERAL

- a. The WORK under this Section includes furnishing all labor, materials, equipment and services required for the installation of carrier pipe and casing pipe at railroad, highway, stream or other crossings as shown on the DRAWINGS. The WORK shall include all excavation, backfill, carrier pipe and casing pipe, complete in place as shown on the DRAWINGS.
- b. All such crossings shall include the complete installation of casing and carrier pipe, end seals, aggregate filler and launching/receiving pits, but shall not include any manholes or valves on either side of the crossing.
- c. It shall be the responsibility of the CONTRACTOR to provide, at no expense to the BOROUGH, any additional insurance coverage which may be required by the railroad companies, PennDOT, etc., and to reimburse the BOROUGH for any inspection costs or other services in conjunction with highway or railroad crossings at time of construction.
- d. The method of installing the casing or carrier pipe for water lines shall meet with the approval of the BOROUGH and railroad company or companies, the Pennsylvania Department of Transportation, the Pennsylvania Department of Environmental Protection and/or other regulatory agencies having jurisdiction. The casing pipe shall be installed with even bearing throughout its entire length. The ends of the casing conduit shall be suitably sealed as shown on Standard Detail No. SD-G-01.

4.02 CASING PIPE

- a. Steel casing pipe shall be provided for encasing water pipe at railroad, highway, stream and other crossings at the locations as indicated on the DRAWINGS. Casing pipe shall be of the diameter as shown on the DRAWINGS; however, the CONTRACTOR may install a casing pipe of larger diameter provided that all clearances under highways, railroad tracks, streams, etc., are maintained.
- b. Steel casing pipe shall conform to the following:
 - 1. Steel casing pipe shall conform to ASTM A139, Grade B steel with a minimum yield strength of 35,000 psi, and shall be coated, both inside

and outside, with a bituminous seal coat to a thickness of 0.05 inches and shall have wall thickness as follows:

Water Main Diameter	Minimum Casing Diameter	Minimum Casing Thickness
Less than 6"	12" I.D.	0.250"
6", 8" and 10"	18" O.D.	0.312"
12" and 14"	24" O.D.	0.375"
16" and 18"	30" O.D.	0.469"
20" and 24"	30" O.D.	0.469"

2. Casing pipe shall be fabricated in a manner to keep field welds to a minimum and shall conform to AWWA C200.
 3. All joints in steel casing pipe shall be field welded to conform to AWWA C206.
 4. All interior and exterior joints shall be brushed clean after field welding. A field prime paint coating shall be applied to all exterior joints and a field prime paint field lining shall be applied to all interior joints.
- c. Where the specified thickness or specified strength of the casing conduit must be increased to meet additional requirements of the regulating companies or bodies, the CONTRACTOR shall furnish and install the casing conduit as required by those companies or bodies.

d. **INSTALLATION**

1. The steel casing shall be installed by means approved by the BOROUGH, such as boring, jacking, etc. All equipment and methods shall be in conformance with the latest editions of Conrail Specifications For Pipeline Occupancy CE-8 (latest edition) and shall be approved by the ENGINEER prior to construction. All supervisory and operating personnel engaged in the installation of the casing pipe shall be fully qualified for such work and shall have had at least 12 months experience in the operation of the equipment being used.

The casing pipe shall be installed true to line and grade, as shown on the DRAWINGS. A minimum of 30 days prior to casing pipe installation, the CONTRACTOR shall submit, to the ENGINEER, a detailed description of the method to be employed for the casing pipe installation, the equipment and materials utilized, the personnel required, and a time schedule to complete the installation. Casing

pipe installation shall not commence until all required information is submitted to, and approved, in writing, by the ENGINEER.

Casing pipe installation shall include the following methods:

Boring - This method consists of pushing the pipe into the fill with a boring auger rotating within the pipe to remove the spoil. When augers, or similar devices, are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than $\frac{1}{2}$ inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited. Plans and descriptions of the arrangement to be used shall be submitted to the ENGINEER for approval and no work shall proceed until such approval is obtained. Any method which employs simultaneous boring and jacking for casing pipes over 8 inches in diameter which does not have the above approved arrangement WILL NOT BE PERMITTED. For casing pipes 8 inches and less in diameter, augering or boring without this arrangement may be considered for use only as approved by the ENGINEER.

Jacking - This method shall be in accordance with the current **American Railway Engineering and Maintenance-of-Way Association** Specifications, Chapter 1, Part 4.15, "Earth Boring and Jacking Culvert Pipe Through Fills." This operation shall be conducted without hand-mining ahead of the pipe and without the use of any type of boring, augering, or drilling equipment. Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can proceed without stoppage (except for adding lengths of pipe) until the leading edge of the pipe has reached the receiving pit.

Bored or jacked installations shall have a bored hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than approximately 1 inch, grouting or other

methods approved by the Engineer shall be employed to fill such voids.

2. Launching and receiving pits shall be constructed for the casing installation. The location of the pits shall be as shown on the DRAWINGS. The size of the pits shall be as required for the specific casing pipe installation equipment to be utilized. All launching and receiving pit excavation, protection, stabilization, etc. shall be in accordance with Part II, Sections I and II of these Specifications. All sheeting, bracing and shoring shall be designed to support all lateral forces caused by the earth and other surcharge loads. The CONTRACTOR shall submit design plans and computations for the pits and the sheeting, bracing and shoring stamped by a Professional Engineer registered in the Commonwealth of Pennsylvania, to the ENGINEER for review and approval.

The pits shall be excavated to a depth as required for the specific casing pipe installation equipment to be utilized. Bedding material, consisting of 1B coarse aggregate material, conforming to the grading requirements specified in Section 703 of PennDOT Publication 408, shall be placed on the bottom of the pit to a depth of 6 inches.

3. The casing pipe installation operation shall be continued on a 24-hour basis, without interruption, except to install new lengths of the casing pipe, until the leading edge of the pipe has reached the receiving pit. The lengths of the casing pipe shall be joined by bevel cut full penetration welds. The joints shall be welded completely around the circumference of the pipe so as to prevent water leakage from the casing throughout its length, except through the weep hole at the low end of the casing. The weep hole shall consist of 1/2 inch diameter, Schedule 40 PVC pipe having a minimum length of 10 inches.
4. After the casing has been installed, the carrier pipe shall be installed. The CONTRACTOR must support, brace, tie, etc. the carrier pipe to the grades indicated on the DRAWINGS. The method of support shall be as shown on Standard Detail No. SD-G-01. Prior to sealing the ends of the casing pipe, the carrier pipe shall be satisfactorily tested.
5. Upon completion of the utility crossing, including the casing pipe installation and installation of the carrier pipe, the CONTRACTOR shall immediately backfill the launching and receiving pits. The pits

shall be backfilled in 8 inch lifts to a point 8 inches below the existing grade. The backfill material shall be 1B coarse aggregate for the pipe bedding and 2A aggregate material for the remainder of the pit. All tamping and backfilling operations shall be performed in accordance with these Specifications.

4.03 CARRIER PIPES

- a. All carrier pipes shall be of the material and diameter as shown on the DRAWINGS.
- b. Each length of water piping shall be blocked at each end and at four (4) points equidistant in a manner acceptable to the BOROUGH, to prevent excessive movement of, and to center the pipe within the casing conduit.
- c. Each length of gravity piping shall be blocked at four (4) points around the perimeter of the pipe, in a manner acceptable to the BOROUGH, to prevent excessive movement of, and to allow gravity flow, through pipe within casing conduit.

4.04 BORED WATER SERVICE CONNECTIONS

Where specifically called for on the DRAWINGS, water service connections shall be placed in bored holes under highways, railroads, streams, etc. These crossings need not be cased but shall be a continuous piece of pipe.

4.05 OPEN TRENCHING

- a. In the event the CONTRACTOR wishes to trench in lieu of tunneling or jacking, written permission shall be obtained from the regulatory agency to do so and the work schedule shall be arranged to coordinate with the operation of the agency.
- b. The trench shall be excavated, shored and backfilled to satisfy the requirements of the regulatory agency.
- c. The CONTRACTOR shall be responsible for the payment of all work done by a railroad company in conjunction with the WORK, including, but not limited to, inspection and signaling costs; track removal, replacement and realignment; and the removal and replacement of the roadbed.
- d. If the CONTRACTOR is permitted to employ open trench excavation, casing conduit may not be required; however, the pipe installed shall meet the strength requirements of the regulatory agencies.

END OF SECTION

BOROUGH OF DOYLESTOWN

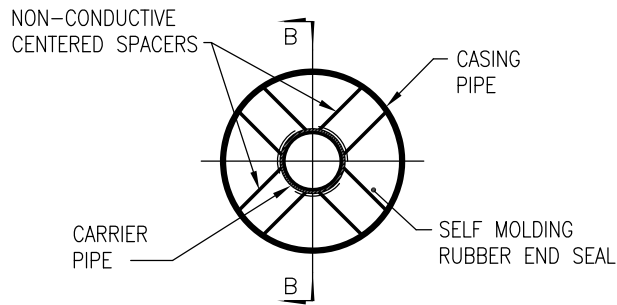
PART 3

STANDARD DETAILS

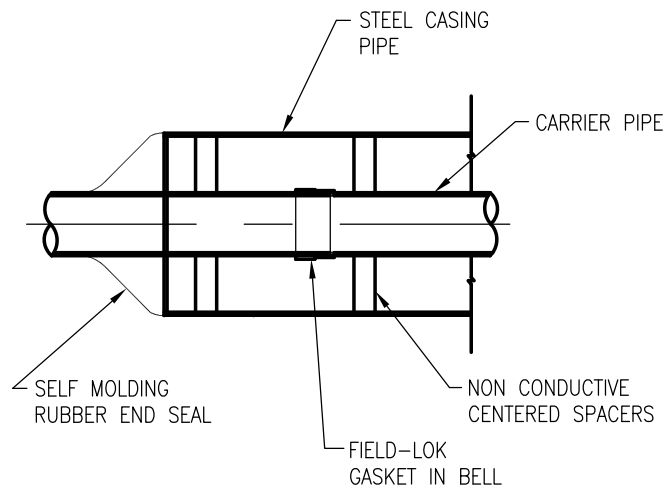
INDEX

WATER SYSTEM ADDITIONS AND EXTENSIONS

<u>Detail No.</u>	<u>Title</u>
SD-W-01	Gate Valve Installation
SD-W-02	Fire Hydrant Installation
SD-W-03	¾" and 1" Standard Water Service - Installation
SD-W-04	2" Standard Water Service - Installation
SD-W-05	Domestic Meter Settings – Meter Box (1½" and 2" Meters)
SD-W-06	Domestic Meter – Installation (Building Interior)
SD-W-07	Residential Water Meter Setting Detail
SD-W-08	Water Meter Installation, Fire and/or Domestic Service (3" and Larger)
SD-W-09	Residential Fire and Domestic Service
SD-W-10	Residential Fire and Domestic Meter Installation
SD-W-11	Combined Domestic and Fire Flow Meter (Building Interior)
SD-W-12	Combined Domestic & Fire Flow Meter Pit (3" and Greater Single Service Line)
SD-W-13	Typical Blocking for Horizontal & Vertical Downward Thrusts up to 150 psi Working Pressure
SD-W-14	Vertical Thrusts Upward up to 150 psi Working Pressure
SD-W-15	In-Line Blow-Off Detail
SD-W-16	Blow-Off Detail – End of Line (Future Extension)
SD-W-17	Blow-Off Detail – End of Line (No Future Extension)
SD-G-01	Carrier and Casing Pipe - Installation
SD-G-02	Reinforced Concrete Slope Anchors for Utility Lines
SD-G-03	Crushed Stone Bedding for Pipe
SD-G-04	Concrete Encasement for Pipe
SD-G-05	Temporary Pavement and Unpaved Street Restoration – Trench Backfill
SD-G-06	Permanent Municipal Street or Driveway Restoration – Trench Backfill and Paving
SD-G-07	Unimproved Area Restoration- Trench Backfill and Seeding
SD-G-08	PennDOT Roads or Driveways – Rigid Pavement Restoration
SD-G-09	PennDOT Roads or Driveways – Flexible Pavement Restoration



END SECTION



SECTION B-B

NOTE - FOR CASING PIPE REQUIREMENTS,
(SEE SPECIFICATIONS)

CARRIER AND CASING PIPE DETAIL

N.T.S.

NOTE:
CONTRACTOR MAY USE AGGREGATE
FILLER AND BRICK AND GROUT END
SEALS IF APPROVED BY AUTHORITY.

STANDARD DETAIL

CARRIER AND CASING PIPE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

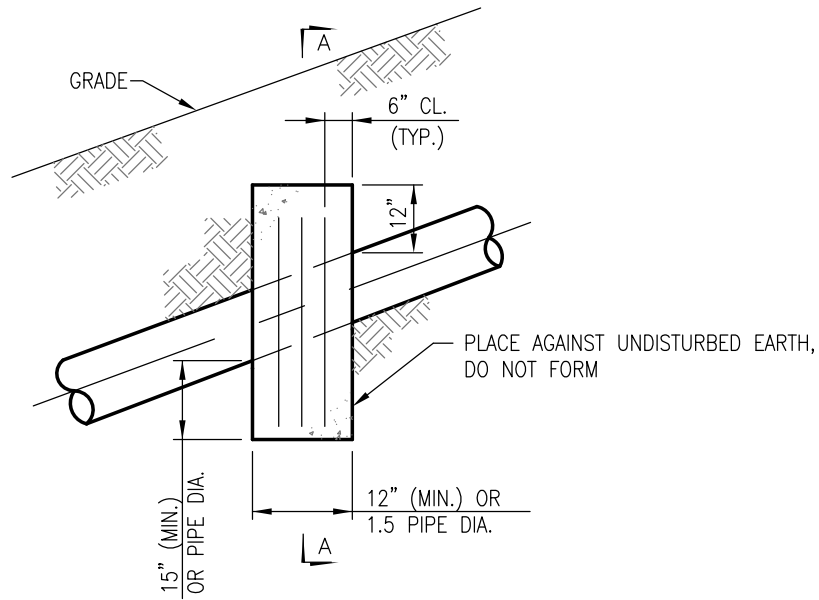
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Detail No.

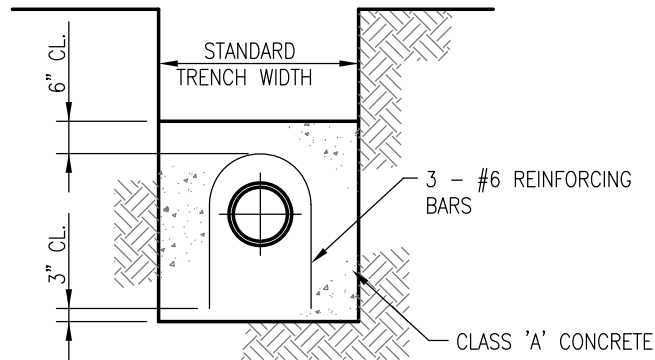
SD-G-01



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ELEVATION



SECTION A-A

MAXIMUM SPACING	
36' C/C	20% TO 35% SLOPES
24' C/C	35% TO 50% SLOPES
16' C/C	50% OR GREATER SLOPES

REINFORCED CONCRETE SLOPE ANCHORS

N.T.S.

STANDARD DETAIL

REINFORCED CONCRETE SLOPE ANCHORS

FOR UTILITY LINES

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

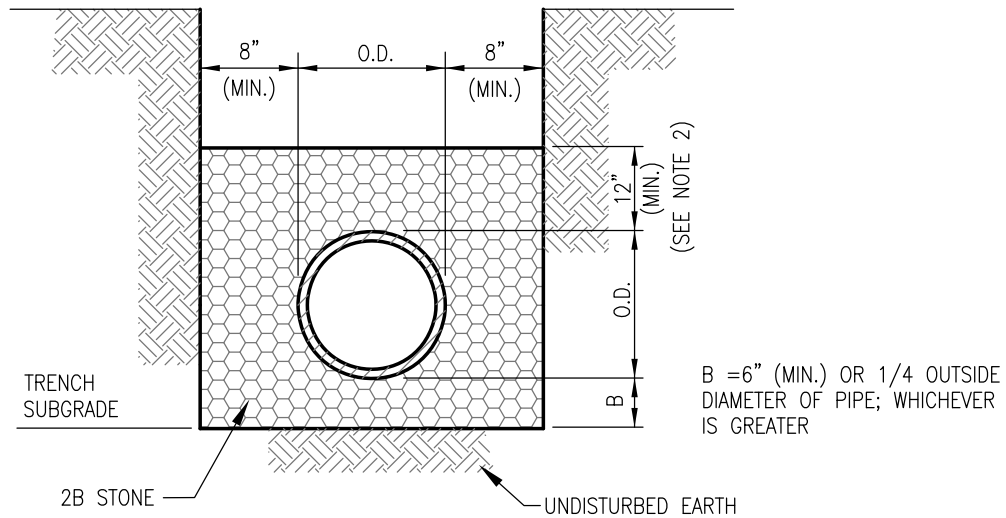
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Detail No.

SD-G-02



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WATER MAINS

BEDDING DETAIL

N.T.S.

NOTE:

1. CONTRACTOR TO COMPLY WITH CURRENT OSHA STANDARD 29 CFR 1910/1926 FOR TRENCH DIMENSIONS, SLOPING, BENCHING, SHORING AND INSPECTIONS.
2. STONE BEDDING SHALL EXTEND 12" ABOVE PIPE UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
3. SCREENINGS MAY BE SUBSTITUTED FOR 2B STONE IN BEDDING FOR COPPER WATER SERVICE PIPE UPON APPROVAL OF THE ENGINEER.

STANDARD DETAIL

CRUSHED STONE

BEDDING FOR PIPE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

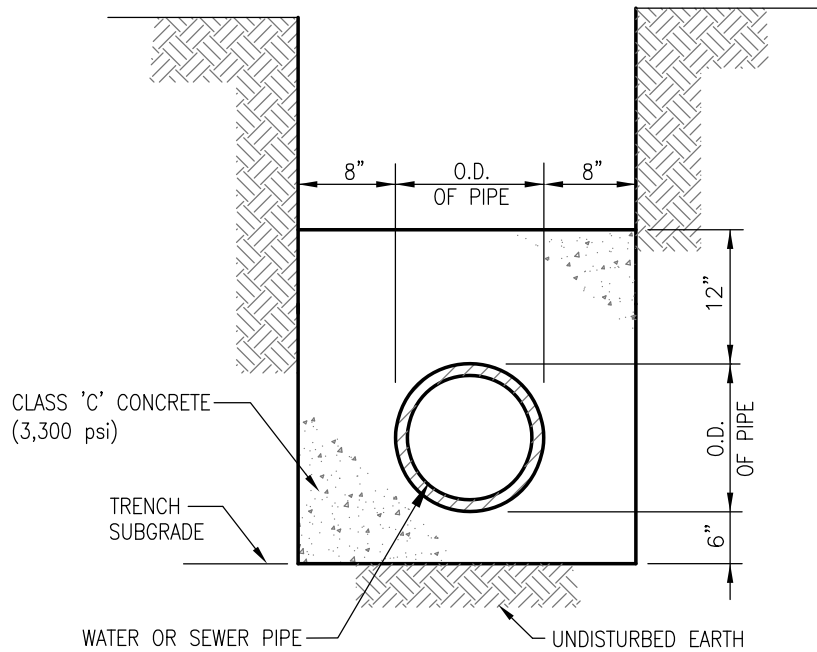
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Detail No.

SD-G-03




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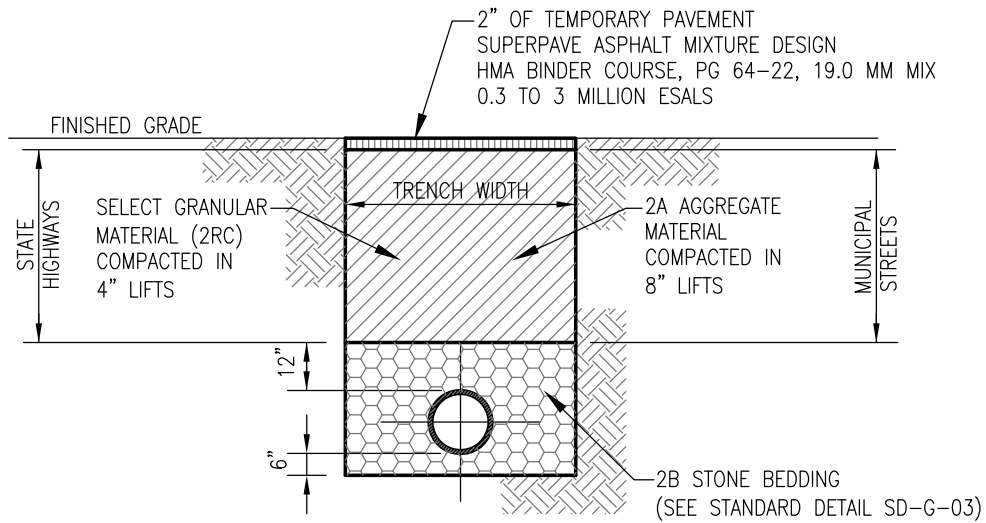


NOTE:
CONTRACTOR TO COMPLY WITH CURRENT OSHA
STANDARD 29 CFR 1926 FOR TRENCH DIMENSIONS,
SLOPING, BENCHING, SHORING AND INSPECTIONS.

CONCRETE ENCASEMENT DETAIL

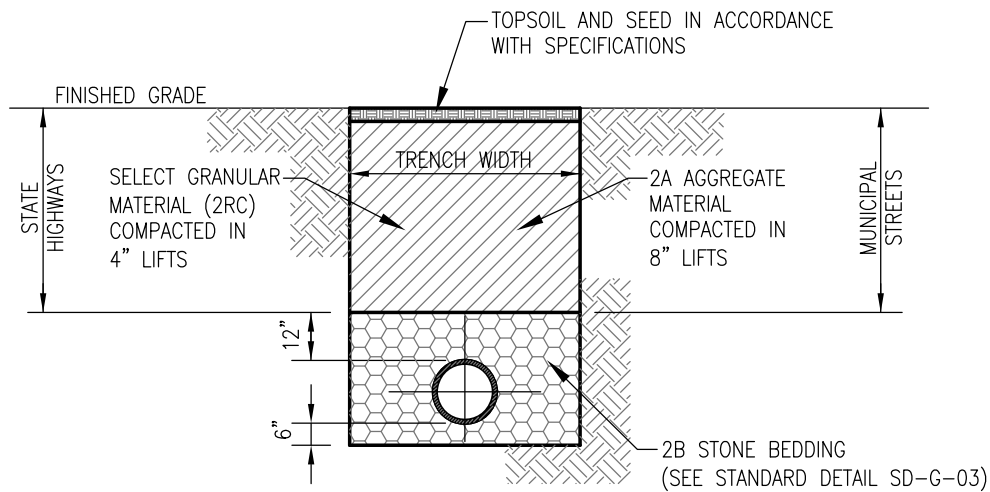
N.T.S.

STANDARD DETAIL	DOYLESTOWN BOROUGH BUCKS COUNTY, PENNSYLVANIA		
CONCRETE ENCASEMENT FOR PIPE			
	Date: 10/23/20	Detail No. SD-G-04	<div style="display: flex; align-items: center;">  <div> 4259 W. Swamp Road Suite 410 Doylestown, PA 18902 www.cksenineers.com 215.340.0600 </div> </div>



PAVED STREET OR DRIVEWAY – TEMPORARY RESTORATION

N.T.S.



UNPAVED STREET OR SHOULDER TEMPORARY AND PERMANENT RESTORATION

N.T.S.

STANDARD DETAIL

TEMPORARY PAVEMENT AND UNPAVED STREET RESTORATION

TRENCH BACKFILL

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

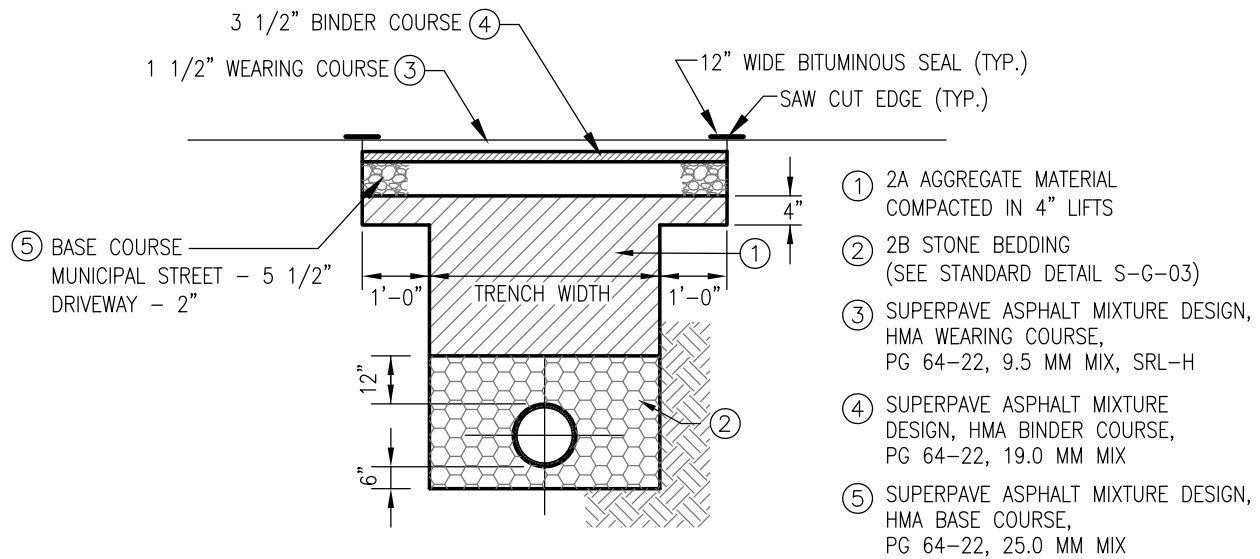
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Detail No.

SD-G-05



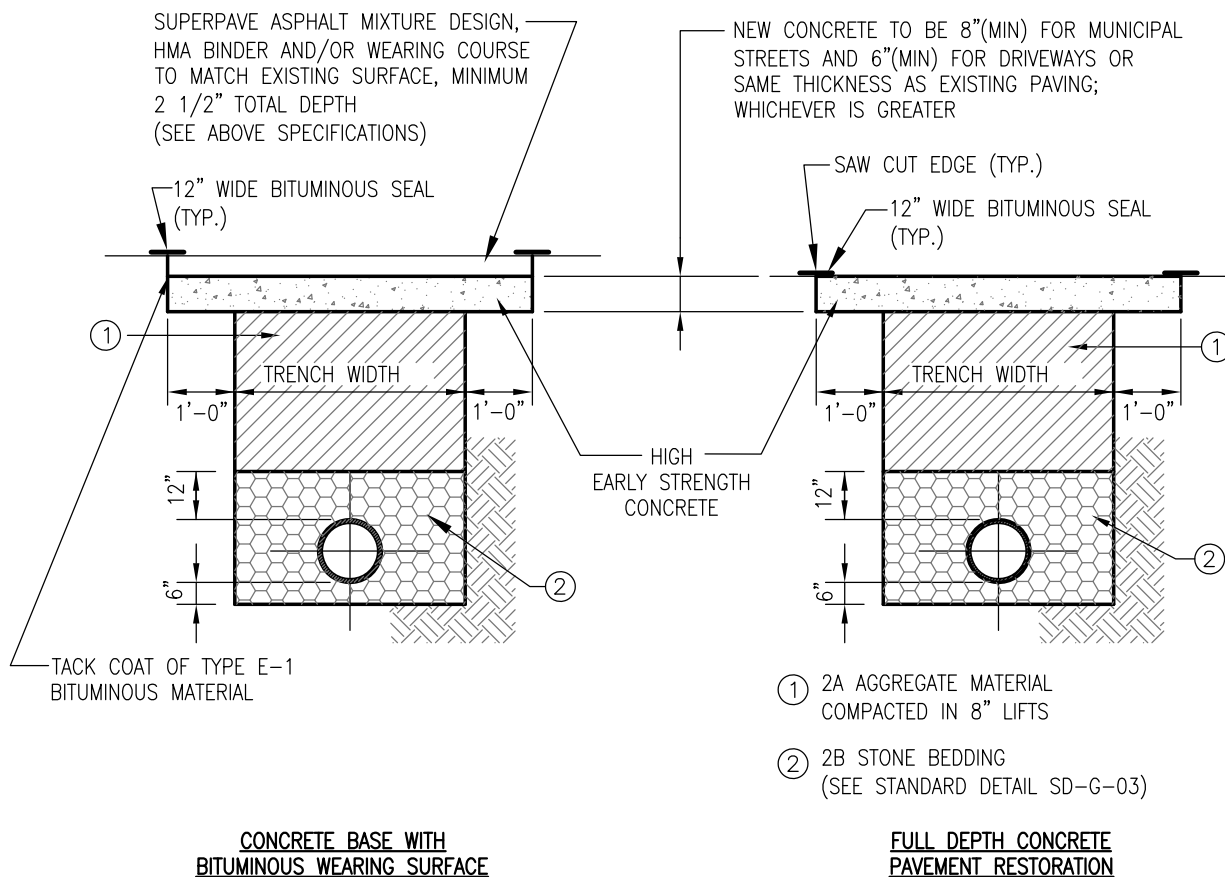
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BITUMINOUS PAVING – PERMANENT RESTORATION

N.T.S.

NOTE: ESAL VALUE FOR SUPERPAVE ASPHALT MIXTURE DESIGNS
SHALL BE BASED UPON ROAD CLASSIFICATION (SEE SPECIFICATIONS)



CONCRETE PAVING – PERMANENT RESTORATION

N.T.S.

STANDARD DETAIL

PERMANENT MUNICIPAL STREET OR DRIVEWAY RESTORATION

TRENCH BACKFILL AND PAVING

BEDMINSTER MUNICIPAL AUTHORITY
BUCKS COUNTY, PENNSYLVANIA

Date:

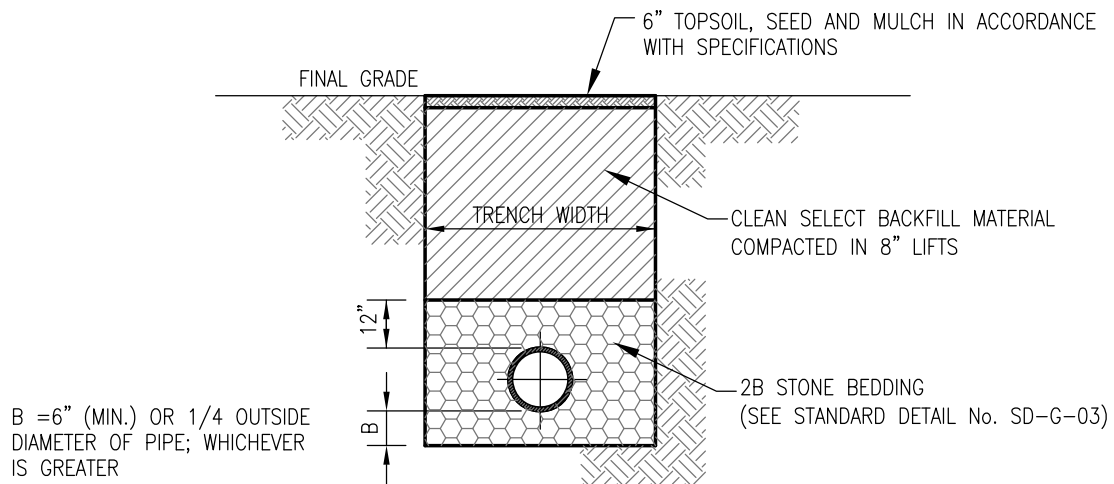
10/23/20

Detail No.

SD-G-06



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UNIMPROVED AREA BACKFILLING AND RESTORATION DETAIL

N.T.S.

STANDARD DETAIL

UNIMPROVED AREA RESTORATION

TRENCH BACKFILL AND SEEDING

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

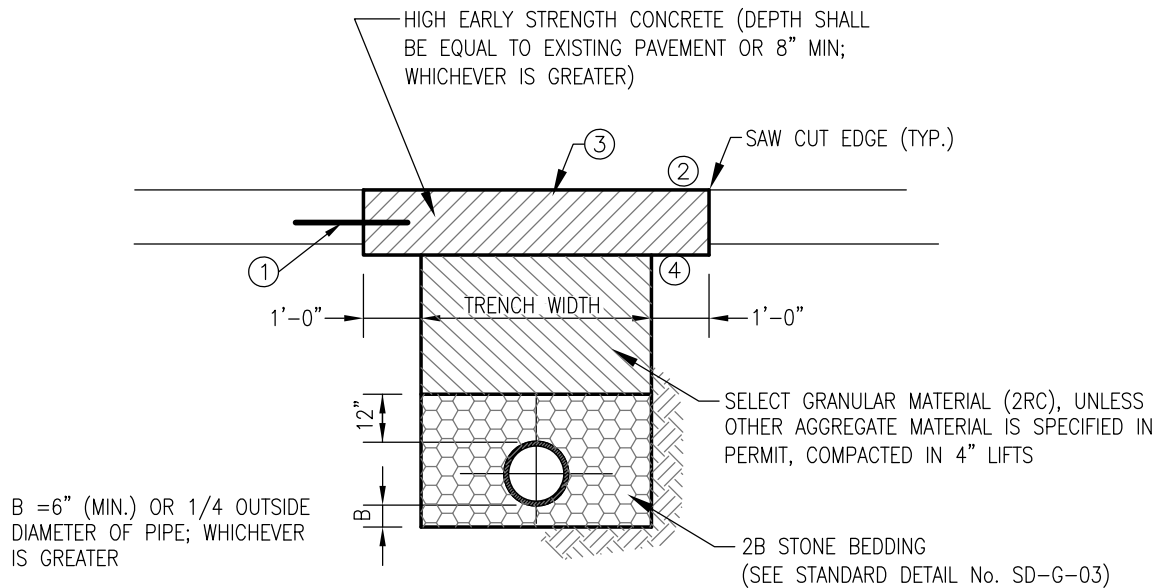
10/23/20

Detail No.

SD-G-07



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- ① ON REINFORCED CONCRETE PAVEMENT, PLACE REINFORCING STEEL, TIE BOLTS, AND LOAD TRANSFER DEVICES IN ACCORDANCE WITH RC-26M OF PENNDOT STANDARDS FOR ROADWAY CONSTRUCTION (LATEST EDITION)
- ② SURFACE TEXTURE SHALL BE IN ACCORDANCE WITH SECTION 501.3(k) OF PENNDOT SPECIFICATIONS, PUB. 408 (LATEST EDITION)
- ③ LIMITS OF CONCRETE REPLACEMENT SHALL BE IN ACCORDANCE WITH SECTION 459.8(i) OF PENNSYLVANIA CODE, TITLE 67, CHAPTER 459, OCCUPANCY OF HIGHWAYS BY UTILITIES.
- ④ CUT BACK IS NOT REQUIRED BEYOND A TRANSVERSE OR LONGITUDINAL JOINT OR CURB.

PENNDOT ROADS OR DRIVEWAYS – RIGID PAVEMENT RESTORATION

N.T.S.

STANDARD DETAIL

PENNDOT ROADS OR DRIVEWAYS

RIGID PAVEMENT RESTORATION

BEDMINSTER MUNICIPAL AUTHORITY

BUCKS COUNTY, PENNSYLVANIA

Date:

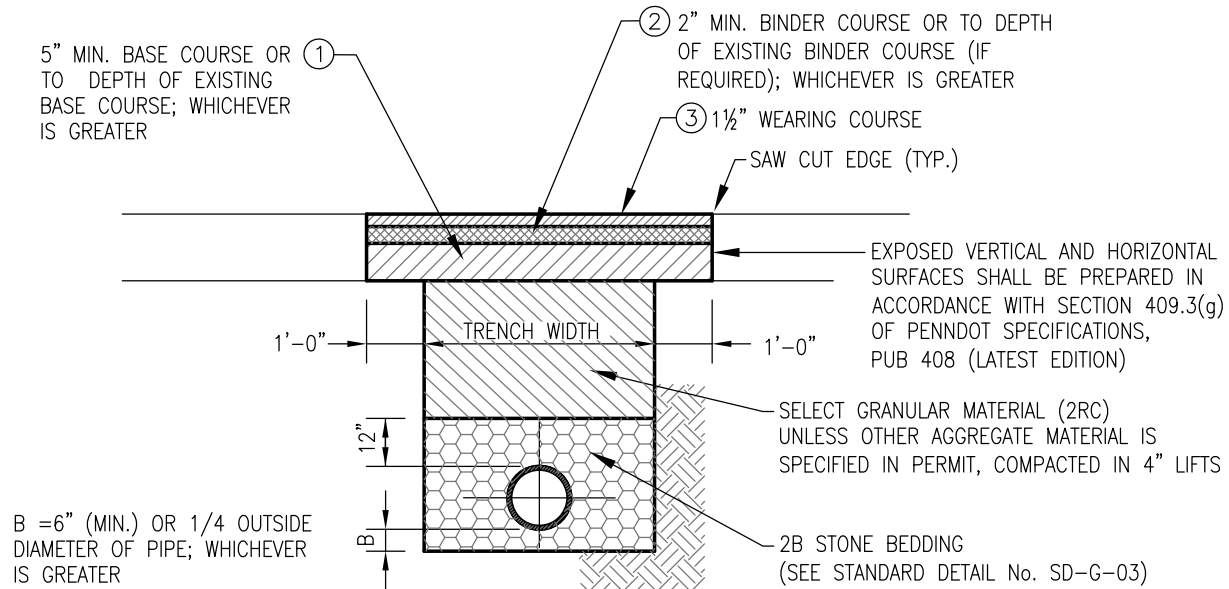
10/23/20

Detail No.

SD-G-08



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- ① SUPERPAVE ASPHALT MIXTURE DESIGN, HMA BASE COURSE, PG 64-22, 25.0 MM MIX
- ② SUPERPAVE ASPHALT MIXTURE DESIGN, HMA BINDER COURSE, PG 64-22, 19.0 MM MIX
- ③ SUPERPAVE ASPHALT MIXTURE DESIGN, HMA WEARING COURSE, PG 64-22, 9.5 MM MIX

NOTE: ESAL VALUE FOR SUPERPAVE ASPHALT MIXTURE DESIGNS SHALL BE BASED UPON ROAD CLASSIFICATION (SEE SPECIFICATIONS)

PENNDOT ROADS OR DRIVEWAYS – FLEXIBLE PAVEMENT RESTORATION

N.T.S.

STANDARD DETAIL

PENNDOT ROADS OR DRIVEWAYS

FLEXIBLE PAVEMENT RESTORATION

BEDMINSTER MUNICIPAL AUTHORITY

BUCKS COUNTY, PENNSYLVANIA

Date:

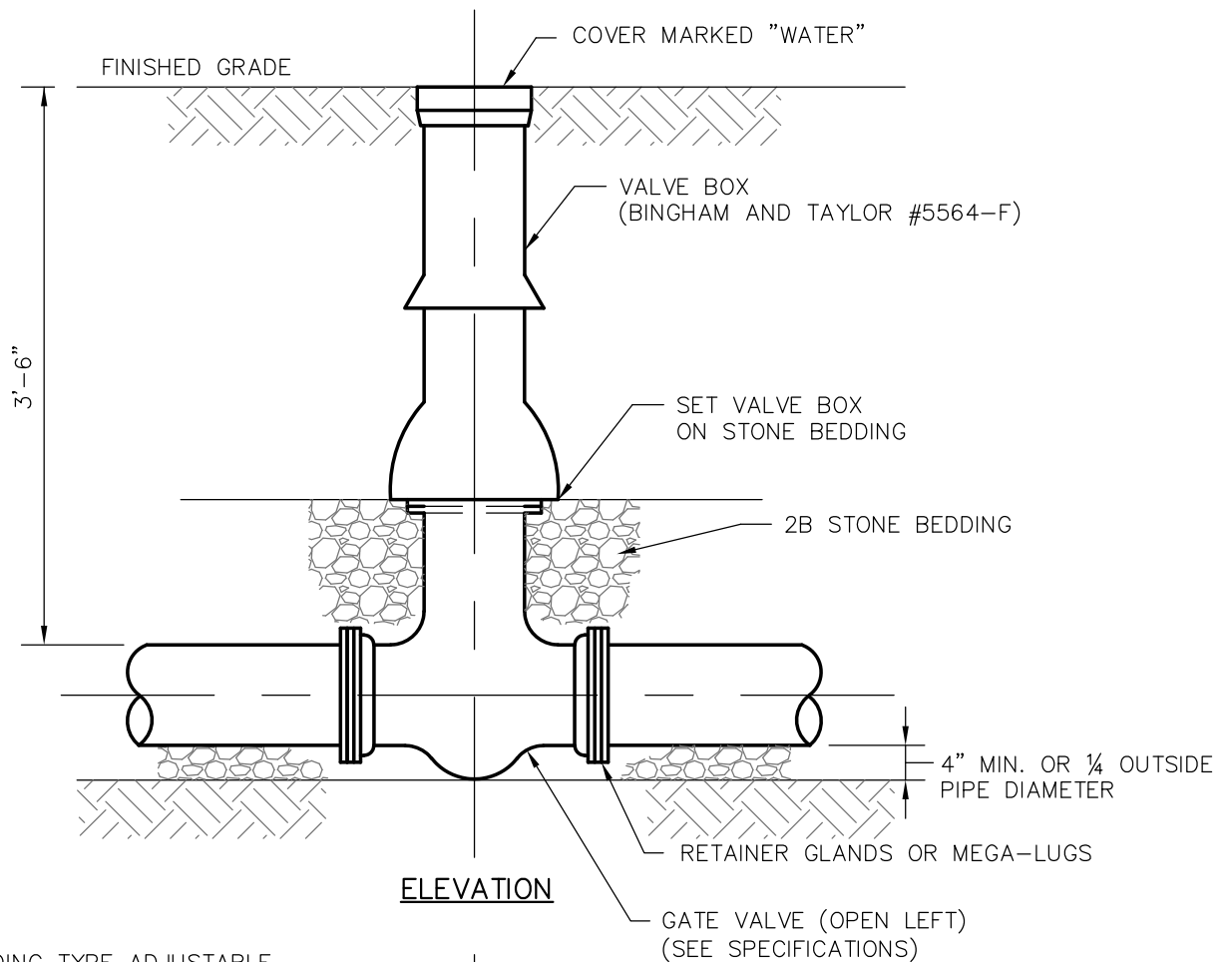
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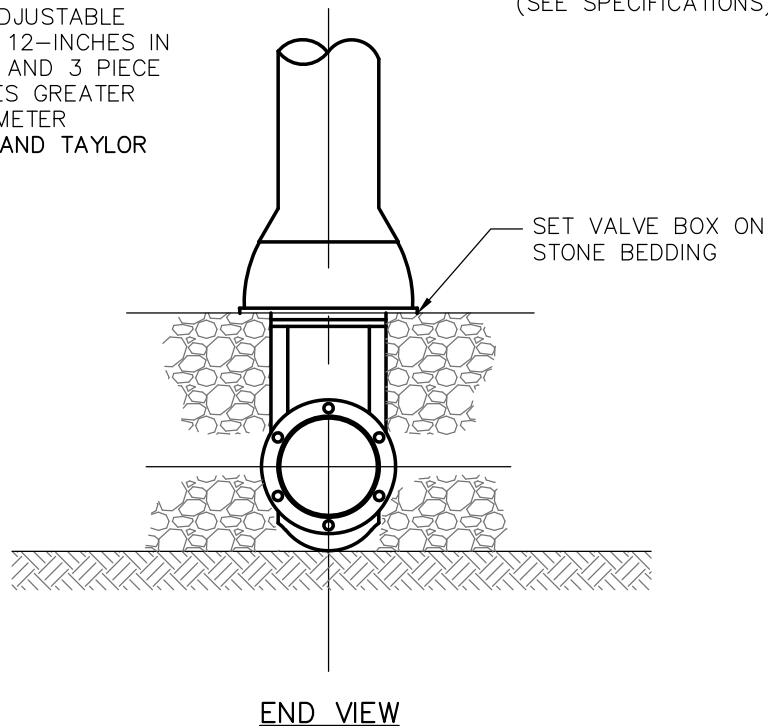
SD-G-09



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NOTE:
 2 PIECE SLIDING TYPE ADJUSTABLE
 VALVE BOX FOR VALVES 12-INCHES IN
 DIAMETER AND SMALLER AND 3 PIECE
 SLIDING TYPE FOR VALVES GREATER
 THAN 12-INCHES IN DIAMETER
 VALVE BOX - BINGHAM AND TAYLOR
 #5564-F



GATE VALVE DETAIL

N.T.S.

STANDARD DETAIL

GATE VALVE INSTALLATION

DOYLESTOWN BOROUGH
 BUCKS COUNTY, PENNSYLVANIA

Date:

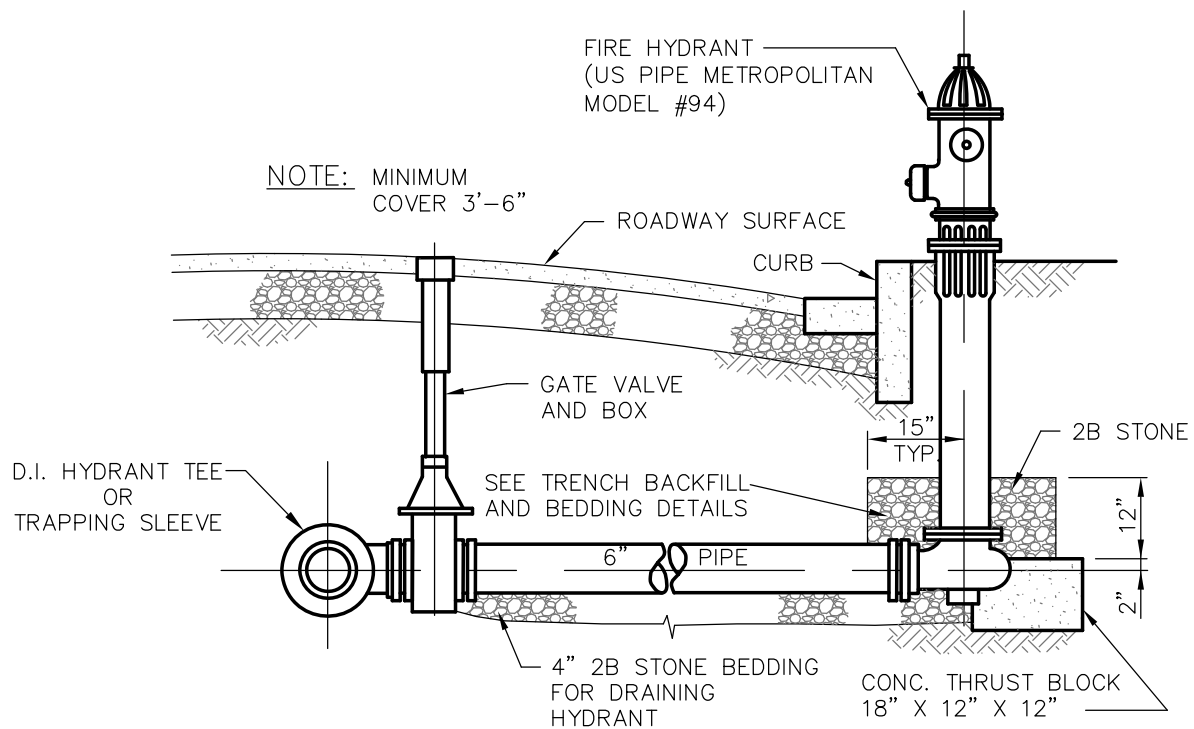
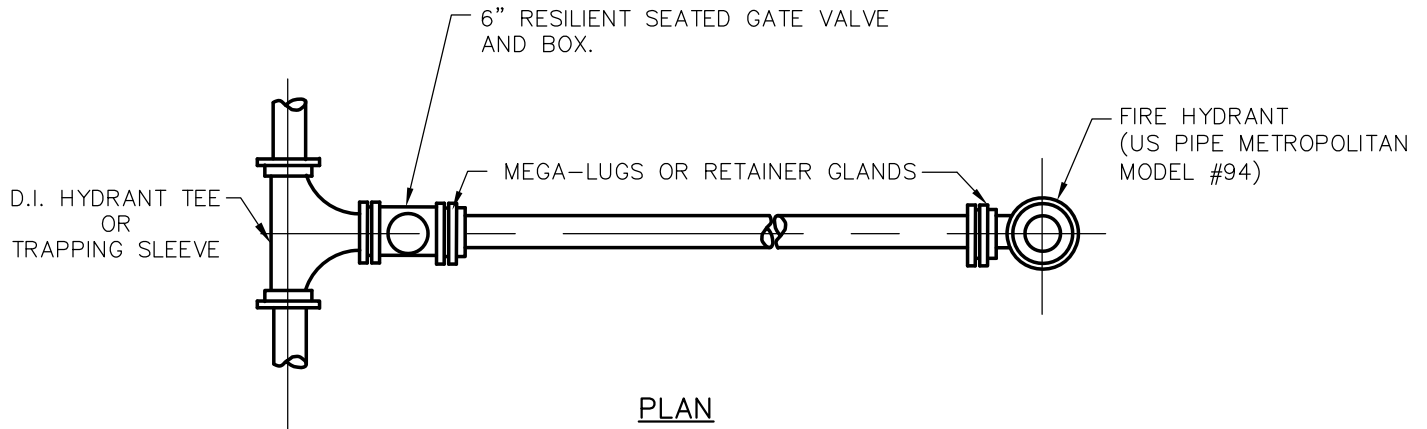
10/23/20

Detail No.

SD-W-01



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NOTE: DO NOT COVER DRAIN HOLES WITH CONCRETE.

FIRE HYDRANT DETAIL

N.T.S.

STANDARD DETAIL

FIRE HYDRANT INSTALLATION

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

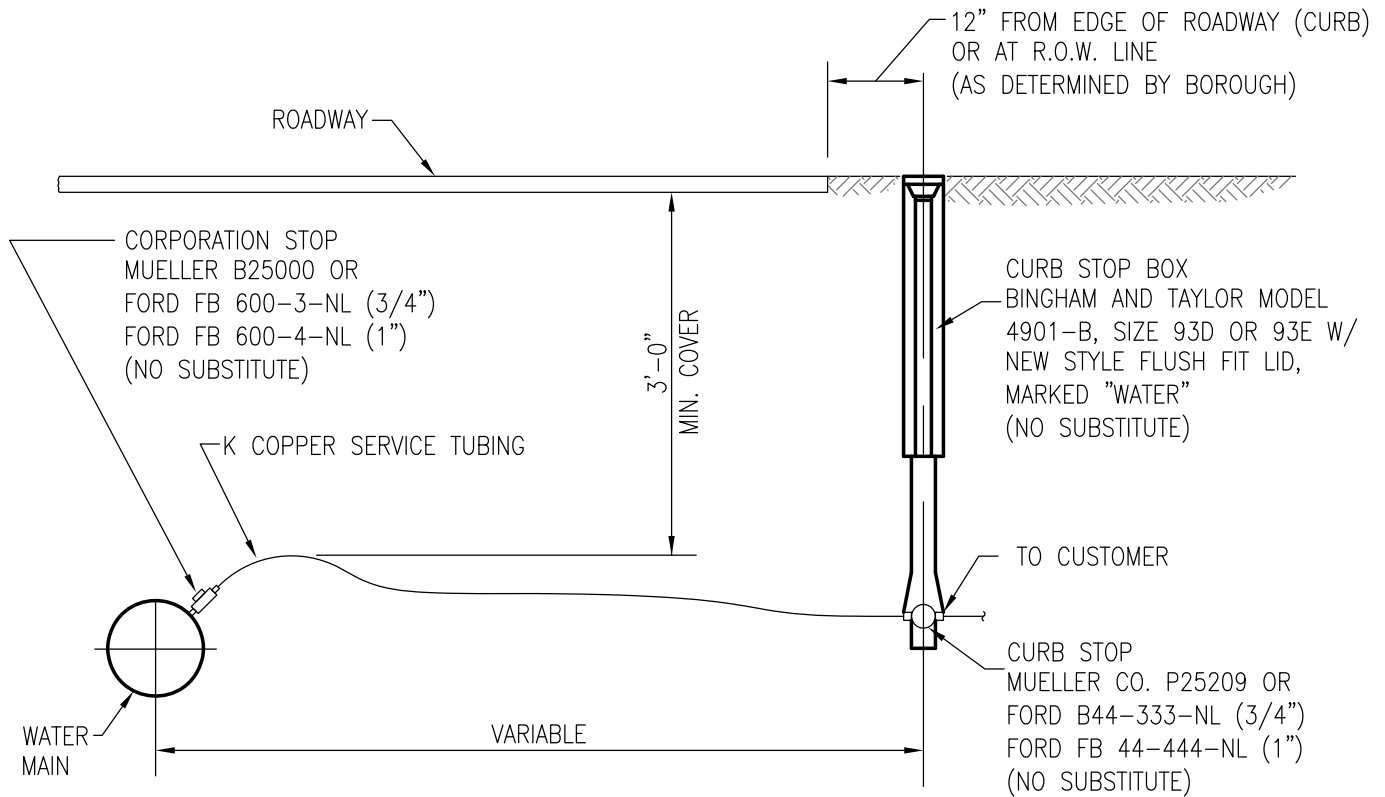
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Detail No.

SD-W-02



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ELEVATION

CONNECTION FOR 3/4" AND 1" WATER SERVICES

N.T.S.

NOTES:

1. ALL CURB STOP AND CORPORATION STOP FITTINGS SHALL BE "NO LEAD".
2. NO FLARE FITTINGS ALLOWED. ALL TUBING CONNECTIONS SHALL BE COMPRESSION CONNECTIONS OUTSIDE BUILDING.

STANDARD DETAIL

3/4" AND 1" STANDARD WATER SERVICE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

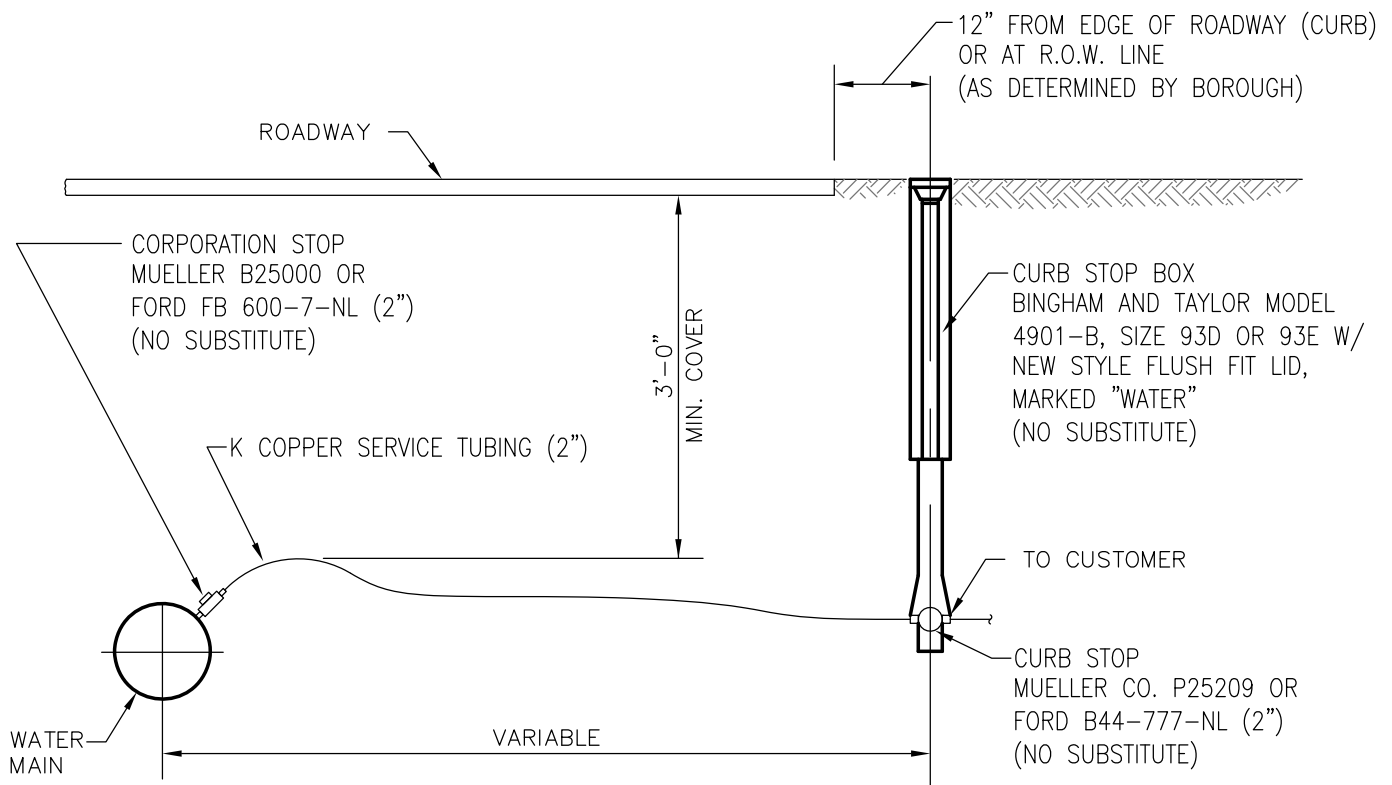
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Detail No.

SD-W-03



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ELEVATION

CONNECTION FOR 2" WATER SERVICES

N.T.S.

NOTES:

1. ALL CURB STOP AND CORPORATION STOP FITTINGS SHALL BE "NO LEAD".
2. NO FLARE FITTINGS ALLOWED. ALL TUBING CONNECTIONS SHALL BE COMPRESSION CONNECTIONS OUTSIDE BUILDING.

STANDARD DETAIL

2" STANDARD WATER SERVICE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

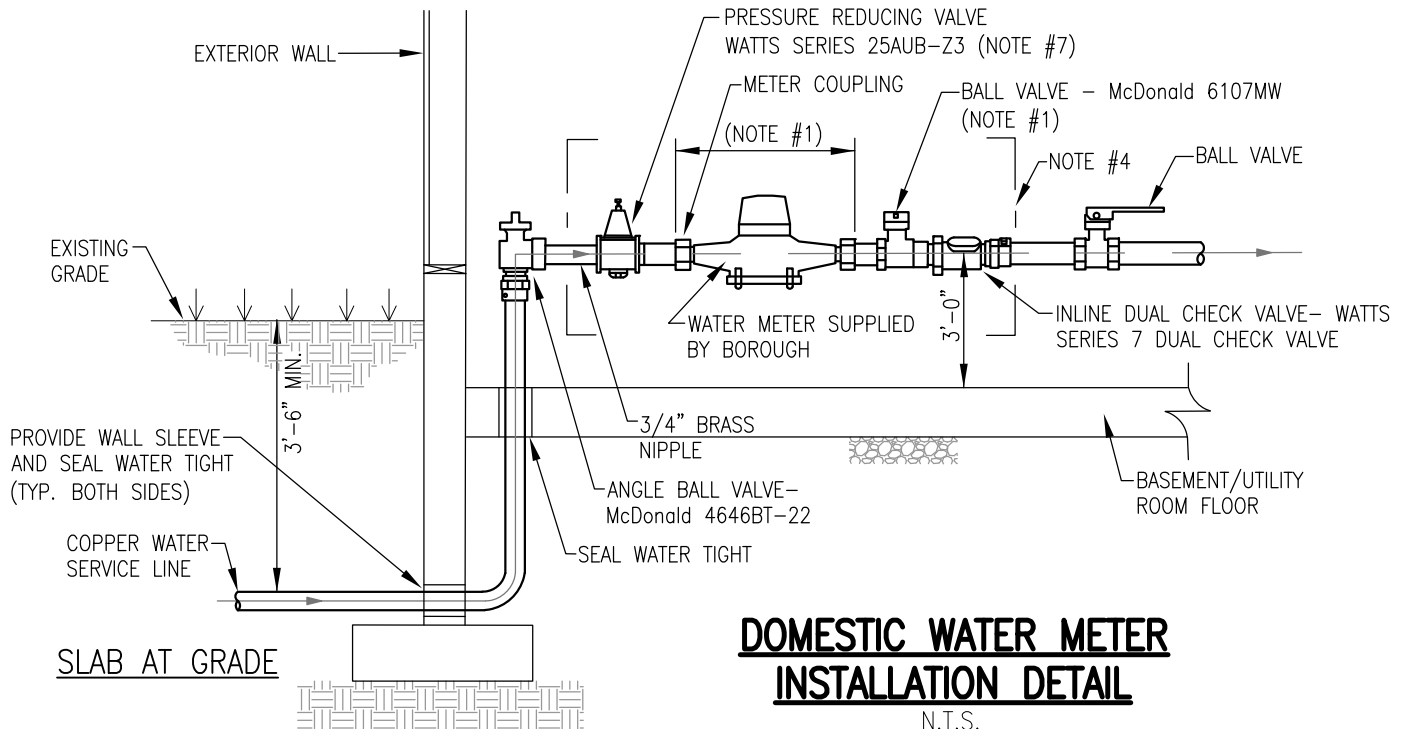
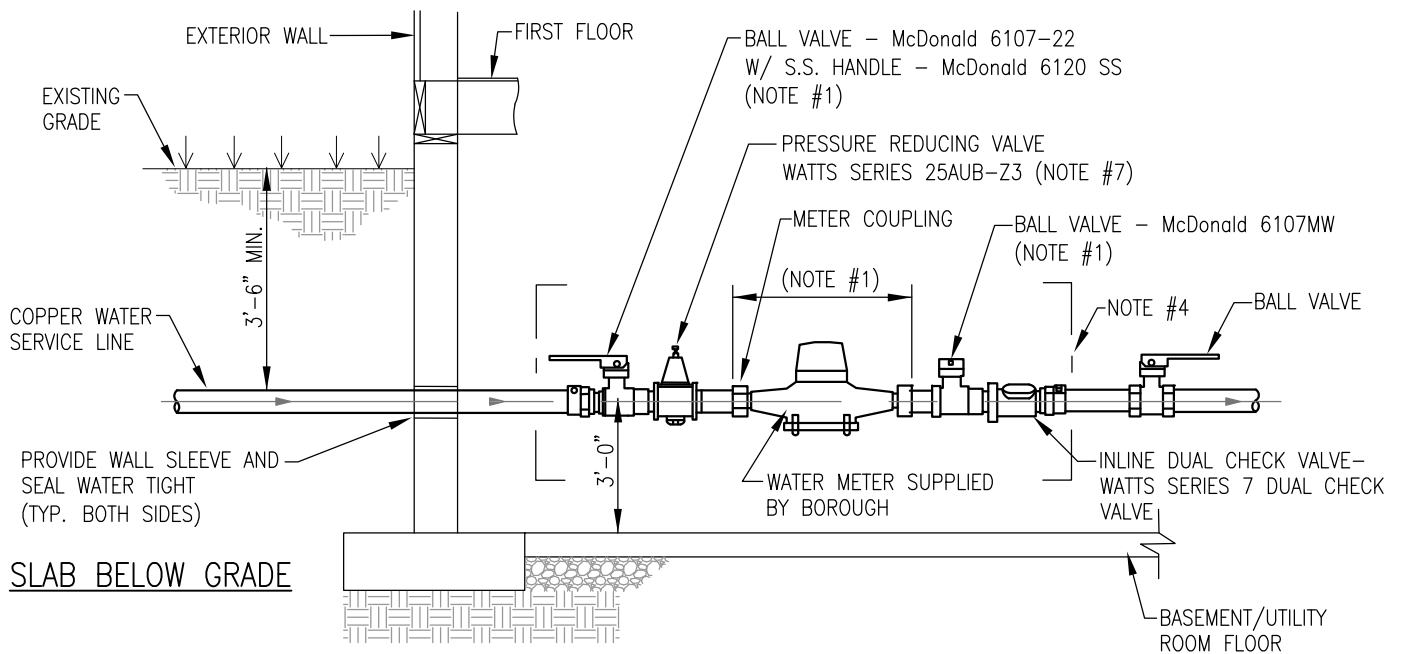
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Detail No.

SD-W-04



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DOMESTIC WATER METER INSTALLATION DETAIL

N.T.S.

GENERAL METER INSTALLATION NOTES:

1. METER AND COUPLINGS TO BE ACQUIRED THROUGH BOROUGH. ALL REMAINING PIPING AND COMPONENTS ARE CUSTOMER'S RESPONSIBILITY.
2. THE WATER METER MUST BE MOUNTED HORIZONTALLY.
3. METER TO BE MOUNTED 3 FEET FROM THE FLOOR.
4. CUSTOMER SHALL MAINTAIN ADEQUATE CLEARANCE AROUND METER INSTALLATION TO FACILITATE MAINTENANCE BY BOROUGH. THERE MUST BE 2 FEET OF CLEARANCE ON EACH SIDE OF THE METER.
5. CUSTOMER RESPONSIBLE FOR INSTALLATION OF THERMAL EXPANSION FACILITIES ON INTERIOR PLUMBING SYSTEM.
6. ISOLATION VALVES SHALL BE BRONZE BALL VALVES, 200 PSI AND AWWA APPROVED.
7. PROVIDE PRESSURE REDUCING VALVE (WATTS SERIES 25AUB-Z3). IF PRESSURE EXCEEDS 70 PSI. SUPPLIED BY CUSTOMER.
8. SERVICE LINE SHALL BE TYPE 'K' SOFT COPPER WITH COMPRESSION FITTINGS.
9. BRASS NIPPLES REQUIRED. NO SOLDER JOINTS ALLOWED.

STANDARD DETAIL

DOMESTIC WATER METER INSTALLATION

BUILDING INTERIOR

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

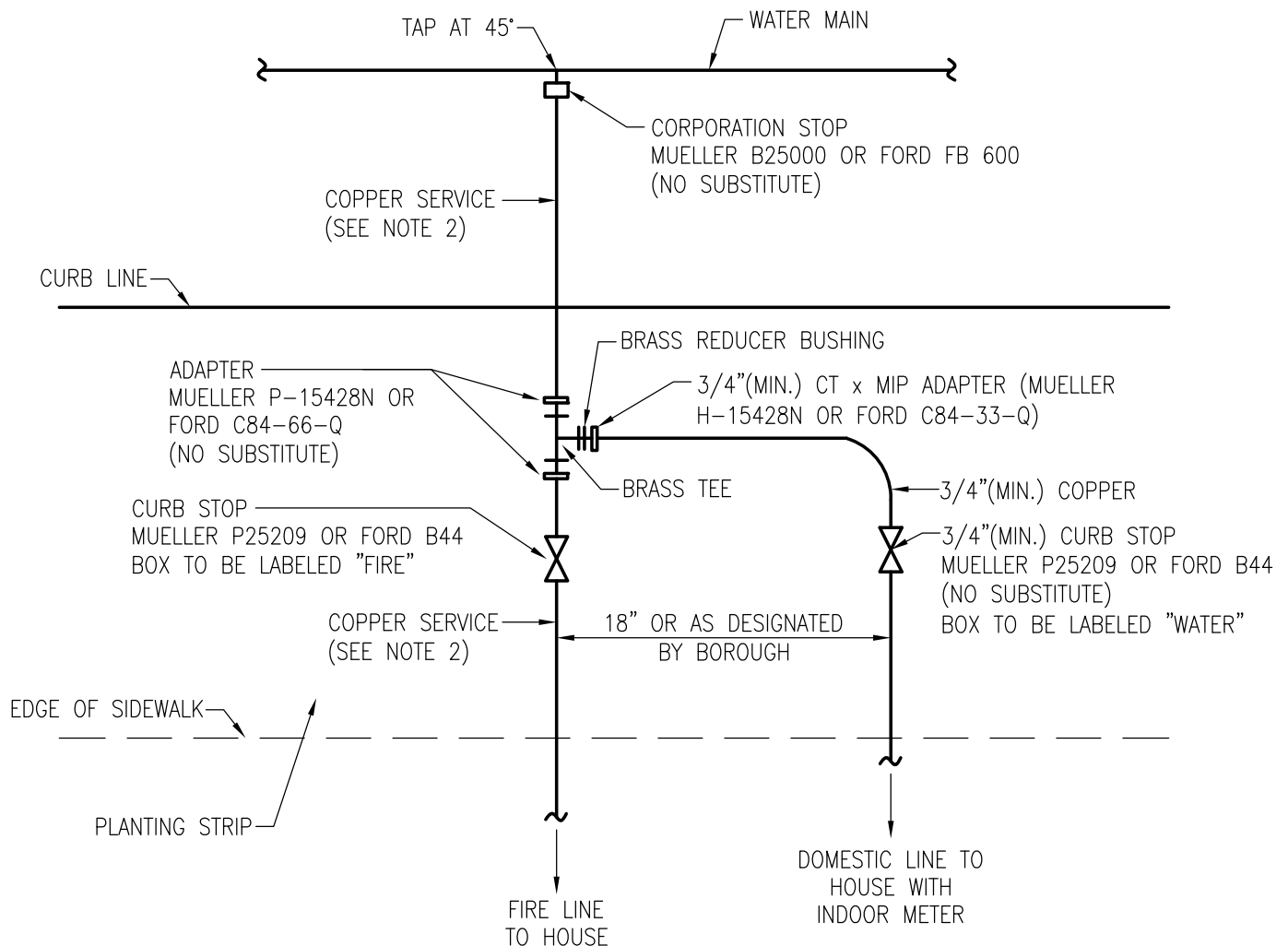
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PLAN

RESIDENTIAL FIRE AND DOMESTIC SERVICE -2" AND SMALLER WITH INDOOR METER

N.T.S.

NOTES:

1. ALL CURB STOP AND CORPORATION STOP FITTINGS SHALL BE "NO LEAD".
2. WATER SERVICE SIZE TO BE DETERMINED THROUGH CUSTOMER'S APPROVED SPRINKLER DESIGN.

STANDARD DETAIL

RESIDENTIAL FIRE AND DOMESTIC SERVICE

- 2" AND SMALLER WITH INDOOR METER

DOYLESTOWN BOROUGH BUCKS COUNTY, PENNSYLVANIA

Date:

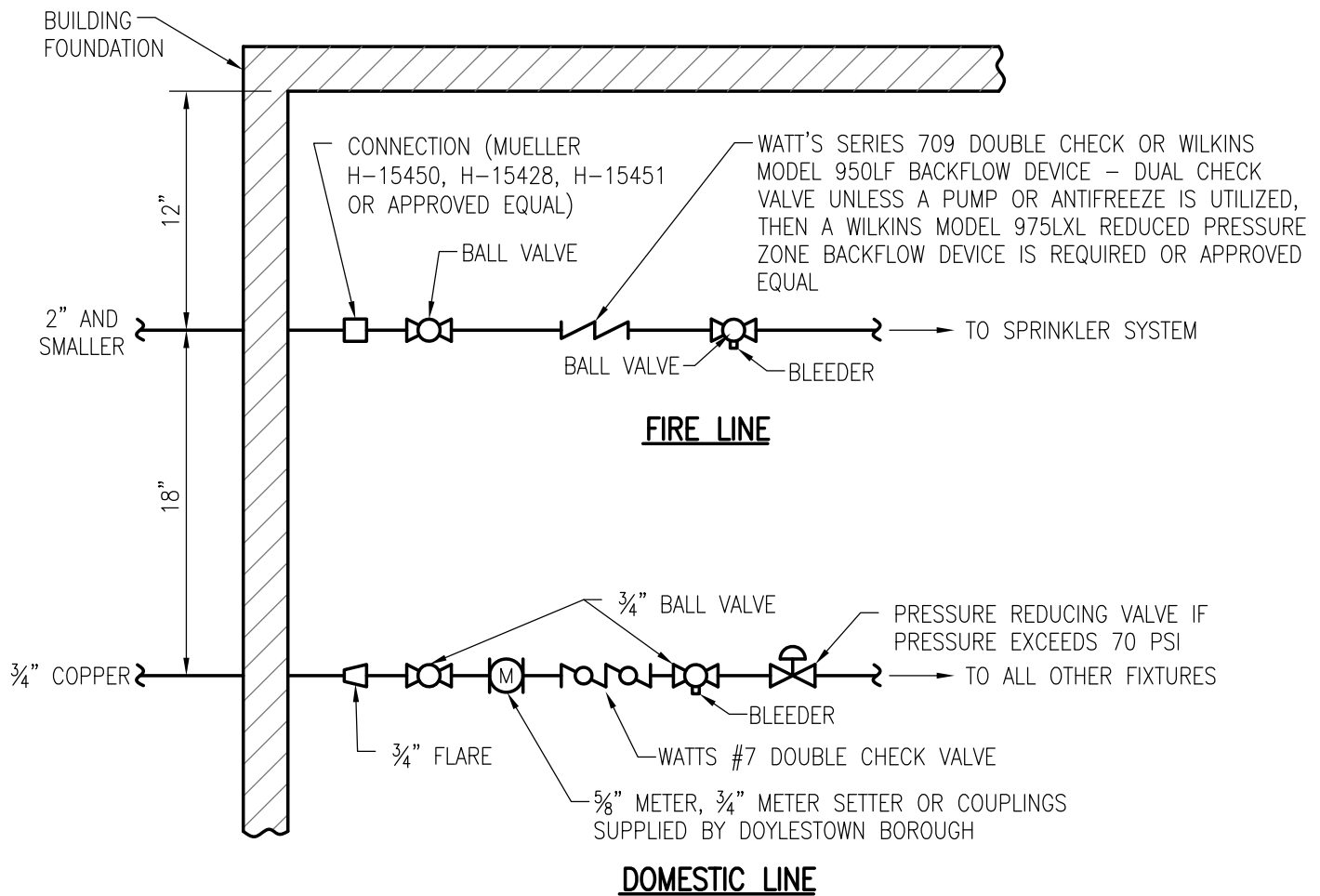
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Detail No.

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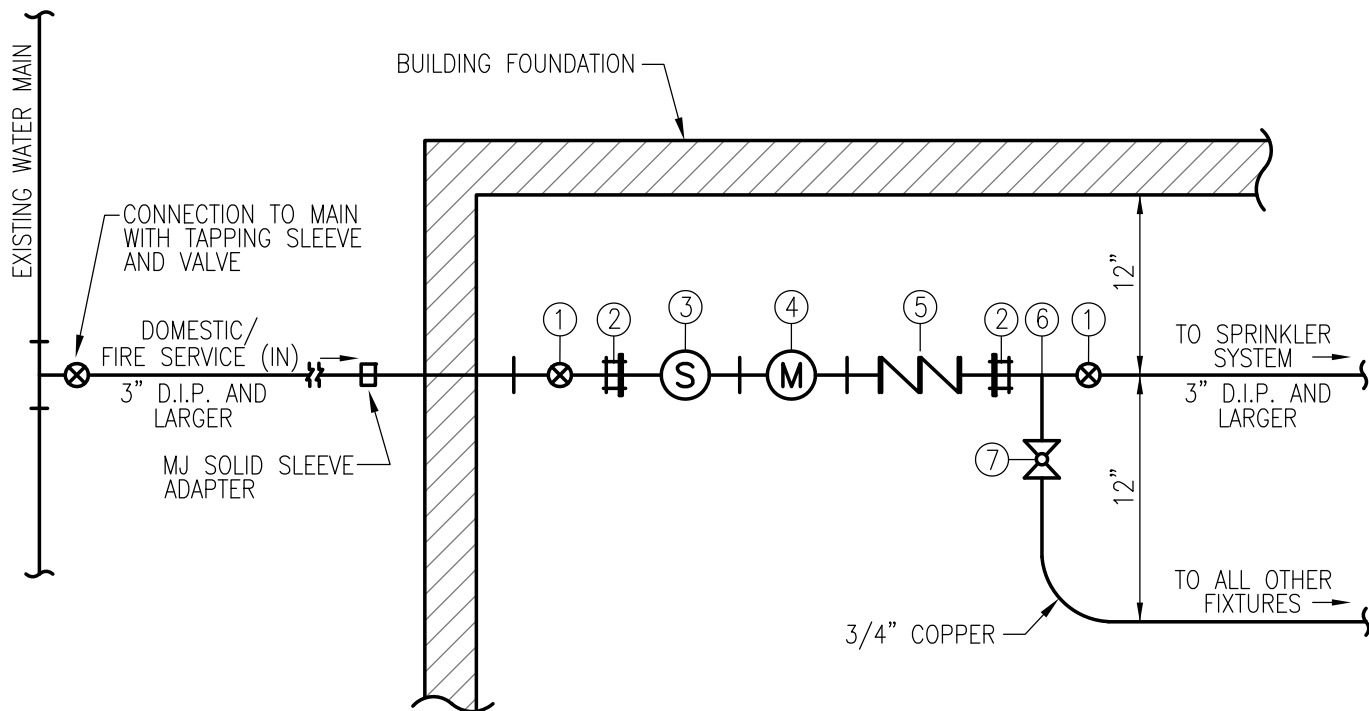
NOTES:

1. BALL VALVE – BRASS 200 PSI A.W.W.A. APPROVED.
2. SERVICE LINE – TYPE "K" SOFT COPPER WITH FLARED OR COMPRESSION FITTINGS.
3. CUSTOMER TO PROVIDE BACKFLOW DEVICE. THE TYPE OF DEVICE MUST BE APPROVED BY AUTHORITY FOR IF PUMP AND ANTIFREEZE UTILIZED, BACKFLOW PREVENTER MUST BE (RPZ) DEGREE OF HAZARD. REDUCED PRESSURE ZONE DEVICE MANUFACTURED BY WILKINS MODEL 975LXL.
4. CUSTOMER PLUMBER TO INSTALL NO. 6 BONDING JUMPER ACROSS METER AND BACKFLOW.
5. IF PRESSURE EXCEEDS 70 PSI, PRESSURE REDUCING VALVE REQUIRED, SUPPLIED BY CUSTOMER.
6. WATER METER WILL NOT BE SET IF PIPING DOES NOT CONFORM TO SPECIFICATIONS.
7. SUPPORT AS NEEDED.
9. BRASS NIPPLES REQUIRED. NO SOLDER JOINTS ALLOWED.
10. FIRE SERVICE – NOT METERED

RESIDENTIAL FIRE AND DOMESTIC METER INSTALLATION
– 2" AND SMALLER WITH INDOOR METER

N.T.S.

STANDARD DETAIL	DOYLESTOWN BOROUGH BUCKS COUNTY, PENNSYLVANIA		
RESIDENTIAL FIRE AND DOMESTIC METER INSTALLATION	Date: 10/23/20	Detail No. SD-W-07	 <div> 4259 W. Swamp Road Suite 410 Doylestown, PA 18902 www.cksengineers.com 215.340.0600 </div>
– 2" AND SMALLER WITH INDOOR METER			



COMBINED DOMESTIC & FIRE FLOW METER -3" AND LARGER WITH INDOOR METER

N.T.S.

MATERIAL LIST

- ① GATE VALVE
- ② FLANGED COUPLING ADAPTER
- ③ STRAINER (BY DOYLE BOR.)
- ④ FIRE SERVICE METER (BY DOYLE BOR.)
(NEPTUNE MACH 10 ULTRASONIC METER)
- ⑤ BACKFLOW PREVENTER
(WATTS SERIES 709 DOUBLE CHECK OR EQUAL)
- ⑥ 3/4" TAP W/ CORP. STOP
- ⑦ 3/4" BALL VALVE

STANDARD DETAIL

COMBINED DOMESTIC & FIRE FLOW METER

- 3" AND LARGER WITH INDOOR METER

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

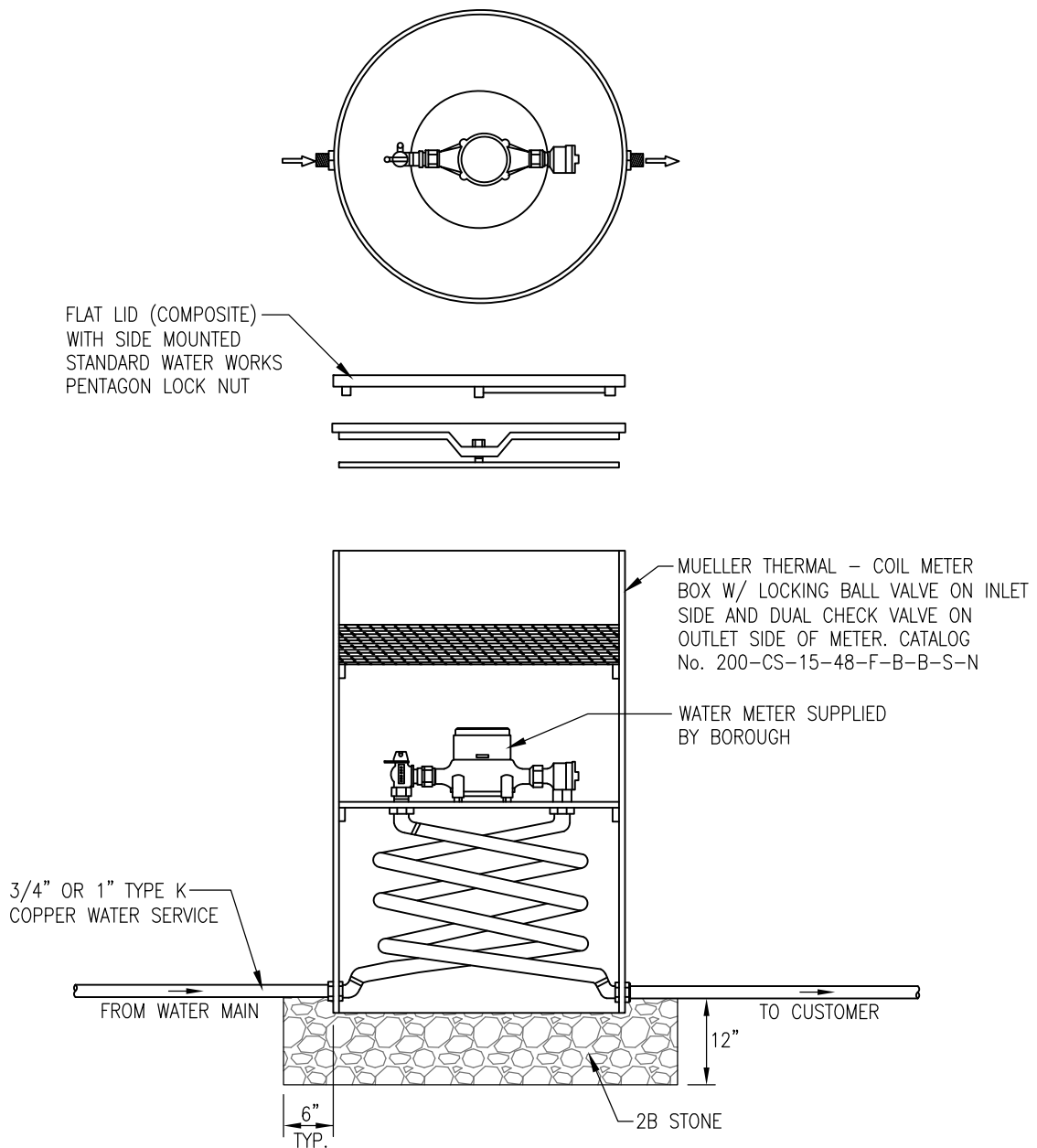
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Detail No.

SD-W-08



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NOTES:

1. A WATER METER BOX IS APPLICABLE FOR SERVICES GREATER THAN 100 FEET IN LENGTH.
2. A CURB STOP AND BOX MUST BE INSTALLED BETWEEN MAIN AND METER BOX.
3. POLYETHYLENE WATER SERVICE TUBING WITH STIFFENERS MAY BE UTILIZED BETWEEN THE METER PIT AND BUILDING

DOMESTIC METER PIT
3/4" AND 1" SERVICES

N.T.S.

STANDARD DETAIL

DOMESTIC METER PIT

- 3/4" & 1" SERVICES

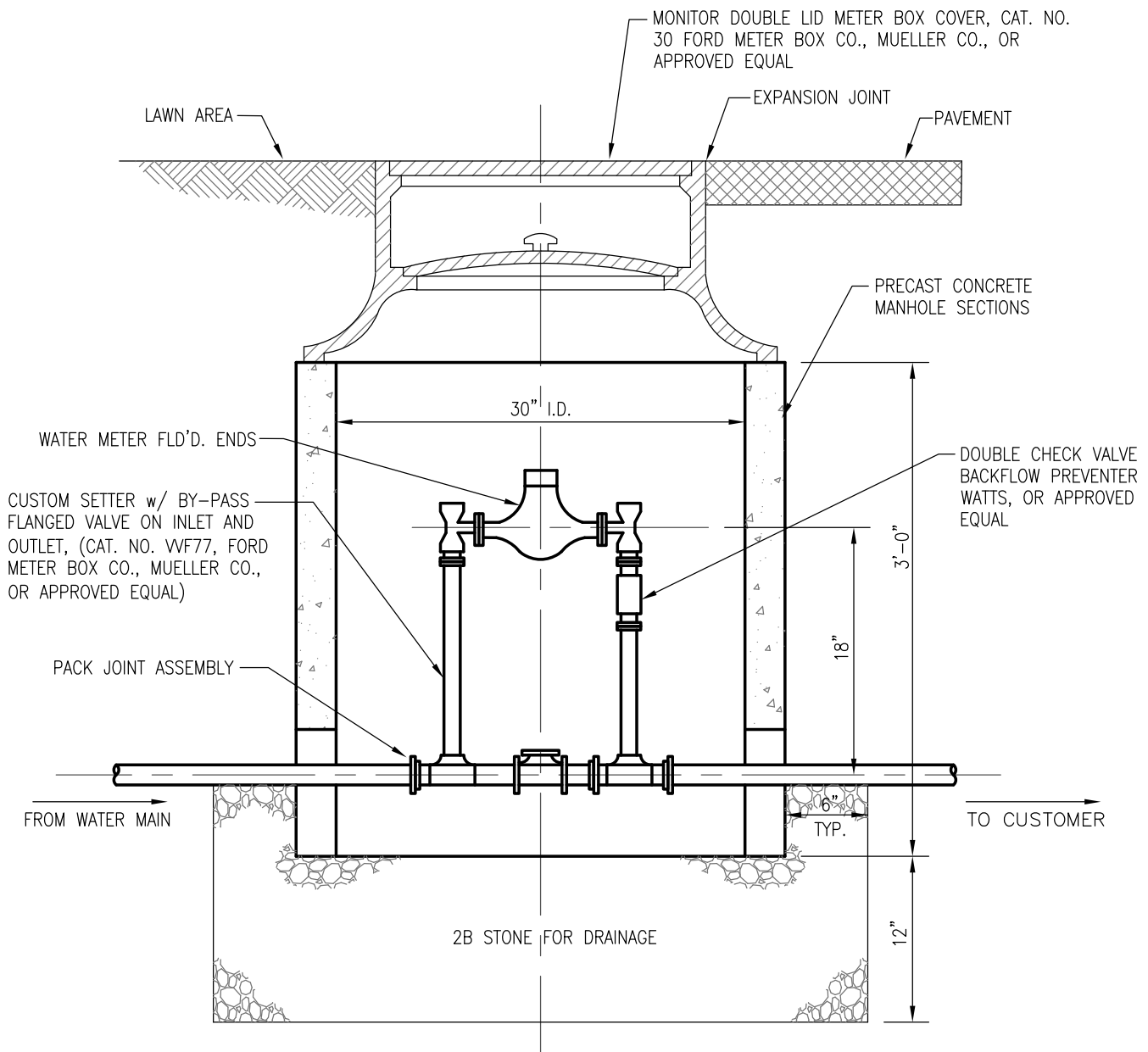
DOYLESTOWN BOROUGH
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Date:
10/23/20

Detail No.
SD-W-09



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DOMESTIC METER PIT – 1 1/2" AND 2" SERVICES

N.T.S.

NOTES:

1. A WATER METER BOX IS APPLICABLE FOR SERVICES GREATER THAN 100 FEET IN LENGTH.
2. A CURB STOP AND BOX MUST BE INSTALLED BETWEEN MAIN AND METER BOX.
3. POLYETHYLENE WATER SERVICE TUBING WITH STIFFENERS MAY BE UTILIZED BETWEEN THE METER PIT AND BUILDING.

STANDARD DETAIL

DOMESTIC METER PIT

1 1/2" AND 2" SERVICES

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

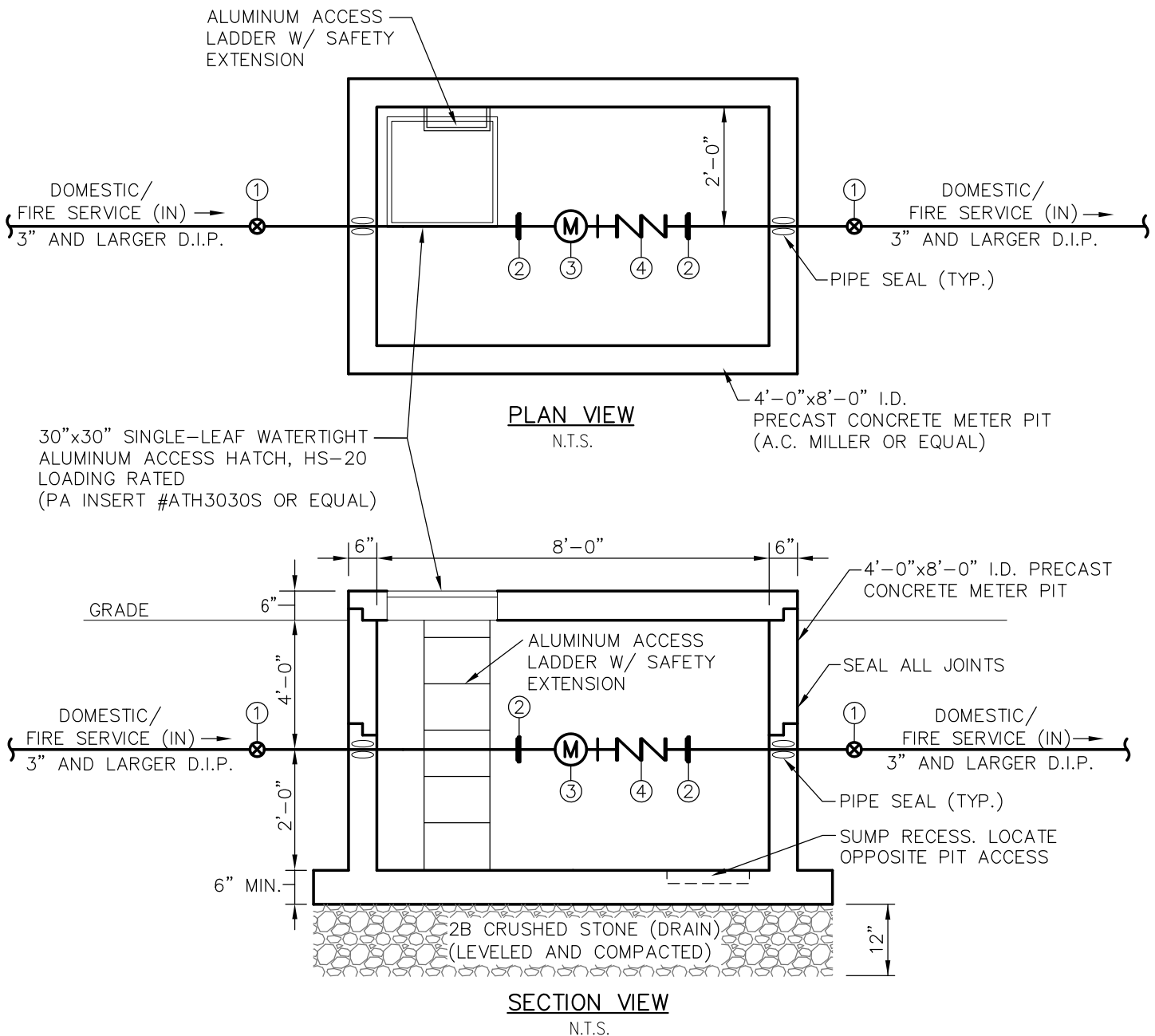
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Detail No.

SD-W-10



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NOTES:

1. ACCESS HATCH SHALL BE SET SO THAT THE TOP OF THE HATCH IS APPROXIMATELY 6" ABOVE GRADE.
2. MANHOLE SECTIONS SHALL BE LAP JOINT WITH A DOUBLE BEAD FLEXIBLE BUTYL RUBBER SEALANT OR APPROVED EQUAL, ON BOTH INSIDE AND OUTSIDE FLAT SURFACE OF LAP JOINT.
3. MANHOLE MANUFACTURER SHALL PROVIDE AN EXTERIOR BITUMINOUS COATING (FACTORY APPLIED). FIELD "TOUCH UP" AREAS AS APPROVED BY BOROUGH.
4. MIN. 2 PIPE SUPPORTS EACH LINE.

METER PIT MATERIAL LIST

- ① GATE VALVE AND BOX
- ② FLANGED COUPLING ADAPTER
- ③ SERVICE METER (NEPTUNE MACH 10 ULTRASONIC METER)(SUPPLIED BY DOYLESTOWN BOROUGH AND PAID FOR BY CUSTOMER)
- ④ BACKFLOW PREVENTER (WATTS SERIES 709 DOUBLE CHECK OR EQUAL)

COMBINED DOMESTIC & FIRE FLOW METER PIT (3" AND LARGER)

N.T.S.

STANDARD DETAIL

DOYLESTOWN BOROUGH BUCKS COUNTY, PENNSYLVANIA

COMBINED DOMESTIC & FIRE FLOW METER PIT

- 3" AND LARGER SINGLE SERVICE LINE

Date:

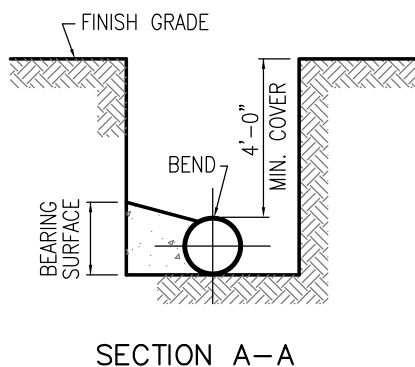
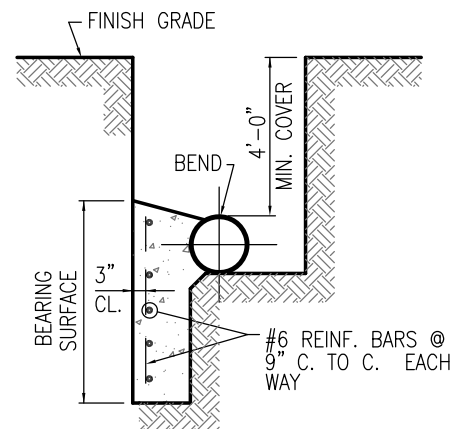
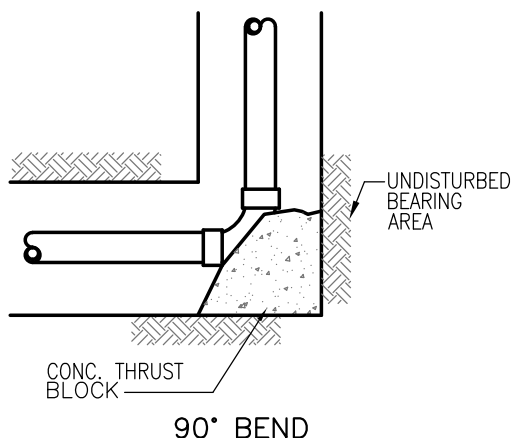
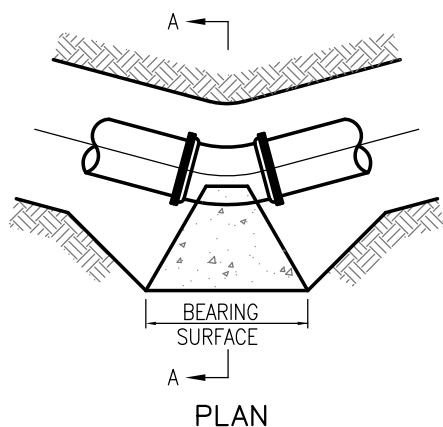
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Detail No.

SD-W-11



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NOTES:

1. ALL CONCRETE SHALL BE CLASS 'A' HAVING A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3300 PSI.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS.
3. NO COUPLING OR JOINTS SHALL BE COVERED WITH CONCRETE.
4. REINFORCING BAR STRAPS TO BE SHAPED TO PIPE CURVATURE.
5. ALL EXPOSED STEEL TO BE COATED WITH CARBOLINE BITUMASTIC 50 APPLIED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS WITH A MINIMUM DRY FILM THICKNESS OF 30 MILS.
6. THRUST BLOCKING FOR TEES SHALL HAVE THE SAME BEARING AREA AS 90° BENDS OF THE PIPE SIZE OF THE OUTLET. DEAD ENDS SHALL HAVE THE SAME BEARING AREA AS 90° BENDS.

BEARING AREA REQUIRED, SQUARE FEET

TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS, PSF	4"Ø AND LESS DEGREE BEND				6"Ø AND 8"Ø DEGREE BEND				10"Ø AND 12"Ø DEGREE BEND			
	11¼"	22½"	45"	90"	11¼"	22½"	45"	90"	11¼"	22½"	45"	90"
LOOSE SAND OR MEDIUM CLAY - 2,000	1.0	2.0	2.7	4.0	1.5	3.0	6.0	10.0	3.0	6.2	12.0	22.0
PACKED GRAVEL AND SAND - 4,000	1.0	1.0	1.5	2.0	1.0	1.5	3.0	5.0	1.5	3.1	6.0	11.0
ROCK - 10,000	1.0	1.0	1.0	1.0	1.0	1.0	1.2	2.0	1.0	1.3	2.4	4.4

BEARING AREA REQUIRED, SQUARE FEET

TYPE OF BEARING MATERIAL AND ALLOWABLE LOADS	14"Ø AND 16"Ø DEGREE BEND OR DEFLECTION				18"Ø AND 20"Ø DEGREE BEND OR DEFLECTION			
	11¼"	22½"	45"	90"	11¼"	22½"	45"	90"
LOOSE SAND OR MEDIUM CLAY - 2,000	6.0	12.0	22.5	40.0	9.5	19.0	37.0	67.0
PACKED GRAVEL AND SAND - 4,000	3.0	6.0	11.3	20.0	4.8	9.5	18.5	33.5
ROCK - 10,000	1.2	2.4	4.5	8.0	2.0	3.8	7.4	13.5

TYPICAL BLOCKING FOR HORIZONTAL AND VERTICAL DOWNWARD THRUSTS UP TO 150 PSI WORKING PRESSURE

N.T.S.

STANDARD DETAIL

TYPICAL BLOCKING FOR HORIZONTAL & VERTICAL

DOWNWARD THRUSTS UP TO 150 PSI WORKING PRESSURE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

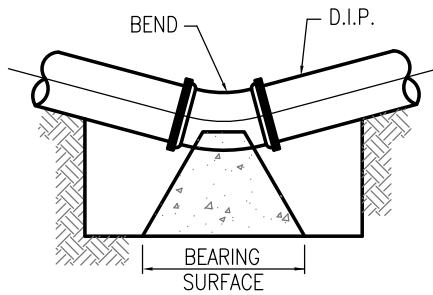
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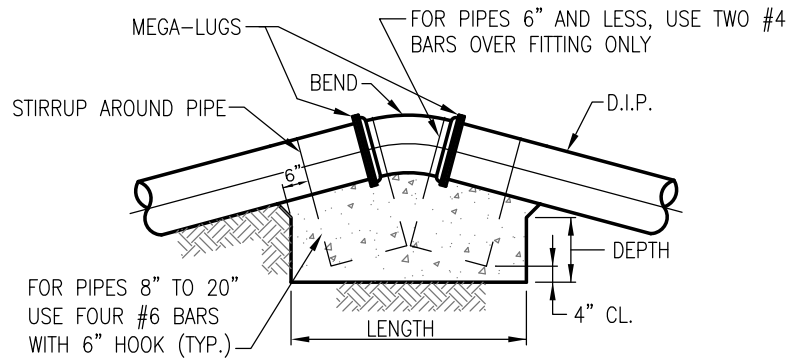
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TYPICAL SECTION
VERTICAL THRUST DOWNWARD



VERTICAL THRUST UPWARD
UP TO 150 PSI WORKING PRESSURE

NOTES:

1. ALL CONCRETE SHALL BE CLASS 'A' HAVING A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3300 PSI.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS.
3. NO COUPLING OR JOINTS SHALL BE COVERED WITH CONCRETE.
4. REINFORCING BAR STRAPS TO BE SHAPED TO PIPE CURVATURE.
5. ALL EXPOSED STEEL TO BE COATED WITH CARBOLINE BITUMASTIC 50 APPLIED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS WITH A MINIMUM DRY FILM THICKNESS OF 30 MILS.

PIPE SIZES	DIMENSIONS OF CONCRETE BLOCKING								
	LENGTH			WIDTH			DEPTH		
	11¼'	22½'	45'	11¼'	22½'	45'	11¼'	22½'	45'
4"Ø AND SMALLER	2.0'	4.0'	4.0'	1.5'	3.0'	3.0'	1.0'	2.0'	3.0'
6"Ø AND 8"Ø	3.0'	4.0'	6.0'	3.0'	3.0'	3.0'	2.0'	3.0'	4.0'
10"Ø AND 12"Ø	4.5'	6.0'	8.0'	3.0'	3.0'	4.0'	3.0'	4.5'	5.0'
14"Ø AND 16"Ø	6.0'	8.0'	11.0'	3.5'	3.5'	5.0'	3.5'	5.0'	5.0'
18"Ø AND 20"Ø	7.0'	9.0'	13.0'	4.0'	5.0'	5.5'	4.0'	5.0'	6.0'

SCHEDULE OF DIMENSIONS FOR CONCRETE BLOCKING OF VERTICAL BENDS WITH AN UPWARD THRUST BASED ON A WORKING PRESSURE OF 150 P.S.I.

VERTICAL THRUSTS UPWARD UP TO
150 PSI WORKING PRESSURE

N.T.S.

STANDARD DETAIL

VERTICAL THRUSTS UPWARD

UP TO 150 PSI WORKING PRESSURE

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

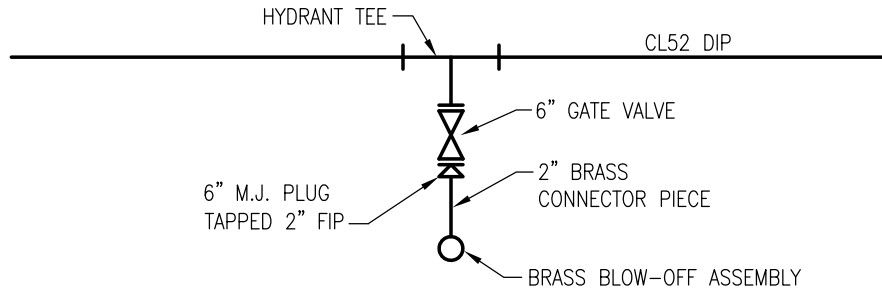
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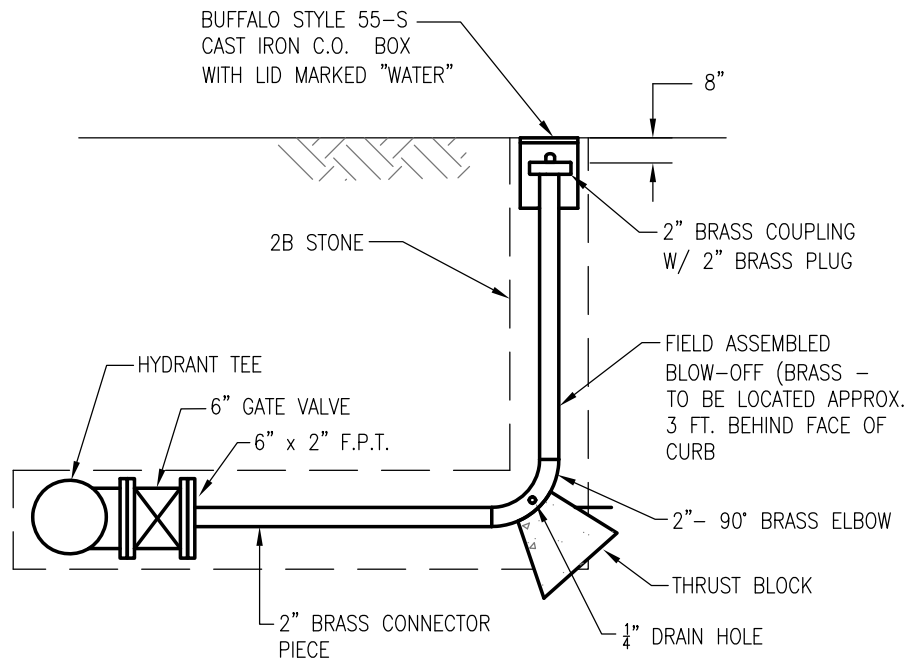
SD-W-13



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PLAN



SECTION

NOTE:
ONLY BRASS FITTINGS SHALL BE USED.

FIELD ASSEMBLED
IN-LINE BLOW-OFF DETAIL
N.T.S.

STANDARD DETAIL

IN-LINE BLOW-OFF DETAIL

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

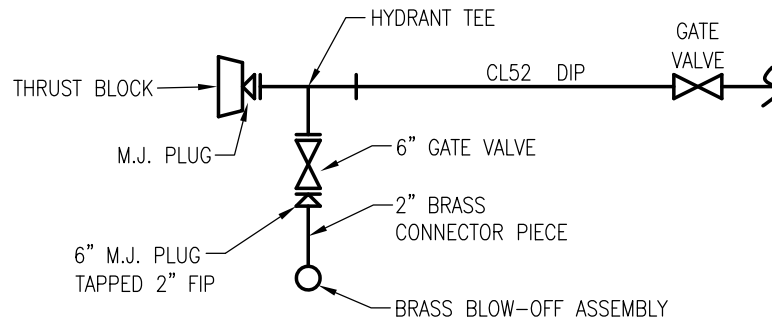
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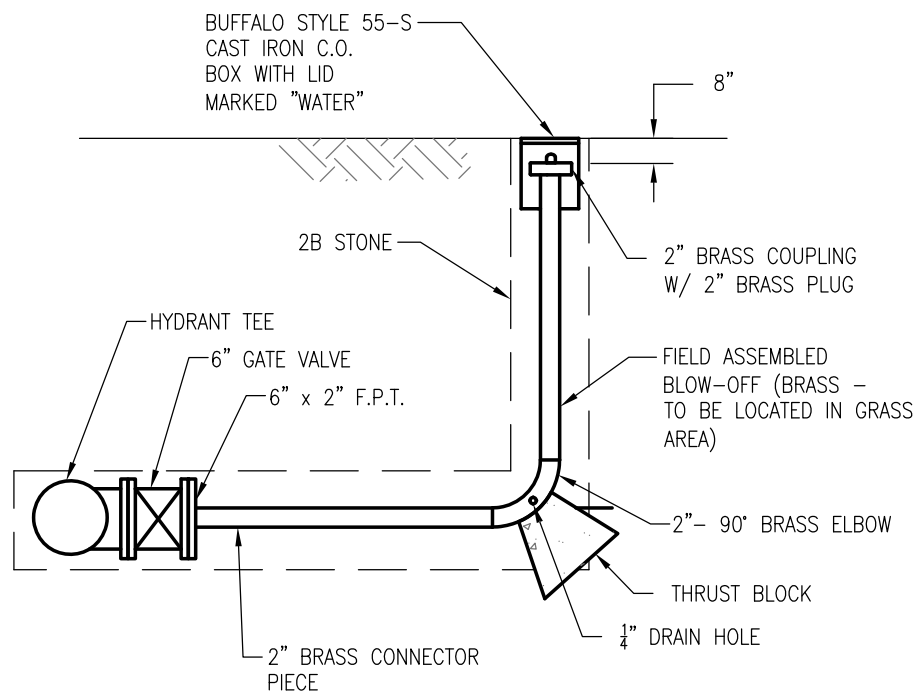
SD-W-14



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PLAN




SECTION

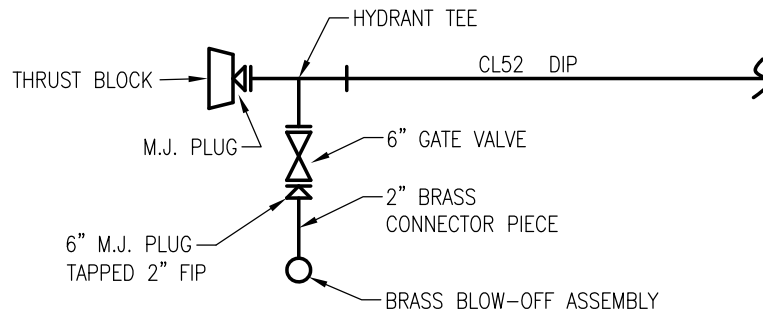
NOTE:
ONLY BRASS FITTINGS SHALL BE USED.

FIELD ASSEMBLED

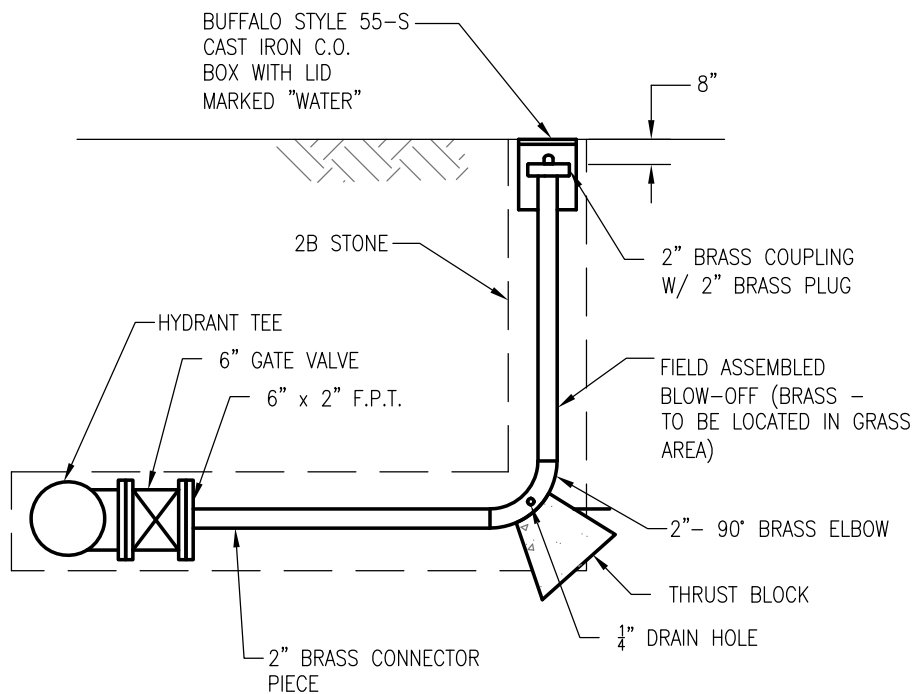
END-OF-LINE (FUTURE EXTENSION)
BLOW-OFF DETAIL

N.T.S.

STANDARD DETAIL	DOYLESTOWN BOROUGH BUCKS COUNTY, PENNSYLVANIA		
BLOW-OFF DETAIL	Date: 10/23/20	Detail No. SD-W-15	 <div> 4259 W. Swamp Road Suite 410 Doylestown, PA 18902 www.cksengineers.com 215.340.0600 </div>
END OF LINE (FUTURE EXTENSION)			



PLAN



SECTION

NOTE:
ONLY BRASS FITTINGS SHALL BE USED.

FIELD ASSEMBLED

END-OF-LINE (NO FUTURE EXTENSION)
BLOW-OFF DETAIL

N.T.S.

STANDARD DETAIL

BLOW-OFF DETAIL

END OF LINE (NO FUTURE EXTENSION)

DOYLESTOWN BOROUGH
BUCKS COUNTY, PENNSYLVANIA

Date:

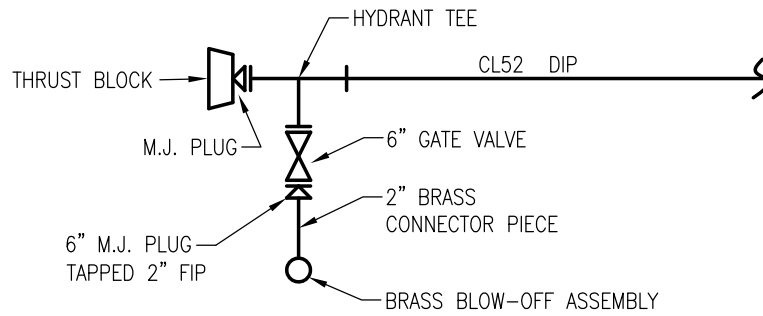
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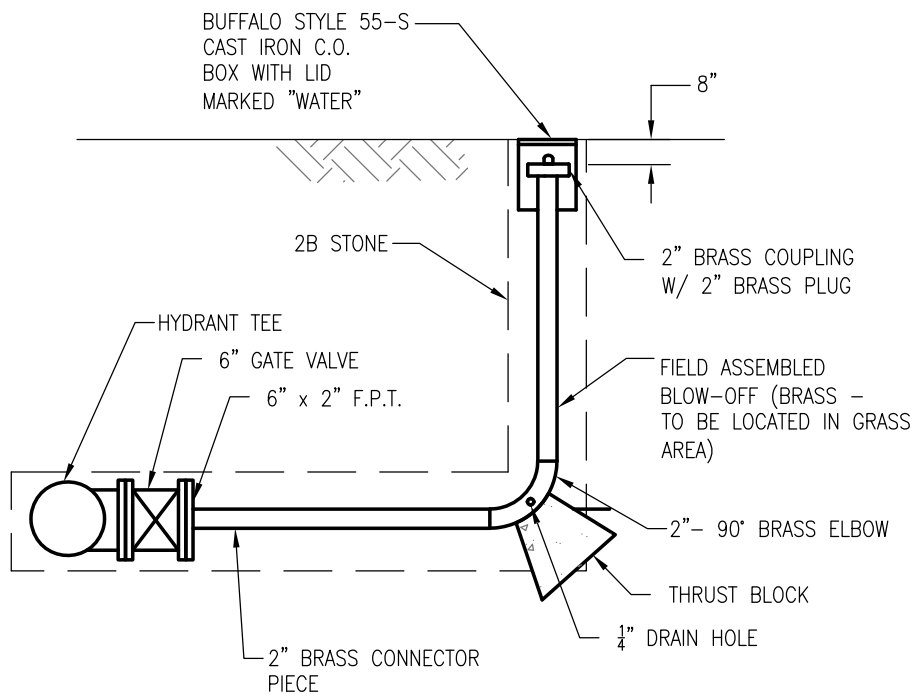
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PLAN



SECTION

NOTE:
ONLY BRASS FITTINGS SHALL BE USED.

FIELD ASSEMBLED

END-OF-LINE (NO FUTURE EXTENSION)
BLOW-OFF DETAIL

N.T.S.

STANDARD DETAIL

BLOW-OFF DETAIL

END OF LINE (NO FUTURE EXTENSION)

DOYLESTOWN BOROUGH
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Date:

10/23/20

Detail No.

SD-W-17



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